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Reinventing the City Building on Creativity

Creativity, innovation and a strong focus on social and cultural aspects of sustainability are at the very heart of developing the City of Varberg to become the Swedish West Coast's Creative Hot Spot by 2025.

In our vision for the future, the City of Varberg has unique opportunities. Our aim is clear, and we are acting on it. We are building a community converging around means of public transportation in a rapidly expanding region. The railway, which has created a barrier between the seaside and the city centre, will now be relocated into a tunnel underneath the city, and the capacity for commuting will greatly increase. To expand on this opportunity we are moving the harbor to further free up land for the city to reclaim. For people living, working or visiting the City of Varberg, the change will enhance the freedom to experience the beautiful coastline. Places for eating and meeting, places to shop and work, comes as a bonus.

The City of Varberg has been awarded **Sweden's Best Place To Live** in both 2014 and 2015, and is nominated again this year. Our thriving city centre is nominated as third time finalist in **Sweden's City Centre of the Year** award. We welcome these awards and regard them as appreciative of our chosen path towards the future.

Come to Varberg. Share our vision.

varberg

varberg.se



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FOREWORD

Jyrki Katainen
**Vice-President for Jobs, Growth,
Investment and Competitiveness**
European Commission

In the European Union, we aim to be greater than the sum of our parts, and we have many parts. The diversity within Europe – not only between but within Member States – inspires innovation and creativity. The European Commission is focusing on reinvigorating Europe's economy to generate jobs and growth. We see cities and regions as powerful engine-houses in this effort.

To generate sustainable growth, we need to unlock investment. The idea behind the Investment Plan for Europe was to make Europe more attractive to investors, mobilising €315 billion of additional investment by 2018.

The Plan combines three pillars: Supporting risk financing through a dedicated fund; technical assistance to link project promoters with potential investors; and streamlining the regulatory environment to make it more attractive to investment. Now, building on our successful experience of the first year of the European Fund for Strategic Investments (EFSI), we are proposing to extend it to address areas where investments can unlock even more value for the European economy.

Each region has faced its own challenges and opportunities through recent years, and our work to boost competitiveness across Europe should have its foundations at local level. This is reflected in the European Commission's priorities, and in the work of the Investment Plan. In the first year of EFSI, we have invested in projects supporting regions and cities, ranging from primary care centres in Ireland to regional transport services in Italy.

The Investment Plan complements other funding sources, including the European Structural and Investment Funds, which are targeted according to Europe's priorities, and according to the individual characteristics of each region. The Smart Specialisation Strategies, for example, offer a framework for working with regional authorities and actors to share infrastructure, pool resources, and invest in innovation-driven economies.

The European Commission is actively supporting the development of cities, which – thanks to investment in smart solutions – can deliver better public services more sustainably. The European Investment Advisory Hub, part of the Investment Plan, was established to provide practical advice on projects and financing for investors, promoters and authorities. We are hoping to expand the Hub's local-level support in the EFSI extension.

In addition, we have recently launched a pilot 'one-stop-shop' – a user-friendly tool for city authorities to access a range of helpful information, including legislation, data, and financing opportunities. We will continue to work with local authorities to strengthen their leadership of economic, social and environmental transformations.

The European Week of Regions and Cities in October showcased the invaluable role of communities across Europe in creating growth and jobs for a better quality of life – step by step. I look forward to ever more examples, when today's investments bear fruit. ■



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WELCOME

The end of 2016 – and what has been an eventful year – is fast approaching. In the November edition of *Adjacent Government*, thought is given to a range of topics that have been at the forefront of policy makers’ minds in the last few months. We start the edition off with a foreword from one of the Vice-Presidents of the European Commission, Jyrki Katainen, who outlines the idea behind the Investment Plan for Europe. He also discusses how the European Commission is supporting the development of cities, to help deliver better services more sustainably.

In our health section this quarter we continue the discussion about antimicrobial resistance and the global challenge to reduce its impact. In the second part of my interview with Alan Johnson from Public Health England (PHE), he details how they are monitoring the problem in the UK and its link with infection control. We also feature articles on this topic from the Minister of Health in Sweden, Gabriel Wikström, and Professor Mark Sharland from the Royal College of Paediatrics and Child Health.

Elsewhere in the publication we focus our attention on Italy, particularly on science and research efforts there. The special focus highlights three articles from key organisations involved in promoting and funding research throughout the country. The focus kicks off with an article from the Minister for Education, Universities and Research, Stefania Giannini, who highlights how the Italian government are aiming to boost research

talent in order to create scientific excellence. Two further pieces come from the Research Council of Italy and AIRC Italy – the Italian Association for Cancer Research.

Consideration is also given in this edition of a number of key issues, including: the value of MBAs, investment in infrastructure, data protection, advocacy and the social care sector, neurodegenerative diseases, and digitalisation in healthcare.

Another topic we highlight is neurodegenerative diseases. Through a number of thought-provoking articles, we tackle key topics from traumatic brain injury and the value of treatment, to Parkinson’s and Alzheimer’s. Features within this section come from leading experts in organisations including the US National Institutes of Health, the Alzheimer’s Society, and the European Brain Council.

As always, I hope you find our November *Adjacent Government* informative and useful and I welcome any feedback you may have. ■

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Laura Evans
Editor

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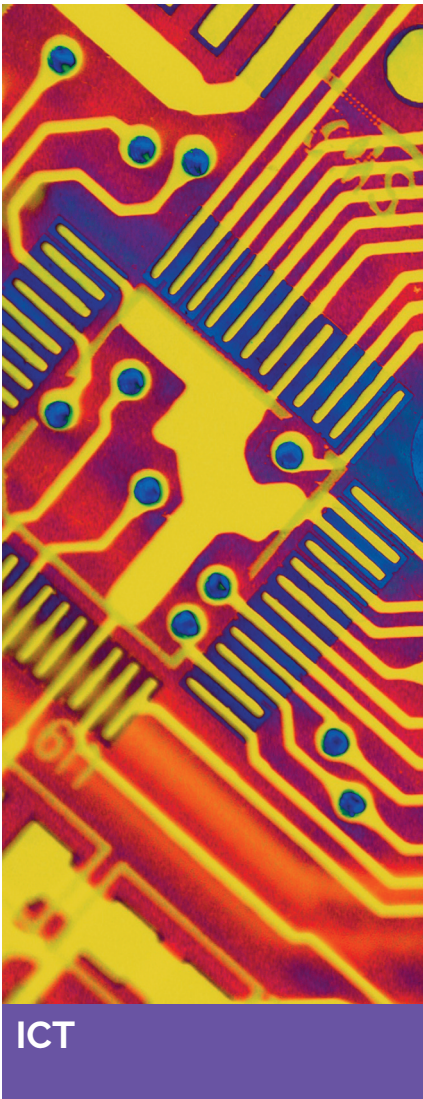
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Transforming care with digital

Dr. Mahiben Maruthappu, Senior Fellow to the CEO at NHS England, outlines how digitalisation will transform healthcare...

Digital has transformed almost every aspect of our society, from how we order a taxi, to renting accommodation, to ordering food. It has improved the efficiency of banking transactions 100-fold and saves the airline industry over £2bn a year.

Yet, while the majority of our population owns a smartphone and uses digital, at the moment only a small number use it to interact with the NHS. We speak of sweating our assets in healthcare, but perhaps the most overlooked asset is the smartphone. Tremendously powerful, personalised and connected. At a time when pressures on the NHS couldn't be higher, the need to adopt digital and incorporate smartphones couldn't be greater.

As the NHS seeks to achieve its aims of radically upgrading prevention, better integrating care, and boosting efficiency, digital is the tool that can enable each of these to occur in tandem. From supporting patients in achieving self-care, to diagnostic support to clinicians, to integrated electronic medical records that combine data spanning the health and social care system, while slicing through administrative costs. Digital can and will transform care. The only question is when.

In an effort to embrace and harness digital, we have launched a number of initiatives to disrupt the system, matched by over £4bn of funding in NHS technology over the coming years:

Prevention: type 2 diabetes costs the NHS around £9bn a year and entails a number of serious complications for patients, including limb amputation – even though the condition is largely preventable through lifestyle modification. To address this, we have launched the world's first Digital Diabetes Prevention Programme, aimed to identify patients at high risk of type 2 diabetes and, using a digital platform, to encourage them to adopt a healthier diet with greater physical activity, to reverse this risk and prevent diabetes from occurring.

Patient empowerment: we have found ways to encourage use of apps in the NHS to allow patients to better manage their own conditions, from chronic obstructive pulmonary disease (COPD) to mental health problems, while knowing that the digital technologies they are using are evidence-based and cost-effective.

Specialist care: a dozen NHS hospital trusts have been selected to serve as digital exemplars. Each hospital is receiving up to £10m, to enable front-line staff to use digital tools and deliver better care. These range from real time video links between ambulances and emergency departments to support better care during journeys to hospital; electronic detection and alerting of patient deteriorations such as sepsis; and online systems able to reduce medication errors by up to half.

Scale: while the NHS has a strong track record when it comes to the discovery and development of innovations, it has struggled to achieve scale. To tackle this head-on, we launched the NHS Innovation Accelerator (NIA) one year ago, designed to spread tried and tested technologies across the health service, including apps and digital social networks. In its first 6 months the NIA benefited over 3 million patients, and within a year over 380 organisations had adopted NIA technologies, demonstrating that the NHS can indeed be disruptive.

These initiatives are part of a comprehensive strategy to digitalise the NHS; empowering patients to better manage their conditions, enabling front-line staff to deliver higher quality care, and boosting system efficiency. The digital revolution has the potential to realise our health, quality and efficiency ambitions; now is the time to embrace it. ■

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Delivering software solutions

Jean-Michel Letennier, President and CEO of Atomic Information Systems (AIS) Corporation outlines how their software solutions can change how organisations think

AIS (www.aisys.us) is a full service application software development firm with its headquarters in Delaware County, New York. It was founded in 2015 by several industry veterans and is continuing to develop 'AtomicDB', a radically new disruptive state-of-the-art associative database technology.

AtomicDB will greatly alter the way people can consolidate, aggregate, merge, correlate, investigate and manage large information data-sets.

This technology is a descendant from research done by the US Air Force in 1964, revised again by the US Navy in 2008. Welcome to the quantum 'associative technology' supporting **green technology**.

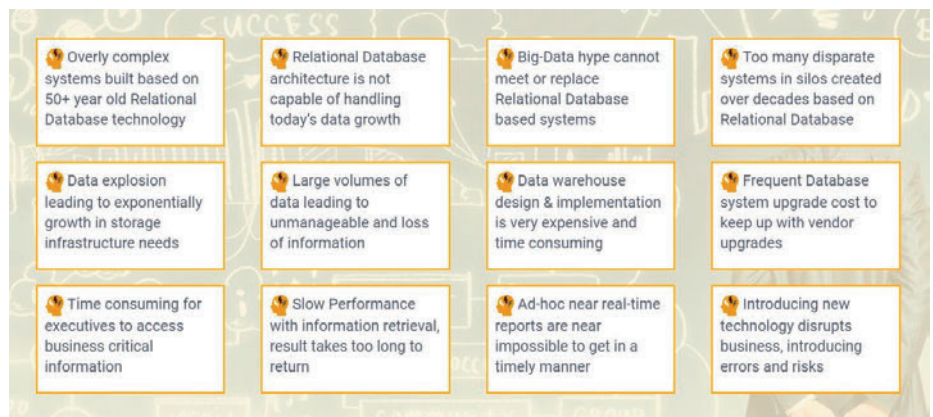
We are more than just disruptive; we are developing massive engineered solutions that are highly efficient and effective. So much so, that companies who subscribe to our software solutions must now find ways to spend their time that was consumed prior to using our solutions.

Company vision:

AIS Corp's vision is to finally be able to fulfil the original dreams of the efficiency of computer science, which to date, has been limited by the relational database paradigm.

Our great aim is to approach enduring status by creating a new market and

Challenges we address:



changing how organisations think. It will provide the impetus for simplifying and creating new ways of living, thinking, doing business or solving problems that we didn't know existed. The next generation of companies will not shake up existing foundations but create new ones!

We are driven by the most obvious adage that 'data is power' and the 'best leaders have the best data'. We provide the next generation of technology that will help store, manage and deal with massive amounts of data. Exabytes of data is what we are talking about!

Leverage the capabilities of AtomicDB to innovate, integrate and re-engineer:

- The operating system;
- How computer memory and storage is used for information management;
- Information privacy;
- Data security;
- Information technology solutions

and services are made available to individuals and organisations using peer-to-peer architecture.

AtomicDB core technology advantages:

- Simplify, manage and implement big data solutions;
- Easily and accurately aggregate and correlate data;
- Address data security and privacy concerns;
- Significantly reduce Application development cost;
- Lower energy consumption by reducing technology infrastructure needs;
- Consolidate multiple data warehouse into a single instance.

Opportunities:

- Electronic health records;
- Banking and finance;
- Data security and compliance;
- Social media and privacy;
- Internet of Things (IoT);
- Empowering through crypto-currency.

PROFILE

Our Value proposition:

60%-80% Reduction in storage requirements	50% Reduction in development time	50% Reduction in time to market	80% Less time to set up and configure
80% Less maintenance	80% Lower time to utilization	80% Lower overall cost	1000x Speed improvement
Do - It - Yourself simplicity	No Query Language needed to filter data	Security based on Factorial encryption	Seamless Multi-database integration
Ability to do OLAP and OLTP in one database	Supports near real-time transaction and analytics	Small footprint (8MB), Efficient on bandwidth	Single instance storage, no duplicate data
Minor schema changes needed for new data	Dynamically switch to critical transaction mode	Only 7 powerful API needed to access data	Energy saving Green Technology

How we can help:

- Breaking down the silos by creating a single instance data warehouse repository or custom data collections allowing cross integration of organisations and systems;
- Database technology platform for building a peer-to-peer and customer-centric solution which can be associated with everything and anything the customer or organisation chooses to be connected and related to;
- Driving efficiency through integrated services thus allowing true IoT;
- Driving sustainable cost reduction from infrastructure optimisation, simplification, operational efficiency and reduction in time and human resources.

Our Products:

AtomicDBOnline

We are launching a preview version of AtomicDBOnline which is powered by AtomicDB. ADBO is an on-line Data Warehouse as a service (SaaS), which is currently being offered to early adapters by invitation only.

Offerings:

- Phase 1 is scheduled to be released in Q4 2016;
- Allow potential customers to experiment and try out;
- Seamlessly aggregate and correlate from various data sources.

AtomicDB enterprise edition

We are developing an enterprise version which will be approximately 1000 times more efficient and capable of dealing with exabytes of data in a single instance storage. This is a collaborative effort with our development partners and will use the next generation CPU, nano memory & storage technologies and operating systems to overcome current hardware limitations.

Offerings:

- Phase 2 is scheduled to be released in 2017;
- Designed to aggregate and correlate petabytes of data;
- Designed to cater to large big-data systems in the world.

Our Development Partners:

Hamlet Group

The Founders of Hamlet Group are helping to turnaround the hospitals and clinics across US into profit making businesses by building a patient-centric health record system and consolidating multiple healthcare systems into a unified solution.

Group FiO

Group FiO is a leading provider of Innovative Business Solutions specializing in cloud based Multi-Tenant ERP, CRM, Order Management and Retail applications.

Novachips

Novachips is a leading provider of a broad range of Flash storage processors and storage drives with breakthrough capacity and scalability.

Gencodestudio

Gencodestudio is a development studio that creates hi-tech games, e-learning and 3D graphics software for computers and mobile devices.



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Corruption in healthcare in Europe

From informal payments to industry kickbacks...

In October 2013 the European Commission has published a "Study on corruption in healthcare" (HOME/2011/ISEC/PR/047-A2). The study was developed by ECORYS, a Dutch consultancy and research company, in collaboration with EHFCN, the European Healthcare Fraud and Corruption Network. Aside from being the first ever on the subject of corruption in healthcare in Europe, the study has the merit of offering an astonishing overview of the way corruption has affected healthcare in every 28 of the EU countries. The 86 corruption cases presented read like a sad 'best of'. Unlike the common assumption that corruption thrives in southern European and former communist countries only, these cases show how stakeholders in "advanced" western and central European healthcare systems incline to corrupt practices as well. Areas affected are healthcare provision, certification and procurement of medical equipment and authorisation and procurement of pharmaceuticals. Corrupt practices vary from "informal" payments requested by doctors from patients, to kickbacks paid by medical devices and pharma companies to physicians. Worldwide 10-25% of public procurement spending in health (medical devices and pharmaceuticals) is lost to corrupt practices. European figures are not available.

The main obstacles in countries in which corruption is widespread include scarcity of health care services (e.g. organ transplants), relatively low



level of healthcare funding (i.e. where healthcare expenditure as a percentage of GDP is below 7%), weak controlling mechanisms, high out-of-pocket payments for healthcare, self-interest and greed from the side of the healthcare providers.

Here are some examples as reported in the study. In Austria a medical doctor working at a regional hospital asked for €60 per visit on top of the official charges. Indications are that this is not an isolated case and that this problem is of a systemic nature. In another case, a hospital doctor offered patients the possibility of moving up waiting lists for cash payments of between €300 and €500.

One of the most prominent scandals in the history of the German health sector was the Globudent Skandal. The company 'Globudent' imported cheap dentures from Turkey and Hong Kong and sold them at inflated

prices to dentists and dental firms. Dentists would subsequently invoice the cheap dentures to the health insurance companies as if these were high-end dentures 'made in Germany'. The profits enabled Globudent to pay kick-backs. In some cases these reimbursements added up to over €200,000 for an individual dentist practice. About 450 dentists were involved in the scheme. Over 40 of them lost their license.

Royal Philips Electronics was fined 4.5 million US dollar by the US Securities and Exchange Commission (SEC) because of alleged bribery in Poland. The company accepted to pay the fine imposed by the SEC to settle the matter. In at least 30 bids, employees of Philips' subsidiary in Poland made improper payments to public officials of Polish healthcare facilities to increase the likelihood that public tenders for medical equipment would be awarded to Philips. Philips would

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submit the technical specifications of its medical equipment to officials drafting the tenders, who would incorporate these specifications into the contracts.

An Executive Director of a district hospital in northern Finland was accused of favoring companies owned by his son. In 11 instances over 8 years the Executive Director bypassed procurement legislation and directed major IT program contracts to these companies (health care IT programs are classified as medical equipment). The deals were constructed in such a way that other players had no chance to participate. Agreements were made in private face-to-face meetings. Purchases were sometimes also delayed so that the family companies had time to prepare for the calls for tender. The Executive received a 9-month suspended sentence for aggravated malfeasance in office.

Impacts of healthcare corruption

The overall impact of corruption in healthcare on society and on individuals can be (much) larger than the monetary value of the sums involved. Directly, corruption in healthcare may lead to low quality in the provision of healthcare services and low quality in the provision of medical devices and pharmaceuticals. Indirectly, corruption in healthcare may cause productivity loss through bad health, distrust in provisions of services by the government, distrust in the health system and distrust in society as a whole.

How corruption in healthcare can be 'institutionalised' has been demonstrated by a scandal in the Czech Republic where a deep and systemic corruption environment has led to the biggest anti-corruption raid in its history.

During his spell at the Ministry of Health (2006-2009) an official described as the "Richelieu of the Czech health-care sector", was the mastermind and moving force behind the Czech healthcare system. By gaining control of both the ministry and as a consequence the main insurer VZP, he positioned himself in the controlling seat of the Czech healthcare system. Essentially unspoken agreements with the political elite shielded the corruption activities in exchange for party donations and political support.

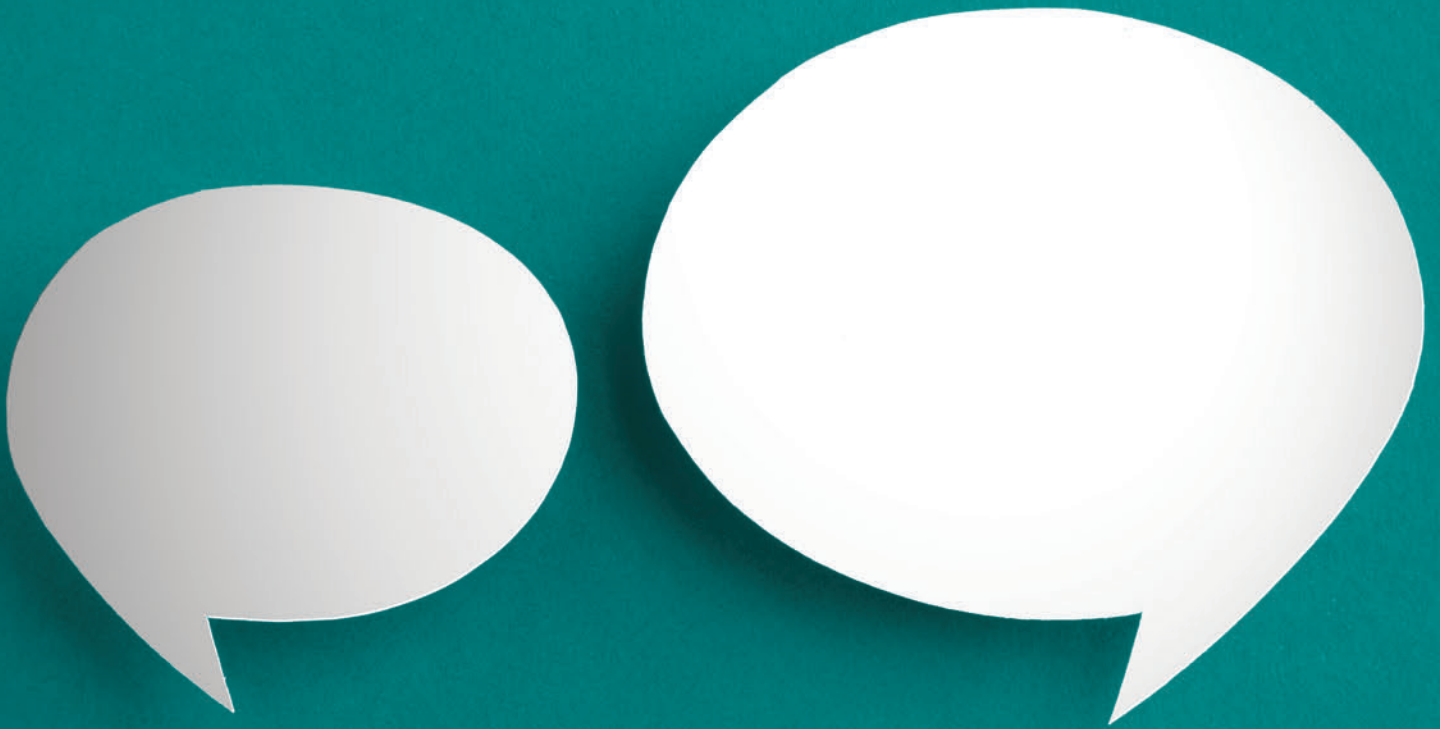
The degree to which misuse of (high-level) positions is a problem within a country, largely depends on the extent to which corruption is embedded in the economy and society. There is no hard data available on the prevalence of this type of corruption in Europe, but it appears to be a problem particularly in countries where corruption is deeply embedded in politics and society, such as Czech Republic, Latvia, Croatia, Slovakia, Romania, Italy, Bulgaria, Greece. However, it is in many cases difficult to draw a clear line between normal lobbying and unethical forms of trading in influence.

Systematic corruption should be prevented and tackled with good anti-corruption legislation, powerful anti-corruption enforcement, changes in healthcare and healthcare supervision systems and general changes in norms and attitude. Isolated healthcare corruption can be countered with more targeted measures (such as anti-fraud and corruption reporting hotlines). This bottom-up as well as top-down approach requires a sustainable effort and, with time, a change in attitudes helping to prevent corruption from the outset should be the result.

EHFCN was formally established in 2005 as a not for profit international association by Belgian law. The Network is membership based. The actual 16 members from 14 European countries represent public and private health-care insurers, health financiers and payers who all have the countering of fraud, waste and corruption in health-care as their core business or as part of their mission. The aim of EHFCN is to improve European healthcare systems by reducing losses to fraud, waste and corruption and its objective is to help members to be more efficient and effective in their work of prevention, detection, investigation, sanctioning and redress of healthcare fraud, waste and corruption, with the ultimate goal of preventing from money being lost and returning money to healthcare services for the benefit of every patient. EHFCN provides its members with high quality information, tools, training, global links and access to professional consultancy. It also promotes the share of good practice, joint work, bilateral agreements and the development of common working standards.



Paul Vincke
Managing Director
European Healthcare Fraud and
Corruption network
www.ehfcn-powerhouse.org/welcome



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eHealth training will be crucial to upskill the workforce

Training and development opportunities are crucial to upskill the eHealth workforce, as Dr Lisa McCann from the University of Surrey points out...

We find ourselves now in a world dominated by technology barely considered imaginable previously in our everyday lives – from the simple smart phone to the more complex self-driving car; technology is here to stay. It is here to stay within healthcare too. We are already witnessing the development of numerous interventions and innovations. Electronic patient records, wearable technologies, sensors, health-related and behaviour change apps with embedded gamification, real time remote monitoring; the list is endless and the opportunities boundless.

We are increasingly surrounded by and immersed in the Internet of Things, and the creativity and innovations by which the paradigm is defined. Embracing these creative and innovative opportunities provides a positive, exciting, potentially revolutionary and dynamic landscape on which to develop and deliver health systems and health services fit for the future – and fit for all.

eHealth pivotal to the future of care

eHealth should not be viewed as an exclusive club with membership restricted to those currently working in the arena, technologically savvy individuals, or those health services which are a step or two ahead of the rest. eHealth, mHealth, Connected Health, whatever the preferred term, is for all to embrace.

From those working clinically and at the ‘front line’ with patients and their families, to those with roles and responsibilities that lie more with operational decisions within healthcare organisations, eHealth is pivotal in shaping the future direction of healthcare. The very concept may challenge some people more than others, but ultimately the concern of those working in healthcare, in whatever guise, is to facilitate and provide the best possible healthcare experiences to all patients.

In that vein, eHealth technologies do not, or should not, discriminate between healthcare professionals or patients in terms of experience, exposure or age. With the right approach to co-design, development and robust evaluation, eHealth technologies can be (and are) accessible to all. Personal experience indicates that working within cultures and healthcare settings in which technology is yet to be fully embraced as well as with patient groups many, remarkably, still consider incompatible with technology (older people, for example), is indeed possible. But more importantly, it is necessary; a status quo in terms of healthcare services organisation, provision and delivery is unsustainable.

So how do we ensure healthcare services are fit for the future? We think outside the box. We work collaboratively. We learn from others. We think creatively and innovatively. We ensure training and development opportunities are in place to upskill the workforce to embrace and respond to evolving healthcare services.

And we remain committed; change may not happen overnight – we may not see immediate cost-saving benefits from the introduction of eHealth technologies within a healthcare setting – but we do see a robust and substantive evidence base gathering momentum to support their introduction and implementation. I for one – and I am sure I am not alone – am excited to learn about, be part of, and embrace the ways in which our health services of the future will evolve and develop. ■

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Dr Lisa McCann
Lead for eHealth

University of Surrey
<http://www.surrey.ac.uk/school-health-sciences/research/e-health>

Fundamentals of eHealth

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Making the NHS digital strategy ‘mission possible’

Helen McKenna, Senior Policy Adviser at The King’s Fund, asks how the NHS digital strategy can be implemented at a time of great financial pressures...

Jeremy Hunt is a man on a mission to digitise the NHS. Back in 2013, just a few months after taking up the role of Secretary of State for Health, he challenged the NHS to ‘go paperless’. The [NHS five year forward view](#) followed, outlining ambitions to ‘exploit the information revolution’, to be led by a newly established National Information Board. [Personalised health and care 2020](#) provided the framework for action to underpin this vision, committing to implement a range of proposals including online access to GP records for all and digital real-time and interoperable care records.

Making better use of information and digital technology in the NHS is clearly a priority for Hunt. While we are accustomed in so many areas of our lives to interacting digitally with services (for example, 70 per cent of flights are now booked online), we continue to engage with health and care services using more traditional methods, with reports suggesting that only two per cent of the population have had any digitally enabled transaction with the NHS.

So is the digitisation of health and care services just around the corner? The answer is complex. On the one hand, some services are further ahead than most people may realise. For example, the vast majority (92.1 per cent) of GP practices now have the technology in place to enable patients to access their records online (Health and Social Care Information Centre 2016). The problem is that patients aren’t aware that this functionality exists (only 5.2 per cent of patients report being aware that their practice offers this) and even fewer (0.9 per cent) report ever having used it (NHS England and Ipsos Mori 2016). A similar picture exists in relation to booking GP appointments and ordering repeat prescriptions online.

There is still a long way to go in secondary care too, which lags significantly behind primary care in relation

to digitisation. In our [recent briefing](#) (Honeyman et al 2016), we identified a number of barriers that stand between where we are now and the vision for a ‘paperless’ NHS.

Perhaps the most important of these is the broader context in which NHS organisations are working, specifically regarding the financial and operational pressures they are under. In 2015/16, NHS providers and commissioners collectively recorded the largest combined deficit in their history and are struggling to meet key performance targets. Organisations’ inevitable focus on stabilising performance in the short term risks crowding out efforts to digitise. There is also a risk that funds earmarked for capital investment are switched to support day-to-day spending.

Other barriers to progress include a lack of clarity about the funding available to support this agenda, and a lack of incentives for NHS leaders (particularly those in acute trusts) to attempt large-scale digital transformation.

In our briefing we also identify a number of things that need to happen if the digitisation dream is to become a reality. The first is to give the NHS more time to achieve it. The recent review chaired by Professor Robert Wachter called for more realistic deadlines, including a phased approach to digital implementation in acute trusts and an extension to the timetable for achieving digital maturity from 2020 to 2023. In principle we support this recommendation, although if accepted by the Secretary of State we would urge that care be taken to maintain local momentum.

Also, a renewed effort to articulate the fundamental case for change to local leaders and clinicians may be needed. Clinical engagement is vital to any effort to secure better



value from NHS care, and efforts to develop and spread technology are no different. This should be based around the principles of user-centred design, whereby clinicians are involved in developing systems rather than having them presented as a *fait accompli*.

So where does this leave us? The government and national bodies have set out an ambitious vision for a digital NHS. Although there are a number of obstacles ahead, not least the backdrop of unprecedented financial and operational pressures against which implementation will take place, there are also opportunities to progress, which could bring the vision within reach. However, for the NHS to get there, ministers and national leaders must now set out a definitive plan that clarifies priorities and funding, sets credible timescales, and is achievable within the current climate. ■

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Priority setting methods and transferability in health information

BRIDGE Health looks at priority setting and transferability of health information to policy now and in a future EU Health Information System...

In the previous issue of *Adjacent Government*, the first concepts of the EU Health Information System were explained and the current activities of BRIDGE Health within these. BRIDGE Health operates through work packages and horizontal activities (HA). In this issue, the focus will be on two of those HA, which are key topics in the field: priority setting methods in health information (HI) and the transferability of HI and data for policy.

Good practice priority setting is a must to make progress in EU health research¹ (Maria M Hofmarcher^{i, ii}, Nataša Perićⁱⁱ, Judit Simonⁱⁱ)

A key function of a useful and manageable HI infrastructure is to set priorities. We frame priority settings in HI as a systematic, explicit and transparent decision-making process to prioritise research in population health, in health services and health systems research. This broad concept of health research should yield societal benefits, including reduced research duplication and importantly enhanced collaboration across disciplines.

While a variety of methods exist, research shows that techniques involving a systematic, interactive forecasting method that relies on a panel of experts and questionnaires (Delphi method) and pre-selected groups identified by managing bodies of organisations through their scien-



tific performance with a view on the health topic of concern (CHNRI Child Health and Nutrition Research Initiative) are most common. Thus, prioritisation is a process where individuals or groups rank identified research priorities in terms of their importance or significance. Specific criteria are normally provided to support this process. At the same time, there are no uniform standards to develop priorities for health research. For example, EU research programmes e.g. Horizon 2020, 3rd Health Programme and Member States driven initiatives, e.g. Joint Programming Initiatives have been applying their own approach. Yet some initiatives have established transparent ranking methods, e.g. the European Centre of Disease prevention and Control (ECDC), or the CHNRI approach. Nonetheless, most priority setting processes lack adequate ex post evaluation.

Priority setting is a challenge at all levels and contexts in health systems because demand for health care usually exceeds available resources. At the same time priority setting differs across countries, within research and across health service areas. Equally, both taxpayers/patients and funders/payers are demanding greater accountability for how resources are spent and how research and health system goals are met. The setting of health targets is another avenue to prioritisation of health research and health care delivery. Currently, about half of all World Health Organization (WHO) Member States indicated that they have established a national or subnational process. On the basis of a BRIDGE health internal survey conducted in 2015, about half of responding project partners indicated to have been involved in priority setting activities including in developing health targets.

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While prioritisation in health research is multi-layered the BRIDGE Health consortium in a recent communication has emphasised the importance of priority setting to take place in an envisioned European Research Infrastructure Consortium on Health Information for Research and Evidence-based Policy (HIREP-ERIC). In line with the analysed literature, we recommend that priority setting processes in an HIREP-ERIC should:

- Be inclusive by adopting a comprehensive concept of priority setting of health research;
- Be overseen by a well-managed and resourced multi-disciplinary advisory group;
- Involve broad representation of stakeholders;
- Utilise objective and clearly defined criteria for generating and ranking priorities;
- Be systematic and transparently documented; and
- Be evaluated.

Efficient transfer of health information (HI) and data to policy is crucial to move towards a healthier life (Anke Joasⁱⁱⁱ)

Evidence-based policy is considered a high priority. Policymaking needs clear messages to prioritise, whereas science is inherently associated with uncertainties. HI is scientific indicator based information, on health status of individuals or the general population, on health determinants, health systems and health system performance.

Transferability of HI to policy concerns the success to collect, process, analyse, report, and use HI and knowledge to

influence decision-making. Not only does the information need to be communicated to the policy makers, but the policy makers should be able to understand and implement the transferred information effectively. This process is closely related to impacts, communication, and data availability. Actor power, framing of issues and ideas, understanding the inherent characteristics of the issue and political context are basic elements of the scientific discussion on efficient knowledge transfer. Health problems that cause substantial damage, that can be easily measured and that have cost-efficient solutions, are likely to gain political support.

The European Commission has established legislation, indicators and databases to promote the transfer of HI to policy, as have the Organisation for Economic Cooperation and Development, and WHO, and there is clear evidence of successful HI to policy transfer in the field of obesity, smoking and alcohol abuse. However, it remains a challenge to fulfil.

In a recent report, WHO states that expertise in public HI remains fragmented and insufficiently used for health policy-making, despite monitoring and reporting of many national and international organisations². Opportunities to support and advance efforts to systematically and sustainably overcome the research-policy gap are considered weak or lacking. Accordingly improved communication between researchers and policy makers (and other stakeholders), strategic planning, tool development and data harmonisation are the key approaches in tackling challenges in transfer of health information and data to policy.

A future HIREP-ERIC should work towards these priorities, via a close cooperation with all relevant Commis-

sion services and established networks at European and international level, as well as with national policy makers, civil society and academic groups. Given the abundance of initiatives and big data, a HIREP-ERIC should focus on coordination, evaluation of existing approaches and tools, on interlinkage and condensation of available tools, and on tailoring to Member State and Commission needs. The management of a corresponding “conceptual framework” could be another important task.

¹ Further information and references can be found in Hofmarcher, M.; Perić, N.; Simon, J. (2016) Priority setting methods in health information, BRIDGE Health Technical Report 09/2016 on Recommendations of priority setting methods for a European Research Infrastructure Consortium on Health Information for Research and Evidence-based Policy (HIREP-ERIC), HS&I and Medical University of Vienna, September 2016.

² <http://www.euro.who.int/en/media-centre/sections/press-releases/2013/10/translating-evidence-into-effective-public-health-policy>

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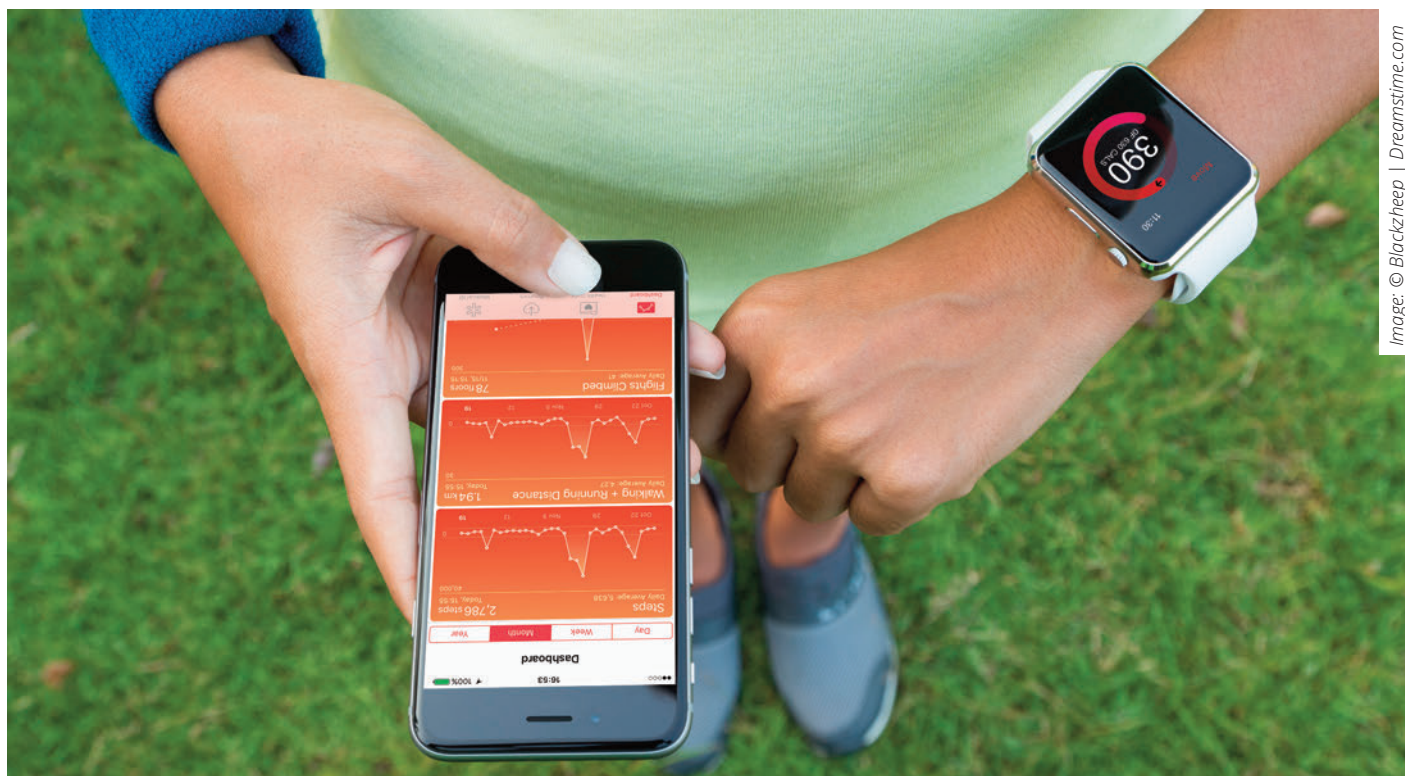


Image: © Blackzheep | Dreamstime.com

Norway's eHealth strategy looks to the future

With its pioneering eHealth strategy, Norway's Ministry of Health and Care Services is establishing a new paradigm in practice...

eHealth, according to the definition of the World Health Organization (WHO), is the 'use of information and communication technologies (ICT) for health'. These are tools and services that – supported by electronic processes and interactions – can improve the healthcare system as a whole, including prevention, diagnosis, treatment, monitoring and management of medical conditions and diseases.

Some examples of the potential applications for eHealth that WHO provides are: treating patients, conducting research, educating the health workforce, tracking diseases, and monitoring public health. Text alerts and reminders, online access to medical records for patients, and smartphone applications recording data on exercise are just a few instances of the expansion of eHealth into everyday life for citizens in many countries.

With Europeans now living longer, on average, than ever before, the European Commission expects the cost of health and social care to rise substantially to about 9% of EU GDP by 2050. Digitalisation of healthcare services is seen as a powerful tool in the struggle to maintain cost-efficient and high quality health and social care services for all.

Improving healthcare for the patient

To this end, the Commission's eHealth Action Plan aims to improve healthcare for the benefit of the patient, as well as giving patients more control of their care and bringing down the costs in already over-burdened systems across the continent.

With high-level international discussion and collaboration as a driving force, many European governments

are now implementing eHealth policies and strategies in order to ensure patient experience continues to improve, and that global access to high quality health-care is accelerated. A growing number of policy makers are recognising that technology in healthcare can play an intrinsic role in the integration of services, as well as delivering key services more efficiently.

In Norway, for example, the Ministry of Health and Care Services has recently created a dedicated Department of eHealth. Within the new department, the subordinate [Norwegian Directorate for eHealth](#) was established in January 2016 to implement national policy on the topic, after a series of reports suggested that stronger leadership and governance was needed to effectively develop eHealth in the Scandinavian country.

The call for stronger national governance, prioritisation and coordination of ICT development in the healthcare sector was also one of the priority areas put forward in Norway's own eHealth Action Plan in 2014.

In order to meet these objectives, the Directorate has two main responsibilities:

- National steering and coordination of eHealth through close cooperation with regional health authorities, local authorities, technical organisations, and other interested parties.
- Development and administration of digital solutions that will improve and simplify Norway's health and care sector.

Strengthening eHealth research in Norway

Alongside the creation of the Directorate, a Norwegian Centre for eHealth Research was also founded in January 2016. [Its aim](#) is to support strategic policy-making and contribute "to a common national ICT solution for health and care services".

The Centre is involved in ongoing cooperation with the World Health Organization, as well as facilitating the participation of researchers in various EU and international projects, ensuring strong interdisciplinary

expertise is developed and shared for the benefit of citizens both at home and abroad.

As senior figures in Norway's Ministry of Health and Care Services have suggested, eHealth also has an important role to play in meeting the health-related objectives set out in the United Nations' Sustainable Development Goals. It can provide evidence in the form of data which is useful in establishing targets, as well as providing services in areas with a lack of equipment and infrastructure.

"The challenges ahead, like NCDs [non-communicable diseases] and a stronger focus on health promotion, underlines the need for building strong primary care," Norway's Minister of Health and Care Services, Bent Høie, [told a ministerial roundtable](#) at the World Health Assembly earlier this year. "Network solutions, information systems to enable contact between hospitals, health care centres and health personnel in all regions are important."

Digital solutions such as electronic health records and information sharing software are already being implemented across Norway, and have begun to demonstrate the benefits of more efficient and patient-centred care. Seamless information sharing across services, geographical areas, and different care levels should improve outcomes for patients, and it is hoped that increased patient safety, improved interactions between health services, and greater levels of patient empowerment will follow. ■

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GoTreatIT® – to support Patient-Centered Care

Fighting vague and imprecise answers when measuring the quality of care – GoTreatIT software creates visual overview of already completed or ongoing treatment, including effects or adverse reactions to it...

Is it sufficient to ask how are you doing?"

Professor Theodore Pincus, USA

"Clinicians may all too easily spend years writing "doing well" in the notes of a patient who has become progressively crippled before their eyes."

Verna Wright, Leeds, UK 1983

More than 13 years back, when Glenn Haugeberg started his work as a specialist in rheumatology at the Hospital of Southern Norway (Sørlandet Sykehus), he realised that he needed an information and communication (ICT) tool to systematically measure the effects of medical treatment. When asking patients how they felt, he could receive such answers as "better than yesterday", which were too vague and imprecise.

The company DiaGraphIT was established in 2004 and developed the GoTreatIT® ICT products in close cooperation with clinicians. The aim was to measure the quality of patient care. The company has for over 12 years offered the GoTreatIT® software on the healthcare market, which is specifically designed to improve cooperation between therapist and patients. Using GoTreatIT®, patients can enter health information into the software, allowing health professionals to get a visual overview of already completed or ongoing treatment, and effects or adverse reactions to it. Experience

shows that this systematic approach frees up resources, improves the quality of treatment and facilitates the administrative work. The GoTreatIT® solutions have been shown to bring real value to both clinics and patients, especially those patients with chronic diseases.

Value for the patients

Current documentation systems for patients can have an idea of conveying health problems and side effects of medication, but without these being recorded in a systematic or uniform manner. The same applies to experienced quality of life, but without these being documented/recorded in a systematic manner. Thus, patients may be at risk of receiving ineffective treatment or treatment with side effects, but without correction. Patients therefore need to know that relevant information about their health status and medical treatment is recorded and documented in a systematic manner. Patients want increasingly to participate in their own health and wellbeing. In the GoTreatIT® products, patients register data about themselves. The clinicians then get an overview of patient-reported health status in relation to the medical treatment given, with an intuitive user interface and data graphically displayed on time graphs. The GoTreatIT® products are used in the patient – clinician dialogue, allowing patients to better understand their

own health, their medical treatment and the effects of it. Patient's perception of, for example, physical function, pain and fatigue is captured more easily and may thus help to adjust medication dosage. In addition, all real-life data can be included in research such as quality studies.

"The company is constantly innovating as a part of our daily work. We are working in close cooperation with researchers, both on ICT and clinical research. We want to take the vision a big step further by giving patients 100% control and monitoring of their disease status, treatment and impact."

Value for clinicians and health personnel

Today it is difficult to get a quick overview of any given treatment and the effects or side effects of it. This results in wasted resources, lost treatment quality and hampered administrative management of important end-points in relation to health. The GoTreatIT® products provide a quick overview of the patient's medical history, a quick overview of the effects and side effects in relation to medical treatment, so that clinicians can easily stop the drugs that do not work, have side effects, or change the dosage. The focus is to support the diagnosis and medical treatment and to improve quality of care. GoTreatIT® provides a more integrated under-

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standing of the patient and at the same time makes it easier to keep track of any given treatment. An important criterion for this success is that the collection of patient data does not increase the workload for clinicians as the software is largely integrated into daily clinical practice. With national quality registers, the documentation requirement for healthcare will increase further. In rheumatology, registry data is coordinated so that hospitals can use the GoTreatIT® solution for registry data which is then transported to the national registry databases. This is done as part of their clinical work and avoids having to deal with an online web-based system or paper-based solution that requires additional logins, is laborious and does not really provide much value in daily clinical care. This allows data collection for “registering and benchmarking” to be performed in one workflow.

Research and quality registers

Research/quality control on existing clinical record systems is very time-consuming. When the answers are

available, the data is already obsolete and findings have limited value in everyday life. The GoTreatIT® system serves as a practical scientific research tool on quality. Since all patient data is structured, researchers and clinicians will be able to carry out research across all patients, as opposed to a limited range of for example 5-10 % of patients. Research on “reality-based medicine” is made considerably easier. The 90-95 % of patients that we currently do not get systematised information on we will be able to collect in the future. Research requires the consent of patients, and the handling of consent is embedded in the GoTreatIT (R) solution. Society and the pharmaceutical industry need real data to really follow up the longitudinal effects of their products in order to constantly improve the benefits of their medication.

GoTreatIT® for the future

The company is constantly innovating as a part of our daily work. We are working in close cooperation with researchers, both on ICT and clinical research. We want to take the vision a

big step further by giving patients 100% control and monitoring of their disease status, treatment and impact. Patients will at any time be able to report into the solution, see their disease status and follow their own disease progression. It will also let relatives and other stakeholders access important disease data presented in a visually understandable way. The built-in warning systems intend to provide increased safety for patients. This applies both to reminders about medication and when disease parameters fall outside the limits. GoTreatIT® Cloud solutions intend to further strengthen the relationship between patient and health personnel, as well as to promote good communication and accurate documentation. Inclusion of connected sensors in our solutions is a part of this intention.

GoTreatIT®
by DiaGraphIT®

DiaGraphIT®

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Preserving our malaria-free Europe

Dr Nedret Emiroglu from the WHO Regional Office for Europe recounts some of the lessons learned in achieving a malaria-free Europe, and suggests ways to preserve it...

On 20 April 2016, the WHO Regional Director for Europe declared that the European Region is the first in the world to have achieved interruption of indigenous malaria transmission. With the number of malaria cases plummeting from 90,712 to zero in two decades, Europe reached its 2015 target to wipe out malaria, thus contributing to the global goal to “End malaria for good”.

How did Europe achieve it? The road to malaria elimination was long and troublesome.

Last malaria case in Europe in 1974

Until after the end of World War II, malaria was endemic throughout much of southern Europe, with the Balkans, Italy, Greece, and Portugal particularly affected.

Soon after the war, intensive control measures were initiated, and by 1970, malaria had been virtually eliminated from the continent. This contributed to the economic development of some of the worst-affected areas in south-east Europe. The last indigenous cases at the time occurred in Macedonia in 1974.

Malaria comes back to Europe

Unfortunately, that was not the end of it. By the late 1980s and early 1990s, local malaria transmission had been re-established in the Caucasus, the Central Asian republics and, to a lesser extent, the Russian Federation.

Following the war in Afghanistan and the dissolution of the former Soviet Union, political and socio-economic challenges, mass population migration and interruption of malaria prevention and control activities favoured malaria reintroduction and transmission. In 1995, a peak of 90,712 malaria cases was reported in the Region.



Dr Nedret Emiroglu
Director Health
Emergencies and
Communicable Diseases

Roll Back Malaria reduces cases by almost 95%

In response to this worsened situation, the [Roll Back Malaria \(RBM\) strategy](#) was introduced in 1999 in affected European countries. Its goal was to prevent deaths, reduce disease and minimise socio-economic losses by strengthening national health services and engaging communities.

International attention was mobilised. Armenia, Azerbaijan, Georgia, Kyrgyzstan, Tajikistan, Turkmenistan, Turkey and Uzbekistan were supported in their [large-scale malaria control interventions](#) by WHO and RBM partners. As a result, the number of malaria cases in the Region declined from 90,712 to 5,072 between 1995 and 2005.

The turning point in 2005

By 2005, malaria resurgence had been contained and the number of new malaria cases had dropped to such a level that the goal of interrupting transmission had become feasible. With this in mind, the affected European countries – Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, the Russian Federation, Tajikistan, Turkey, Turkmenistan and Uzbekistan – made a commitment through the [Tashkent Declaration to eliminate malaria](#) in the Region by 2015.

The Declaration led to the new [Regional strategy: From malaria control to elimination in the WHO European Region 2006–2015](#). The rationale for its development was based on the:

- Feasibility of malaria elimination in the past;
- Impact of RBM interventions at present;
- Strong political commitment at national level;
- Effective tools available in the regional context.

The goal of the new strategy was to free affected countries from malaria by 2015 and keep the malaria-free status where it had been achieved. The threat of malaria importation was especially on the radar.

Getting to zero

This Strategy guided affected countries to cut the number of indigenous malaria cases to zero.

By 2010, only 179 cases of malaria were reported in six countries. However, 2011 and 2012 saw renewed malaria transmission – in Georgia, Greece and Turkey – due to importation. This resurgence was brought under control and, in 2014, indigenous transmission was confined to Tajikistan only.

Political commitment won over malaria

Elimination in the European Region was made possible by high-level political commitment, intense programme activities in the affected countries, WHO technical support and a combination of domestic and external funding.

Key elements were heightened detection and surveillance of malaria cases, integrated strategies for mosquito control with community involvement, cross-border collaboration with neighbouring countries, and communications to people at risk.

More efforts required to stay at zero

The achievement of zero indigenous malaria cases in Europe is extraordinary but fragile. Until malaria is



eradicated globally, people travelling to and from malaria-endemic countries can import the disease to the continent.

The [Regional framework for prevention of malaria reintroduction and certification of malaria elimination 2014–2020](#) is available for European countries to avoid resurgence of malaria, prevent its re-introduction and certify their malaria-free status.

A promising story

Malaria elimination is a major milestone in Europe's public health history. But it is a milestone also in the global efforts to eradicate malaria and achieve the Sustainable Development Goal to end the epidemic by 2030.

Malaria-free Europe is a lesson learnt for good. We have learnt a great deal: That malaria elimination is possible; that we need sustained political commitment, resources and vigilance; that we cannot drop the guard when things look positive. We hope that this lesson will benefit the rest of the world. ■

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Director Health Emergencies and
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www.euro.who.int

Supporting cancer prevention in Europe

Adjacent Government highlights how the European Commission is committed to cancer prevention in Europe...

According to the European Commission, cancer is likely to remain one of the biggest killers of the 21st Century. Overtaking cardiovascular diseases, it now accounts for a quarter of all deaths and remains the largest killer of people between the ages of 45-65 in Member States across the EU.

In 2012, it was estimated more than 1.75 million people died from cancer and 3.45 million new cases were diagnosed. Between 2007 and 2014, the EU invested more than €1.4bn in collaborative research projects in order to tackle cancer.

The European Commission has long been committed to the fight to reduce cancer throughout Europe. The Commission reinforced its commitment in 2009 by launching a [European Partnership for Action against Cancer](#). The aim of the partnership was to create strong cooperation between the EU and Member States in order to develop improved screening rates, which according to reports have been achieved. It was also developed to help and support Member States in the effort to tackle cancer more efficiently and provide a framework for sharing information.

Despite advances being made in order to prevent cancer, it still remains one of the key health challenges faced by society. In order to take concrete action, The Commission set a goal, to reduce cancer incidence by 15% by 2020 through the Partnership.

The Commission has also developed a [European Code against Cancer](#), which is based on the latest scientific evidence. The Code is a set of 12 recommendations on how people can take action themselves in order to reduce their risk of developing cancer.

World Cancer Day is a campaign that runs year after year, to raise awareness to the importance of tackling cancer and stamping it out for good.

This year, [Commissioner Andriukaitis delivered a message](#) and highlighted that through healthier lifestyle choices, one out of 3 deaths could be avoided.

“On World Cancer Day, all my thoughts are with all those who are suffering from cancer or who have lost a loved one to cancer. I know first-hand the emotional devastation of cancer, having lost three beloved brothers to this terrible disease.

“I would also like to give a message of hope and empowerment by highlighting that one out of three cancers can be avoided by making healthy lifestyle choices. This does not apply to all, but for those who can be helped, it is important to arm them with the information they need to prevent cancer.

“The Commission has worked in collaboration with scientists of the International Agency for Research on Cancer (IARC) who I had the pleasure to visit in Lyon a few weeks ago, on recommendations to remain cancer-free. The fourth edition of the European Code Against Cancer, launched in October 2014, includes recommendations both on primary prevention (e.g. not smoking, good nutrition, physical activity, etc.) and secondary prevention (e.g. screening for breast, cervical and colorectal cancer).

“I promote this Code at every occasion, and urge everyone to do the same. The Code is for all Europeans, having been translated into all official languages of the EU.” ■

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Why non-coding RNA research for cancer is key

Jo Vandesompele, Chief Scientific Officer at Biogazelle outlines how non-coding RNA research for cancer can help to develop a more targeted approach for treatment in oncology

DNA is the hereditary code that is passed on from parents to their children. Every cell inside our body has the same code that contains the blueprint of life. If errors accumulate in the DNA of a given cell, it may lead to uncontrolled cellular growth and the formation of a tumor. During the act of reading the instructions coded in DNA, another chemical substance is produced in the cell, namely RNA. Until recently, these RNA molecules were thought to be translated into proteins, the building blocks of cells and our body. However, an entirely new class of RNA has emerged, outnumbering the classic RNA molecules that give rise to proteins. These new so-called long non-coding RNAs (lncRNAs) are not translated into proteins but still have crucial functions in health and disease, including cancer. Many of these lncRNAs are active in only very specific cell types or under very specific conditions; as such, they offer great untapped potential for developing innovative diagnostic and therapeutic applications.

Thanks to several decades of research, we have acquired a better understanding of cancer and have access to a wide variety of therapeutic strategies to help patients. While survival rates have increased substantially over the years, several challenges remain in the field of oncology. First, we need better laboratory tests for early diagnosis, monitoring of treatment effectivity, and early detection if

cancer comes back. Secondly, we need more effective and less toxic treatments that result in long term cures. Many conventional anti-cancer therapies do not only attack tumor cells, but also harm normal cells giving all kinds of short and long term side effects. One promising class of new medicines are targeted therapies that selectively kill cancer cells that carry a particular error in their genetic code. While great progress has been made, the number of such drugs is still small and their use almost invariably leads to rapid development of resistance against this targeted therapy. We thus need therapeutic strategies that combine several of these drugs at the same time, acting synergistically allowing lower doses and avoiding resistance and relapse. A third and final challenge is the development of lab tests that help decide which patient should get what targeted therapy, so that the right patient gets the right drug, immediately and effectively.

RNA in general and lncRNAs in particular can be exploited to address the aforementioned challenges. Disease causing RNAs can be therapeutically targeted by 2 drug technologies acting inside the cancer cell. RNA interference (RNAi) technology using short RNA molecules and antisense technology using short DNA molecules can both selectively degrade the target RNA. Antisense in general has some advantages because naked delivery of the

compound is possible (i.e. the drug does not need special formulation) and works effectively for long non-coding RNAs that are only active in the cancer cell's nucleus. Novel chemical modifications are under development that target the antisense DNA molecule to particular organs. Some 50 companies have RNAi or antisense therapies in clinical development. Of 12 companies with products on the market or in clinical phase III testing, Ionis Pharmaceuticals and Alnylam are most active in the development of RNA targeting therapies.

The key advantage of targeting RNA is that it allows rational drug design, meaning that compounds can be designed, synthesized and tested for the effectiveness of degrading the target RNA. Inherently, this leads to shorter drug development timelines; furthermore, the mode of action of these medicines is relatively well understood. And when targeting e.g. lncRNAs that are exclusively active in a particular cancer type, the RNA can be used to develop a so-called companion diagnostic test to select patients that will likely benefit from this novel therapy. In addition, measuring the target RNA levels provides a direct read-out for treatment response (when the tumor disappears, so will the RNA), and for occurrence of relapsed disease (when the tumor grows back, so will the RNA be detectable). Of particular interest is the recent finding that many of these specific lncRNA

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molecules are not only active in the cancer cell, but also circulate in the blood because of leaky tumors. One could thus take full advantage of so-called liquid biopsy lab tests, which are patient-friendly tests (as no surgery is required) in which blood is drawn for RNA quantification. At each patient visit during treatment and follow-up, blood can be drawn for straightforward and effective monitoring.

Biogazelle has been a pioneer in long non-coding RNA research in cancer and has developed several tools to measure their activity levels in diseased and healthy tissues as well as blood derived plasma. We and our customers also have access to a proprietary database, named LNCarta that contains predicted functions for several thousands of these novel lncRNA genes. Combining this functional information with integrated genetic data sets from public and

internal sources allows us to dramatically reduce the time required to prioritise therapeutic targets in cancer. Our in-house high-throughput screening platform subsequently employs antisense-mediated knockdown to functionally validate the therapeutic potential of prioritised lncRNA targets.

A recent paper in Nature elegantly demonstrated the therapeutic potential of targeting lncRNA with antisense molecules for the treatment of melanoma. Fundamental research on the characteristics of lncRNAs led to the identification of this target. At Biogazelle, we systematically screen for targets with properties that lie at the basis of this successful proof of concept. In a research collaboration with Ionis Pharmaceuticals, we are currently performing early stage validation of a series of lncRNAs as targets for the treatment of lung, liver and colon cancer. We truly believe

that rationally designed therapeutic strategies targeting specific disease associated long non-coding RNAs is a promising avenue to reach the goal of precision oncology to bring more effective and less toxic treatment to the right patient.

biogazelle
deploying the transcriptome

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Obesity, fatty liver disease and liver cancer in Europe

Alterations in our way of living over the last decades, including high caloric intake (e.g. through high fructose and high fat diet) combined with a sedentary lifestyle, have augmented the incidence of overweight and metabolic syndrome, characterised by abdominal obesity, insulin resistance, hypertension and dyslipidemia. This trend is observed not only in industrialised countries such as the United States of America or Europe but also step by step in developed as well as developing countries.

Overweight and metabolic syndrome lead to diseases of several kinds, including coronary heart diseases, Type 2 diabetes, and also cancer (e.g. liver, colorectal). Epidemiological data clearly indicate that overweight and metabolic syndrome are reaching pandemic dimensions in industrialised countries. Notably, it is suggested that newly developing countries – as a consequence of industrialisation and adaptation of their lifestyle – will also experience a steep increase in overweight and metabolic syndrome-triggered diseases. In the past ten years, the rate of obesity has doubled in adults and tripled in children in the USA. A similar trend has also been observed in Europe.

The liver – which is the most important metabolic organ – is strongly affected by a chronic state of overweight and metabolic syndrome. Non-alcoholic fatty liver disease (NAFLD), the most frequent liver disease worldwide, is a clinical manifestation of



overweight and metabolic syndrome. NAFLD is a chronic disease that can last several decades, characterised by predominant macrovesicular steatosis of the liver. Although the prevalence of NAFLD is increasing globally, epidemiology and demographic characteristics of NAFLD vary worldwide. It is becoming increasingly clear that a number of pathways are involved in the pathogenesis of NAFLD and NASH and its progression to advanced stages of liver disease. These pathways may be diverse in different cohorts of patients suffering from the condition, and understanding which pathways play a role in its development will be critical before launching treatment modalities.

A significant number of NAFLD patients develop nonalcoholic steatohepatitis (NASH), fibrosis and conse-

quently hepatocellular carcinoma (HCC). In recent years, obesity, leading to metabolic syndrome, steatosis and steatohepatitis, has attracted increased attention due to an increased HCC incidence in the US and Europe. In line with this, the most common etiology for HCC in industrialised countries has recently switched from chronic viral infections (e.g. hepatitis B and hepatitis C virus) to obesity, making HCC the most rapidly increasing type of cancer in the US, with a similar trend observed in Europe. Today we lack a detailed understanding of how chronic steatosis develops into NASH and what factors control its transition from NASH to HCC. At the same time, no therapeutics exist to efficiently treat NASH, and treatment options for the therapy of late stage HCC are limited and prolong the lifespan of patients for between three to six months.

“In the past ten years, the rate of obesity has doubled in adults and tripled in children in the USA. A similar trend has also been observed in Europe.”

In laboratory mice, NASH can be induced by several different diets, such as a methionine/choline-deficient (MCD) or choline-deficient diet (CD) but not by a high-fat diet (HFD) alone. However, C57BL/6 mice fed with MCD or CD do not develop obesity or metabolic syndrome, and the diet has to be discontinued after a few months due to weight loss (up to 40%) or occasional cachexia. Hence, these approaches do not recapitulate NASH and its consequences (e.g. transition to HCC) in humans, and appropriate mouse models for genetically and mechanistically dissecting NAFLD-induced NASH and NASH-triggered HCC development have been thus far lacking.

Deficiency in the essential nutrient choline was described in NAFLD patients to exacerbate NAFLD and NASH. Moreover, humans with inadequate choline uptake were shown to have defects in hepatic lipoprotein secretion, oxidative damage caused by mitochondrial dysfunction and ER stress.

Based on the clinical observations of choline deficiency to exacerbate NAFLD and NASH patients, we have recently combined choline deficiency with a high fat diet (CD-HFD) as a chronic diet for laboratory mice, which may lead to

metabolic syndrome, steatosis, liver damage and NASH, thus delivering the ‘second hit’ that promotes dietary-induced liver carcinogenesis – similar to the human situation. This approach has enabled us to establish a chronic mouse model of NASH and metabolic syndrome, triggering subsequent HCC in a wild-type C57BL/6 mouse, in the absence of chemical carcinogens or genetic mutations predisposing to NASH or HCC development (Wolf et al., *Cancer Cell*, 2014). CD-HFD-treated mice display obesity, overweight, insulin resistance, liver damage and fibrosis and hepatic mitochondrial damage, dyslipidemia and NASH, as observed in human patients. HCC developed 12 months post-CD-HFD start and resembled histologically, genetically and morphologically human HCC. Interestingly, by using this novel model we could show that adaptive immune cells (e.g. cytotoxic T-cells as well as natural killer T cells) greatly contribute to the diet-induced liver pathology. Consequently, we also analyzed NASH patients and patients suffering from other liver diseases with concomitant lipid deposition diseases (e.g. chronic HCV infection) and could find the same activated immune cells in livers of NASH patients, as well as the same cytokines, which we identified to be causally linked to NASH and HCC disease development.

We thus believe that our mouse model recapitulates several pathophysiological aspects of human NASH and enables us to study its development and transition to HCC. In the

future, the link between activated T-cells in the liver and their crosstalk to hepatocytes could give us important insights into how we can generate novel therapeutics for treating NASH as well as NASH-induced HCC in industrialised countries.

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Breast cancer: prevention and survival

Rachel Clark, Health Promotion Manager, at World Cancer Research Fund, sheds light on breast cancer and how to reduce the risks of developing the disease...

Breast cancer is the most common cancer in women in the UK. In fact, 1 in 8 women will develop the disease at some stage in their lifetime. Breast cancer is rare in men, with around 400 new cases diagnosed each year in the UK, compared to around 50,000 new cases in women.

Is breast cancer preventable?

Evidence from World Cancer Research Fund estimates that about 40% of breast cancer cases in the UK could be prevented by maintaining a healthy weight, being physically active and not drinking alcohol. That's about 20,000 fewer cancer cases a year.

Many people think that breast cancer risk is down to genes. However, only 3% of breast cancer cases are hereditary, and many of the factors that increase the chances of developing the disease are linked to lifestyle.

As with all cancers, the risk of developing breast cancer depends on a number of factors and varies from person to person.

Lifestyle risk factors:

- Drinking alcohol;
- Being overweight or obese (increases the risk in postmenopausal women);
- Lack of physical activity (increases the risk in postmenopausal women).

World Cancer Research Fund also found convincing evidence that not breastfeeding increases the mother's risk of breast cancer.

Other risk factors:



- Age – risk increases with age;
- Starting periods at a younger age (before age 12);
- Late menopause (over age 55);
- Not having children, or having a late first pregnancy (over the age of 30);
- Family history – particularly if a close relative is diagnosed before the age of 50;
- Naturally occurring oestrogen and progesterone can influence the development and growth of some breast cancers. Some medications containing artificial versions of these hormones have also been linked to an increased breast cancer risk. These include:
 - Taking combined hormone replacement therapy (HRT) (the evidence is less clear for oestrogen- only HRT) – risk continues to increase slightly the longer someone takes HRT but decreases gradually once they stop;

- Taking the oral contraceptive pill (the evidence is less clear for the mini pill) – risk increases slightly when someone takes the pill, but slowly returns to normal after they stop.

More than 90% of women diagnosed with breast cancer at the earliest stage survive their disease for at least five years compared to just 15% for women diagnosed with the most advanced stage of disease.

How can people reduce their risk of breast cancer?

Cut down on alcohol

We have strong evidence that drinking alcohol increases breast cancer risk. It is estimated that 22% of cases could be prevented if we didn't drink any alcohol.

“Many people think that breast cancer risk is down to genes. However, only 3% of breast cancer cases are hereditary, and many of the factors that increase the chances of developing the disease are linked to lifestyle.”

Maintain a healthy weight

Being a healthy weight is one of the best things people can do to help protect against breast cancer.

Be more active

People should aim to be physically active for at least 30 minutes every day.

If they can, women should breastfeed their baby.

These steps are based on research from our Continuous Update Project (CUP).

What about screening?

The good news is that most breast cancer cases can be successfully treated if they are detected early – that's why it is important for women to attend breast screening whenever they are invited. Visit NHS Choices to find out about breast cancer screening, symptoms and treatment.

If the cancer has spread, treatment becomes more difficult, and generally a person's chances of surviving are much lower.

Breast cancer survivors

There is growing evidence that eating a plant-based diet, maintaining a healthy weight and getting regular physical activity may help to prevent people from getting cancer again, and improve survival, particularly following [breast cancer](#).

However the evidence is not yet clear enough for us to be able to make more detailed recommendations. So, until further research is done, the best advice to reduce the risk of cancer returning is to follow our Cancer Prevention Recommendations.

Future research

More and more people in the UK are living with a diagnosis of cancer, and this is likely to increase as treatments for the disease improve. Preventing a recurrence of the disease and improving general health in cancer survivors is a new focus of research and is a priority for the scientific work we fund.

Health professionals based in the UK can take advantage of our [FREE cancer prevention package](#), which includes online training and resources.

Visit the [World Cancer Research Fund website](#) to find out more about cancer prevention. ■

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Pancreatic cancer: Understanding drug delivery key to better outcomes

To improve outcomes for pancreatic cancer patients, better drug delivery models are vital, as Zhihui Wang, Eugene J Koay, and Vittorio Cristini outline here

Pancreatic cancer is now the third leading cause of cancer-related deaths in the United States, and, despite extensive research in the past decades, the 5-year survival rate is only about 6.7 per cent. Pancreatic ductal adenocarcinoma (PDAC) – the most common type of pancreatic cancer – is characterised by leaky and disorganised vasculature, abnormally dense stromal cells, and deregulated transport proteins. These features constitute physical barriers to the chemotherapy drug delivery process. It has been increasingly recognised that studying a tumour's physical properties may provide a deeper understanding of resistance to drug delivery and the poor outcomes of PDAC.

One of the ways to measure drug transport properties is through diagnostic imaging. Computed tomography (CT) scans are a common form of imaging test where a series of X-rays are processed to form a cross-sectional or even 3D image. Tumours are characteristically less dense than normal pancreatic tissue, allowing the size and location of the tumour to be distinguishable with CT in most cases after injecting a contrast dye. Once the tumour is imaged and a biopsy taken, it can be diagnosed, staged, and a treatment plan can be developed.

Using parameters from individual patients, we are working to develop models that describe drug delivery

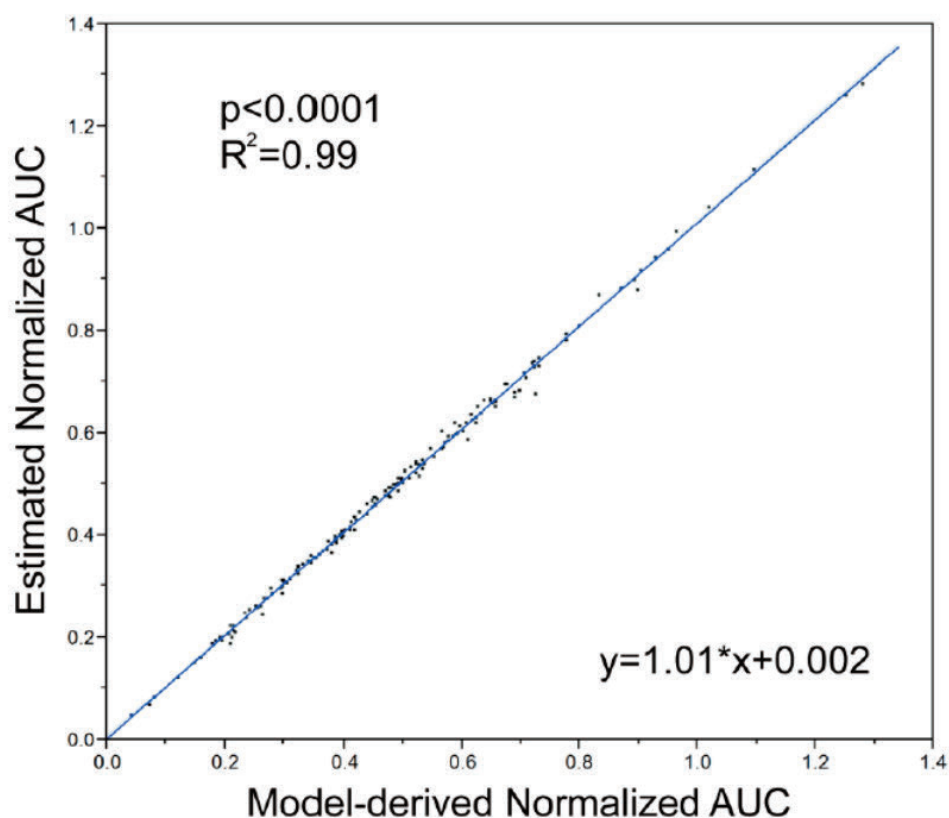


Fig. 1. Comparison of the estimated normalised AUC with the model-derived normalised AUC using a piece-wise linear equation. This demonstrates a 1:1 correlation between the estimated and model-derived values, indicating that the mathematical model can be approximated using a straightforward calculation that can be applied at any institution. Adapted with permission from (Koay et al., *J Clin Invest* 2014; PMC3973100).

and potential barriers of delivery to tumours. Modelling includes the entire process of cancer treatment from delivery, to uptake by the tumour, to the effects of the drug on a subcellular level. It is our understanding that for mathematical modelling to be clinically relevant, it must be able to be easily implemented in the diagnosis and treatment process. In other words, if developing a model of a specific tumour requires many extra steps

and is inconvenient for physicians and patients, it is unlikely to be implemented. We aim to develop clinically applicable models that can be assessed at the point of care for physicians and patients.

Working in this clinically-relevant direction, we have developed a model of mass transport that uses standard-of-care imaging for patients with PDAC (Koay et al., *J Clin Invest* 2014;

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PMC3973100). Multiple, systematic measurements of the CT Hounsfield Units (HU) of the tissue of interest (i.e. PDAC or normal pancreas) at sequential time points during the pancreatic protocol were used to quantify the mass transport properties of individual PDACs; the reader is encouraged to refer to the original article for modelling details.

With this model, we derived quantitative mass transport parameters that describe influx and efflux rates of contrast, and the maximum enhancement of the pancreatic tissue imaging. We also calculated a volumetric area under the model-predicted enhancement curve (AUC) from the CT scan as a measure of enhancement. Briefly, we used measurements from 176 routine CT scans taken before treatment to create a model that can quantify

the mass transport properties in normal and malignant pancreatic tissues. Out of the 176 scans, 110 patients received preoperative gemcitabine-based chemoradiotherapy.

To assess the appropriateness of the developed model, we compared the model-derived AUC with an estimate of AUC using a simple piecewise linear function. There was a 1:1 linear relationship between the estimated and model-derived AUC parameters (Fig. 1), which was expected since our model is continuous. Moreover, the simple piecewise linear approximation can be easily translated to clinical practice, as only a straightforward calculation is necessary.

Further development of diagnostic tests that allow simultaneous radiologic cancer staging, as well as biophysical

tumour profiling, is warranted. The concept of individualised cancer therapy based on biophysical characterisation is also supported by our recent work on other cancer types (Pascal et al., Proc Natl Acad Sci U S A 2013; PMC3761643), as patients with good response to therapy appeared to have different physical tumour properties compared to those with poorer responses. Future research will aim to better understand these transport mechanisms, validate our findings, and develop rational therapeutic interventions for patients with PDAC and other cancers.

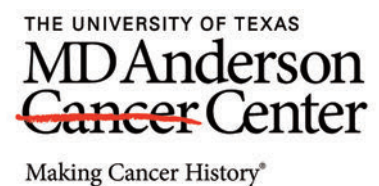
Additional resources:

<http://www.internationalinnovation.com/taking-cancer-out-of-the-equation/>

<http://www.pnas.org/content/110/35/14266.long>

<http://stacks.iop.org/1478-3967/11/065002>

<http://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1004969>



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New developments in the treatment of ovarian cancer

Gunnar Kristensen, from the Department of Gynecologic Oncology at Oslo University Hospital, looks at different forms of new treatment to tackle ovarian cancer...

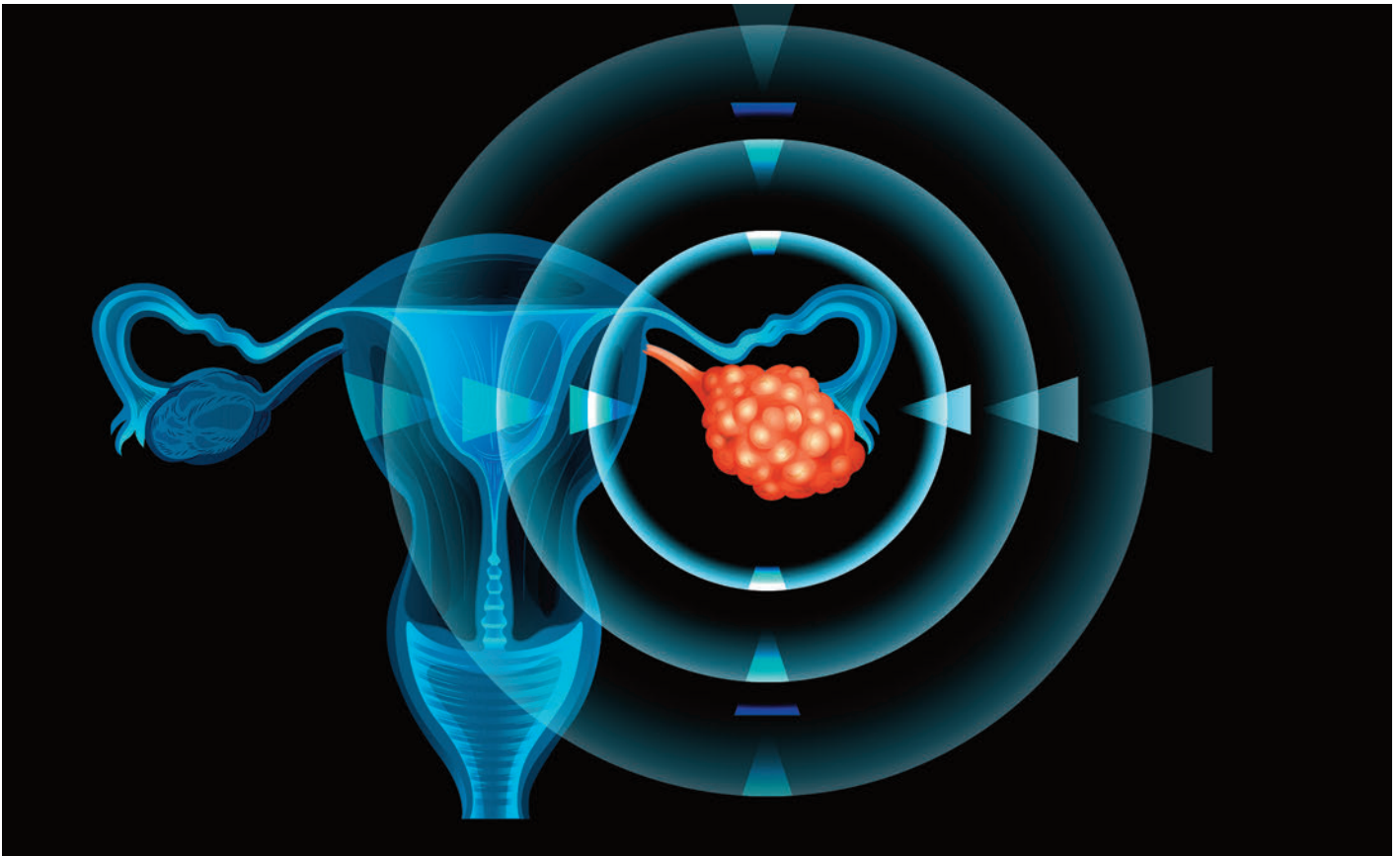
It is recognised that the disease we usually call ovarian cancer can originate from either the ovaries, the fallopian tube (the organ bringing the eggs from the ovaries to the uterus) or the peritoneum (cells lining the abdominal cavity). These tumors all behave in the same way and are usually diagnosed in the late stages. This is due to vague or absent symptoms in the early stage and the fact that they spread to the abdominal cavity very early. It is important that patients and health care providers are reflective on even vague gynecological symptoms that could be indicative of ovarian cancer and refer the patient to specialised health care.

Once the diagnosis is established, the first step is usually to perform surgery with the goal of removing all of the visible cancer elements, or at least reduce the tumor to the maximum of 1cm in diameter. If the preoperative evaluations with CT and/or laparoscopy indicate that it is most unlikely to achieve this, the patient is usually offered chemotherapy to shrink the tumor before surgery. After surgery, all patients with advanced cancer are treated with chemotherapy. It has been shown that treatment with bevacizumab, combined with chemotherapy and continued bevacizumab afterwards for a total treatment time of 12-15 months can increase the time to a relapse. In the ICON7 study it was shown that patients with a high risk of relapse benefitted from such treatment while patients with a lower risk did not. The high risk group in ICON7 was patients with stage 4 disease and patients with stage 3, with residual cancer after surgery of more than 1cm. Bevacizumab belongs to a group of drugs (VEGF inhibitors) that works by blocking the formation of new vessels. As growing tumors need new vessels as a supply of nutrition, this will slow their growth. Bevacizumab is an antibody to VEGF and is given intravenously. Other VEGF inhibiting drugs work by inhibiting the growth signal within the cell and are given orally. Most patients with advanced ovar-

ian cancer will suffer a relapse and be treated with chemotherapy again. In the case of a relapse, treatment with bevacizumab improves the effect of chemotherapy and prolongs time to a new progression (PFS). This was especially seen when bevacizumab was given together with weekly paclitaxel to patients with tumors relapsing early after end of previous chemotherapy (Aurelia study).

Breaks in the double strand of DNA often occur and are immediately repaired by repair mechanisms in the normal cell. Two mechanisms are of special importance, the homologue repair mechanism (HRD) and the PARP mechanism. The best known genes of importance for HRD repair are the BRCA 1 and 2 genes, but other genes are important as well. In tumors with a defect in the HRD repair mechanism, inhibition of the PARP will prevent repair and the cell will die. In 2014, the results from a randomised phase 2 study, comparing the outcome after maintenance treatment with the PARP inhibitor olaparib versus placebo after chemotherapy for a platinum sensitive relapse of high grade serous ovarian cancer were published. A substantial prolongation of median PFS in patients with a BRCA mutated tumor (11.2 versus 4.3 months) was seen. In patients with a tumor without BRCA mutated cells, a smaller gain in median PFS was seen (7.5 versus 5.5 months). A recent update has been published showing that patients with BRCA-mutated platinum sensitive recurrent serous ovarian cancer receiving olaparib, appear to have longer overall survival.

At the ESMO (European Society for Medical Oncology) 2016 congress, the results from a phase 3 study on maintenance treatment with niraparib (another PARP inhibitor) after chemotherapy for a platinum sensitive relapse of high grade serous ovarian cancer were published. Maintenance treatment with niraparib was compared to placebo. In patients with a BRCA mutated tumor, the median PFS was increased substantially



from 5.5 to 21 months; in patients with other kinds of HRD deficiency the median PFS was increased from 3.8 to 12.9 months and even in patients without a HRD deficiency, the median PFS was increased from 3.9 to 9.3 months. Maintenance treatment with PARP inhibitors is well tolerated. These results are very promising in the treatment of high grade serous ovarian cancer and highlights the importance of also looking at other genes involved in the homologue repair mechanism, as well as the BRCA genes.

Immunotherapy with immune checkpoint inhibitors has reached great interest also in ovarian cancer. Several years ago, this kind of treatment was found quite effective in the treatment of malignant melanoma. Since then, the effect of blocking immune checkpoints has been established in several tumor forms. In ovarian cancer antibodies against PD1 or PD-L1 are studied intensively. So far, only a few results have been published. Two smaller studies have shown response rates of around 20% and stabilisation of the disease in 40-50% of cases. The idea of immunomodulation is to enhance the activity of tumor infiltrating T cells (TILS). It has long been known that a high number of TILS in the tumor is indicative of a better prognosis. The TILS are meant to destroy the tumor cells. Blocking the checkpoints by an antigen allows for a higher penetra-

tion of TILS into the tumor. Other factors are also of importance for the ability of TILS to penetrate into the tumor. For the time being, we see a number of studies evaluating the effect of antibodies blocking the PD1-PD-L1 checkpoint. In the future, we expect to see studies combining these drugs with other ways of enhancing the penetration of TILS into the tumor.

Low grade serous ovarian cancer is another entity. These tumors are rarer. They don't respond as well to chemotherapy, but grow slowly, so patients can usually live with these tumors for many years. Estrogen is a growth stimulator for these tumors but not for high grade tumors. It has recently been shown that blocking the estrogen production can prolong survival of patients with low grade serous ovarian cancer. We are awaiting results from studies on other ways than chemotherapy to control these tumors. ■

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Encouraging communities to get healthy

Beki Cadd and Stephanie Bradbeer from Action PR highlight the importance of increasing leisure participation amongst disengaged groups within communities...

According to statistics from Sport England, 15.8 million adults play sport at least once a week. This represents an increase of 1.75 million since 2005, indicating the 2012 Olympic legacy is playing out as hoped. The numbers however do not tell the whole story. More men play sport than women (40.7% of men, 31.5% of women) and age is also a factor. While over half of 16-25 year olds take part in at least one activity session a week, less than a third of older adults are similarly engaged. Take up is highest among professional workers, and while the numbers of black and minority ethnic groups playing sport have increased by nearly 700,000 since 2005, as well as the percentage of disabled people, these figures are still proportionately low.

Leisure operators need to be doing more to engage with a wider audience to combat these differences. By empowering community groups that are typically less engaged with physical activity, they are perfectly placed to provide opportunities to be healthier and more active.

“The key thing for us as a not-for-profit leisure operator is to broaden the reach of our centres and truly be a community based provider delivering projects that are targeted towards these hard-to-reach groups,” says Richard Bagwell, Freedom Leisure Group Sport Development Manager. “This requires us to adapt our provision, use different venues, offer easy access trials, subsidised pricing and provide clear pathways from our short-term health programmes into longer term activities.”

Engaging with NGBs, the NHS and councils also opens up access to different population groups, as well as sources of funding.



“Working with partners in the community we can identify ways to help support these individuals and widen participation, by understanding and integrating with the needs of the local population. For example, in areas with little provision for teenagers, we can offer sessions that help to increase their self-esteem and encourage them to engage in physical activity.”

Combating the perception that the leisure centre is an intimidating space is another factor in broadening participation. Free taster sessions are a proven option in engaging new participants and demonstrating how exercise can be fun. Providing a separate stream for those with health conditions and lower fitness levels is also key.

“It is important for leisure facilities to cater to both the fit and healthy and those with longer term health issues, otherwise we are excluding a large percentage of the population,” says Mark Leahy, Everyone Active Regional Contract Manager. “Providing specialised programmes for these users will help to integrate



CASE STUDY

Everyone Active centres in Ealing, Brent and Harrow have seen great success increasing participation – one of the key objectives. The year on year increase in centre attendance has been impressive, rising significantly since Everyone Active took over the contract, and up 13% from 2014/15-2015/16 across all boroughs. Ealing in particular has seen great success with attendances up 25% compared to 2014/15.

This success comes from a programme of tailored outreach, to engage different ethnic and religious groups within the community. The team at Southall Sports Centre, Ealing, have been working closely with the largest Sikh Temple in the western hemisphere, visited by over 10,000 people every week. A discounted membership rate is offered to all attendees, and fitness and health awareness days at the temple have allowed Everyone Active to reach out to new members, promoting the benefit of exercise. In particular, the women's only classes now on offer at Southall Sports Centre have been extremely popular with the Sikh Temple members.

The Harrow contract has worked hard to host disability sports days, which have been a huge success in getting more of the local disabled population in to the leisure centre and participating in a range of activities. They also work closely with school sports partnerships, ensuring uptake on school swimming lessons has been very high, with a year on year increase. ■

them into the physical activity sphere and widen participation by promoting sustainability and lifelong health. Meeting their needs in a personalised setting means that individuals are much more likely to stay and further improve their health.”

Operators must also acknowledge the ageing population, considering specific classes for an older demographic. Low impact exercise and a social element have shown success in helping to engage this demographic. Some leisure operators are also training their staff to assist customers struggling with dementia and Alzheimer's, as well as developing partnerships with organisations such as the Stroke Association and Age UK.

There are many possible solutions to encouraging more people in communities to get healthier and more active. With a focused, personalised method and by considering health across the board, operators are able to promote a sustainable approach to fitness and thereby look to increase participation in those currently underrepresented groups. Responding to the needs of the local community and working closely with the local authority means operators can offer a programme of activity to match.

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3D body scanning: measuring body volume for obesity assessment

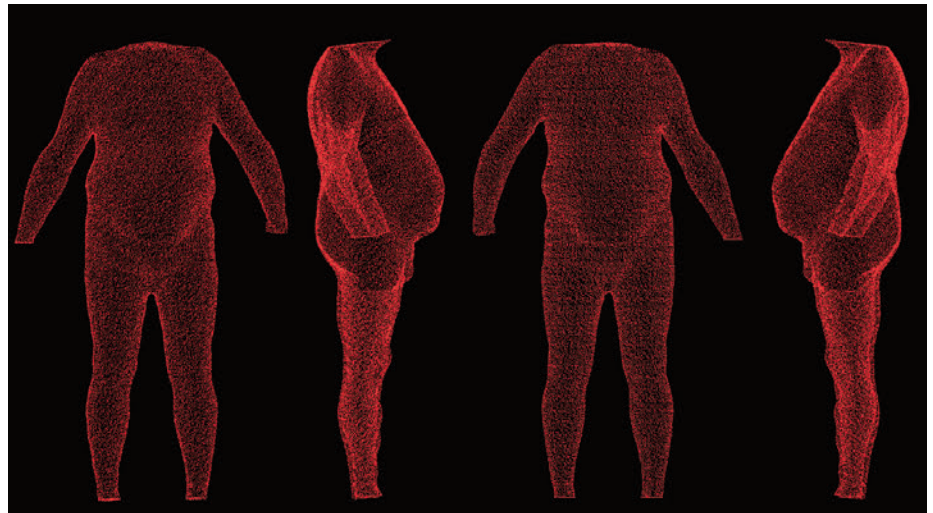
A research group at University College Ghent is developing a method to measure body fat using 3D body scanning...

Obesity is a condition in which the amount of fat tissue is increased resulting in adverse effects on health and is associated with increased morbidity and mortality¹. This state of fat accumulation is linked to increased risks of type 2 diabetes, cardiovascular disease, fatty liver, sleep apnea syndrome and certain types of cancer and a decreased life expectancy.

The prevalence of overweight and obesity has increased dramatically worldwide and the number of people struggling with obesity today has doubled the past three decades. Among the Belgian adult population, 48% are too heavy for their height: 34% of the adult population are overweight, while 14% suffer from obesity. Overweight is more frequent in men (41%) than women (28%), but there is no difference between men and women with regard to obesity (14%). What is distinctly alarming is that more than half of all individuals in the 45-54 age group are overweight and one of five people in the 55-74 age group are obese².

Weight indexes

In both clinical and scientific practice, assessment of body fat is not always possible because of costs, available time or limited access to the necessary measuring devices. Therefore, body weight indexes are often used as a proxy measure for the assessment of the degree of adiposity. The body



3D bodyscan of an obese man (front, right, back and left)

mass index (BMI), developed by the Belgian scientist Adolphe Quetelet in 1832, is calculated as the ratio of body weight in kg, over body height in meter. According to the World Health Organization, a person with a BMI equal to or more than 25 is considered to be overweight. A person with a BMI of 30 or more is generally considered obese.

Although the BMI is quick and easy to calculate, its accuracy to diagnose obesity has shown to be limited, particularly for individuals in the intermediate BMI ranges³. Also, the BMI was originally designed to be used at the population level and is therefore not as effective in individual cases because body weight is influenced by more than fat tissue alone. Furthermore, the relationship between BMI and health can vary with ethnicity making global comparisons problematic.

Therefore, it has been suggested that future research on body composition measurement should focus more on body shape and volume rather than body mass. With the advent of 3D body scanning technology, it is possible to obtain accurate and reliable anthropometric measures of an individual. Also, 3D body scans provide information on an individual's body volume and body shape. Because a body scan results in a digital avatar, the distribution of body mass and fat deposition can be visualised and processed on a higher level compared to manual anthropometric measurements.

Innovative research

At University College Ghent in Belgium a team of researchers is involved in the Anthropometric based Estimation of adiPoSity (ADEPS) project. They use state-of-the-art technology like 3D body scanning and air displacement

PROFILE

3D bodyscanner (www.symcad.com)



3D BODY SCANNER
SYMCAD III-C

by **TELMAT**
INDUSTRIE

Configuration:

- nb sensors: 20
- scanning in 1.5 sec.
- accuracy: 0.15%



www.telmat.com

measurable anthropometrics that are useful in clinical practice and research. In developing this tool, the ADEPS project offers a practical contribution to getting a grip on obesity, the largest preventable health problem of our time.

“Results from our research will allow clinicians and researchers to assess the amount of body fat at a minimal cost and without using advanced equipment.”

The results from the ADPES project are to be expected by the end of 2016.

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plethysmography to study the extent to which body fat percentage can be predicted using anthropometric measurements. The objective of the ADEPS project is to gauge body fat percentage from readily available anthropometric measures that don't require sophisticated equipment.

A 3D bodyscanner uses structured white light technology to produce consistent point clouds and body models with a 3D-point accuracy of less than 1 mm. From a set of bodyscans a procedure is developed to determine total body volume. Derivation of body volume, together with measurement

of body mass, permits calculation of body density and subsequent estimation of percent fat and fat-free mass.

Using advanced statistical modelling the investigators will identify which anthropometric measurements provided by the body scan are useful predictors for body fat percentage resulting in predictive models. These models will then be validated using a reference method for body fat percentage determination. Resulting predictive equations will be converted into population-specific nomograms for convenient assessment of body fat percentage from simple and manual

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Air quality: what can we do to protect our lung health?

Professor Guy Joos, President of the European Respiratory Society and Dan Smyth, Chair of the European Lung Foundation, look at the importance of healthy lungs and how air pollution can affect them...

Regular exposure to air pollution is linked to the development of certain lung conditions, such as chronic obstructive pulmonary disease (COPD), and lung cancer and it can shorten life expectancy. Despite the evidence supporting this, there is still a lack of awareness amongst the general public about how they can reduce their exposure and among healthcare professionals about what practical information they can deliver to help patients.

Clean air means air free from particulate matter, pathogens, smoke and dangerous gases. We all have little control over the air that we breathe, but learning more about the quality of air and its impact can help us to find the best way to protect ourselves. Air pollution could refer to the quality of the air we breathe while at home, in the workplace, and outdoors exercising and commuting.

The effects of air pollution on the lungs depend on the type and mix of pollutants, the concentration in the air, the amount of time that you are exposed to the pollutant, how much of the pollutant you breathe in and how much of the pollutant penetrates your lungs.

Outdoor air pollution has been one of the European Union's main environmental policy concerns since the late 1970s. Efforts to reduce emissions of air pollutants have led to reductions in several pollutants including sulphur and nitrogen oxide, which has helped reduce the number of urban smog and acid rain episodes that were seen in the past. However, levels of nitrogen oxides and small particles (e.g PM10) from transport pollution have increased and become the dominant sources of atmospheric pollution in urban areas. Outdoor air pollution remains the number one environmental cause of death in the EU, still leading to about 400,000 premature deaths each year in the EU.



Not many of us realise that pollution indoors can also affect us. We actually spend about 90% of our time inside, either at home or in the workplace, so indoor air is very important for our health. Indoor air pollution comes from many places, including tobacco smoke, open fires and heaters, building materials and furniture, cleaning products, cooling systems and air pollution from outdoors. Adults spend one third of their lives at work and there are additional exposures for people in different professions. 10-15% of all asthma cases are work related, caused by a factor in the work environment, for example flour and grain for bakery workers and cleaning products for cleaners.

Lung health symptoms that can be seen straight after exposure to high pollution levels, either indoors or outdoors include irritation of the airways, dyspnoea (difficulty breathing) and an increased chance of asthma sufferers having an attack. Being exposed to air pollutants for a long period of time has been shown to increase the occurrence of lung diseases, including cancer, and deaths from these diseases.

The Healthy Lungs for Life campaign has put a spotlight on the importance of clean air this year, to help

raise awareness of how both indoor and outdoor air pollution can impact our lung health and what action can be taken to improve the situation.

Healthy Lungs for Life is a global, long-term health awareness campaign that aims to speak not only to those already affected by lung disease, in order to improve their quality of life, but also to those who may be affected in the future. The objective is to focus on prevention and public education, to try and reduce the burden of lung disease on society. The campaign was created and is led by the European Respiratory Society and the European Lung Foundation and is a partnership between organisations across the globe.

This year, the campaign was launched at the European Respiratory Society's International Congress in September in London – a fitting setting to raise the question of air pollution as a topic high on the agenda for the New Lord Mayor of London. The campaign was launched with a range of lung testing events across the city targeting the public, a media campaign reaching the national and international press and sessions held at the Congress targeting professionals. The campaign will now be rolled out across the world for other respiratory stakeholders to hold similar events in their own countries and cities.

The campaign has had a huge impact on these target audiences – members of the public were engaged in the theme and over 2,000 people had their lungs tested during the events. Practical information on how we can reduce exposure was also shared. For outdoor air pollution, this includes:

- **Check the air quality index of the day in your area** – actual air pollution levels depend on the type of pollutant, the location and the local weather;
- **Check the weather forecast** – air pollution tends to be at its highest on hot, sunny days;
- **Avoid walking along busy streets with lots of traffic fumes** – take alternative routes or keep 1-2 metres from the road where you can;
- **Plan any outdoor exercise to** avoid rush hour, busy roads and peak pollution exposure.

For indoor air pollution there was a focus on the impact of passive smoke in the home, with advice being given to ensure people do not smoke inside. In addition, people were asked to think about their working environments.

Over 22,000 respiratory professionals attended the ERS Congress and were exposed to key messages around the campaign, and had the opportunity to attend sessions hearing the latest research in the field, collect information packs and personal air quality monitors.

The campaign will go to Brussels in November to share these key messages with policymakers and to raise awareness amongst decision makers about the impact air pollution is having on citizens across Europe. Other countries taking part in the campaign include Brazil, Kyrgyzstan and Ireland.

Part of the success of the campaign is the overarching reach of both the ERS and ELF. Through the targeting of patients, professionals and policymakers, we believe we can drive positive change by making individuals aware of how to decrease their exposure to harmful pollutants, encouraging healthcare professionals to give practical advice to their patients on the risks of exposure and targeting policymakers to act for the benefit of lung health. The air we breathe – today, tomorrow, yesterday – matters. We must act now to reduce pollution levels and improve health outcomes in the future. Everyone needs to be aware of what it is, where it is and the harm it can cause.

Learn more about the benefits of cleaner air for lung health: www.healthylungsforlife.org . ■

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www.europeanlung.org/en/
www.ersnet.org/

Advanced practice provider emergency ultrasound pathway

Virginia M Stewart, at FESPA outlines the importance of guidelines for delivering emergency ultrasound treatment...

As per the August 2012 American College of Emergency Physicians (ACEP) Emergency Ultrasound (EUS) section: "There are no definite protocols for training that have come from their distinct specialties (as of yet), therefore section members have employed the general ACEP training guidelines when applied to credentialing of mid-level providers. For nurses, many programs have successfully implemented training in IV placement and bladder volume assessment."

In 2008, ACEP guidelines for non-resident emergency providers using ultrasound recommended:¹

- A minimum of 4 hours of didactic training;
- A minimum of 150 ultrasounds reviewed by the designated reviewer;
- 25 ultrasounds in each of the 6 main areas of competency to obtain "general EUS competency";
- A recommended 25 reviewed ultrasounds in any area of competency;
- 10 reviewed ultrasounds for procedures using ultrasound guidance.

Evidence for APP use of EUS applications:

While many studies evaluate the performance of emergency physicians (EPs) trained in EUS, studies have only recently been emerging that specifically evaluate the EUS performance of APPs. In many academic programs, emergency APPs learn ultrasound

alongside residents and EUS naïve attending physicians. In one prospective study, APPs post-test performance after a condensed EUS course was equivalent to the average score for all participants, and slightly exceeded scores of attending physicians.² Areas of competency included: echocardiography, aorta, ectopic pregnancy, trauma, renal, gall bladder, and obstetric. Another prospective single-center study demonstrated an overall diagnostic accuracy or 85% for diagnosis of deep venous thrombosis with a 3 point scan protocol among 183 low-risk patients.³

Prompt recognition and treatment of tension pneumothorax is critical in a trauma setting and is within the scope of APPs. After a brief presentation, ultrasound naïve APPs accurately detected pneumothoraces, as well as normal hemothoraces, with a sensitivity of 95.4% (95% CI 0.75-0.99), a specificity of 100% (95% CI 0.81-1), a PPV of 100% and a NPV of 95.6%.⁴ Pre-hospital studies have demonstrated adequate EUS image quality and interpretation by non-physician providers in the setting of trauma, cardiac arrest, and thoracic ultrasound.^{5,6}

Scope of practice of EUS for APPs:

Point-of-care ultrasound is the use of ultrasound technology by trained providers for the bedside evaluation, diagnosis, treatment, and resuscitation of emergent, urgent, and ambulatory

complaints. Typically EUS involves limited studies that answer a focused yes/no question pertaining to a specific organ system, and is performed by a physician, or APP under direct physician guidance.

EUS can be classified by the following functional categories:¹

- Resuscitation;
- Diagnostic;
- Symptom or sign-based: ultrasound based on clinical pathways based on the patient clinical complaint, symptom or sign;
- Procedure guidance;
- Therapeutic and monitoring.

Applications of EUS:¹

- Trauma;
 - Focused Abdominal Sonography in Trauma protocol (FAST).
- Intrauterine pregnancy;
 - Identification of in all trimesters, and recognition of ectopic pregnancy.
- Abdominal Aortic Aneurysm (AAA) diagnosis;
 - Diagnosis of aortic dissection.
- Cardiac;
 - Limited: to include presence of cardiac motion during cardiac arrest, and identification of pericardial effusion and tamponade physiology;

PROFILE

- Advanced applications: qualitative and quantitative assessment of ejection fraction, focal wall motion abnormalities, assessment of valvular abnormalities and pathologies, identification of thrombus and cardiac masses, and identification of lethal and non-lethal arrhythmias including electromechanical dissociation;
- Procedural guidance for pericardiocentesis.
- Thoracic ultrasound;
 - Evaluation of traumatic, infectious, and neoplastic pulmonary processes, thoracentesis and thoracostomy procedural guidance, and mediastinum evaluation.
- HEENT;
 - Confirmation of endotracheal tube placement, diagnostic angioedema classification, evaluation of vocal cord injury, peritonsillar abscess identification and procedural guidance of drainage, limited thyroid evaluation.
- Biliary;
 - Diagnosis of cholecystitis, cholelithiasis, and pancreatitis/choledocholithiasis.
- Renal/urinary tract;
 - Bladder volume quantification, identification of hydronephrosis.
- Deep venous thrombosis diagnosis (limited compression study).
- Soft tissue and musculoskeletal;
 - Diagnosing cellulitis, necrotizing fasciitis, and other soft tissue infection, procedural guidance for abscess drainage, and foreign body removal, diagnosis of long bone fracture, diagnosis and procedural guidance for joint and fracture reduction and arthrocentesis.
- Ocular;
 - Diagnosis of retinal detachment, vitreous hemorrhage, foreign body, lens dislocation, globe rupture, and central retinal artery and venous occlusion.
- Procedure guidance;
 - Vascular access, peripheral nerve blocks, and any invasive procedure performed in the emergency department.
- Bowel;
 - Including diagnosis of intussusception, appendicitis, pyloric stenosis, diverticular disease, volvulus, obstruction.
- Adenexal pathology diagnosis;
 - Infectious more so than neoplastic.
- Testicular;
 - Diagnosis and procedural guidance for torsion.

Level of Supervision

Many academic and community health systems within the United States allow for the independent performance and interpretation of EUS by APPs, with direct visualization, or immediate over-read and verification by the attending physician. Depending on the level of training, facility, and patient acuity, the level of supervision (direct or indirect) varies. Direct supervision involves the attending EP in the room during the ultrasound. Indirect supervision involves the EP immediately reviewing images obtained. It is this author's recommendations that direct attending physician supervision be mandatory for all unstable patients, and procedural guidance involving major vascular structures or risk of significant complication to major vascular or other structures.

EUS in stable patients with low pretest

probability of significant morbidity or mortality, and "low risk" procedures (superficial abscess incision and drainage, foreign body identification or removal, and nerve blocks that do not involve risk to significant vascular structures) may be supervised indirectly, with the attending EP present for key parts of the procedure, and reviewing images obtained immediately after they are taken and prior to the patient disposition.

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Do youth offenders benefit from physical activity?

Ellen Rowles from Action PR, outlines why physical activity can hold a vital key in the success of supporting youth offenders...

Statistics from the Youth Justice Board show that last year alone, there were around 950,000 recorded arrests for offences in England and Wales, of which 94,960 were people aged 10-17 years. Their statistics also show that the number of young people arrested has fallen by 13% between March 2014 and March 2015. While offences may have fallen by 73%, offences committed by 10-17-year-olds still account for 10% of all arrests in England and Wales. These statistics show that youth crime is still an issue faced by every community. Local councils must work in partnership with the right organisations to tackle and prevent the problem of youth offending before individuals fall into the criminal justice system.

Evidence suggests that participation in positive activities is a factor in preventing offending, an approach which has been adopted by East Sussex County Council. With the help and support of funding from County Sports Partnership Active Sussex, a wide variety of leisure trusts across the county have worked together to introduce a new 8-week fitness programme for young offenders or those at high risk of offending.

The 'Yot Fit' programme was created specifically to help to reduce the rates of offending in East Sussex, whilst also aiming to increase activity levels amongst young people. The programme was originally piloted through Eastbourne Borough Council's community department, East Sussex Youth Offending Team and the Sovereign Centre – an Eastbourne Leisure Trust facility – thanks to funding from Sport England's Sportivate programme.

Through health promotion, diversionary activity, positive role models and team interaction the programme aims to build a positive group identity. The sessions offer participants a wide range of sporting opportunities, as well as the chance to improve body image and weight

management – both of which are common issues for young people, particularly those involved with substance misuse.

Since the original pilot, where over 20 young people were engaged, Active Sussex has funded further projects in the Hailsham and Seahaven areas. The not-for-profit leisure trust Freedom Leisure was invited to join Eastbourne Leisure Trust, as well as Wave Leisure in delivering the programme, whilst extending the offer to those on the cusp of becoming young offenders after consulting with East Sussex County Council Targeted Youth Service.

“We are fully committed to providing a wide range of fitness opportunities for our community. This programme plays a vital role supporting young people to have a more positive attitude and we look forward to continuing the scheme for our local youth.”

Freedom Leisure launched the programme at Hailsham Leisure Centre, which it operates in partnership with Wealden District Council, earlier this year. The programme began with an induction, including a centre tour and health check of weight, waist, height and resting heart rate so that progress could be monitored at the end of the course. All participants were given the opportunity to try out a variety of classes including body pump, circuits, boxercise and swimming at the centre. They also had access to café facilities which allowed for social time and group bonding.

After participants completed the programme they were offered a reduced price membership as an incentive to continue keeping active, and as a reward to young offenders who had behaved appropriately during the course. Many participants who attended the course



stated that they would have previously found the expense of a gym membership a barrier to exercise.

“Active Sussex is proud to support such a positive project that highlights the value and impact that sport and physical activity can bring to a young person’s life. The project also highlights the benefits of working with a wide coalition of partners to tackle inactivity and pilot effective local delivery,” says Sid Fletcher, Sports Projects Officer, Active Sussex.

Freedom Leisure has since received further funding to introduce two new 8-week programmes which took place in October this year at Hailsham Leisure centre and at Summerfields Leisure Centre in Hastings.

“We are proud to be working with the council’s Youth Offending team and are pleased with how well the pilot project was received by participants,” says Freedom Leisure Group Sport Development Manager Richard Bagwell. “We are fully committed to providing a wide range of fitness opportunities for our community. This programme plays a vital role supporting young people

to have a more positive attitude and we look forward to continuing the scheme for our local youth.”

To date, over 60 young people have been engaged throughout the project, and whilst it’s too early to measure the long term impact, the feedback from participants has been hugely positive. Over a third regularly attended courses, and more positive attitudes and behaviours among the young people have been reported. It’s clear to see that with further investment, this programme and others similar to it, that physical activity can play a vital role in boosting self-esteem and support young people who are perhaps at risk of offending. ■

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Image courtesy of © Psious 2016

VR supporting patient-centered care

Xavier Palomer, CEO of Psious, details how virtual reality is changing the landscape of patient-centered care...

Virtual reality (“VR”) as a treatment modality has already changed the landscape of mental health care, building on research accomplished over past decades using expensive technology limited to laboratories. Now, while remaining a valued treatment in the traditional therapy setting, complementary technological capabilities allows companies to develop novel and effective techniques that dovetail with the embrace of patient-centered care across the health-care industry.

To begin, the uses of VR in clinical mental health include overcoming specific phobias and wide-ranging anxiety disorders through the existing exposure therapy protocol in cognitive behavioral therapy. There are also robust treatments for pain management and distraction, stress management and wellness, empathy

training, and reduction of self-criticism, among others. Understanding why these therapies work is fundamental for understanding why their implementation can help achieve patient-centric goals including improved perception of care, providing more service with given resources, providing better information about the patient to the therapist, and reaching otherwise inaccessible patients.

The reasons that VR works are relatively simple, although only fully understood after experienced firsthand. First, it provokes similar physiological and emotional responses as the corresponding lived experience, so therapists can use simulations to recondition the patient’s response to negative stimuli: spiders, claustrophobic tunnels, tense social interactions, and many more. This simulation for outside experiences

also functions in pain management by immersion in agreeable environments, lowering perception of pain. To work on empathy, patients inhabit cultural roles dissimilar to their own, experiencing unwelcome social reactions, and facilitating feelings of isolation or victimisation prompted by such experiences.

Established advantages of working with this technology include customisability to each patient by a professional therapist, making anxiety therapy outcomes easier to accomplish than traditional methods using a less wieldy mix of language, images, and lived experience. Studies also show that patients often prefer this form of therapy because it is perceived as more feasible and less arduous. When the corporeal and emotional response align with the lived experience, while the intellect understands the safety of the therapist's office (or their own home, as explained later) cognitive dissonance creates opportunity for the therapist to actively change their perception of the experience.

These and other established advantages of VR therapy are compelling, but are potentiated by integrating additional patient management tools, as well as cutting-edge techniques in VR.

Patient-centered care focus in virtual reality

To put the patient at the centre of care, virtual reality therapy resources can be potentiated to extend and improve the patient-therapist relationship, allowing patients to make more progress in less time, and allow behavioral health organisations to accomplish more with fixed resources. VR therapies that can be conducted online also allow a number of previously impossible treatment paths: distance therapy for patients with physical disability or severe anxiety that prevents them from leaving their homes. Finally, the implementation of VR group therapy gives greater efficiency in patient management, while potentially improving therapy outcomes through the monitored social reinforcement of group therapy.

A case study possible with available technology will reveal how these layered benefits will give real results for a group of 10 patients suffering from a fear of flying (aviophobia) diagnosis.

The therapist conducts an initial evaluation of each of the 10 participants, and explains the course of exposure

they will receive over the coming weeks. She notes the patient's specific challenges (takeoffs, landings, turbulence), and introduces them to virtual reality through a neutral or positive environment.

Subsequently, the group sessions are managed by the therapist to provide a supportive environment in which she conducts entire flight sequences, while guiding reactions and negative thoughts. After VR exposure, sessions are closed with supportive group discussion that allows patients to empathise and share their progress to each other and the therapist.

In between these 10 weekly sessions, the therapist assigns individualised courses of homework sessions, a combination of customised exposure to the flight simulation and immersive relaxation and Mindfulness exercises that the patient accesses from a low-cost VR system at home. Along with the patient's own notes, biometric data from technologies such as HRV and EEG can be transmitted securely to the therapist's reporting and analysis tool, allowing them to remain aware of their progress throughout the week and check in at any time.

While the group therapy sessions are less customisable than one-on-one, they offer social reinforcement that is otherwise difficult to orchestrate. Each patient is individually evaluated and the therapist takes on a broader role in coordinating intensive self-administered sessions in virtual reality.

During the 10 week course, one patient loses mobility with an injury, and the therapist arranges a remote connection to have him participate fully in the group sessions from home until able to return.

The patients take a more active role in their own care, by committing to their homework sessions and collaborating with the therapist. They see their own physical and emotional responses subside in response to events that used to cause uncontrollable panic. They are able to empathise with fellow patients experiencing the same. The therapist, using a collaborative platform, consults other professionals when encountering cases that present unexpected or novel challenges.

In the end, our case study has one therapist conducting a total of 20 sessions (10 individual evaluations, 10



Image courtesy of © Psious 2016

group) and prescribing/monitoring 300 homework sessions (3 per week, per patient) that extend and deepen positive outcomes in shorter time. Progress apparent through biometric measures and subjective perception are individually discussed in the last session, to build confidence and send the patients into real world encounters with lasting confidence.

Doing the same treatment individually not only lacks the group support, but would entail a total of at least 100 sessions to approach the same level of care, at one individual session per week, per patient.

Doing more with less has been called “the principle behind patient-centered care,” but the more important measure, of course, are patient outcomes. Improved outcomes will begin to migrate beyond behavioral health, for example, by helping to prepare patients for stressful medical procedures. One such example is habituating patients to the abrupt noises and confined environment of MRI procedures, where more than 30% of patients experience anxiety, and up to 14% (depending on conditions) fail to complete the costly procedure. The benefits of more widely integrated VR therapy are becoming apparent from both patient and provider perspectives.

Even beyond the benefits apparent in this sophisticated implementation of group therapy, VR-specific technologies will improve the tracking and analysis of patient well-being with increasing sophistication and utility. In particular, eye-tracking and motion analysis can give therapists important information about patients’ avoidance behaviors within VR experiences. Combined with existing biometric data from heart rate, galvanic sensors, EEG, and others, there will be increasing amounts of meaningful information to analyse in the service of improving patient care. As data technologies develop and converge, companies like Psious will continue to build value by helping healthcare companies get the most care to their patients. ■

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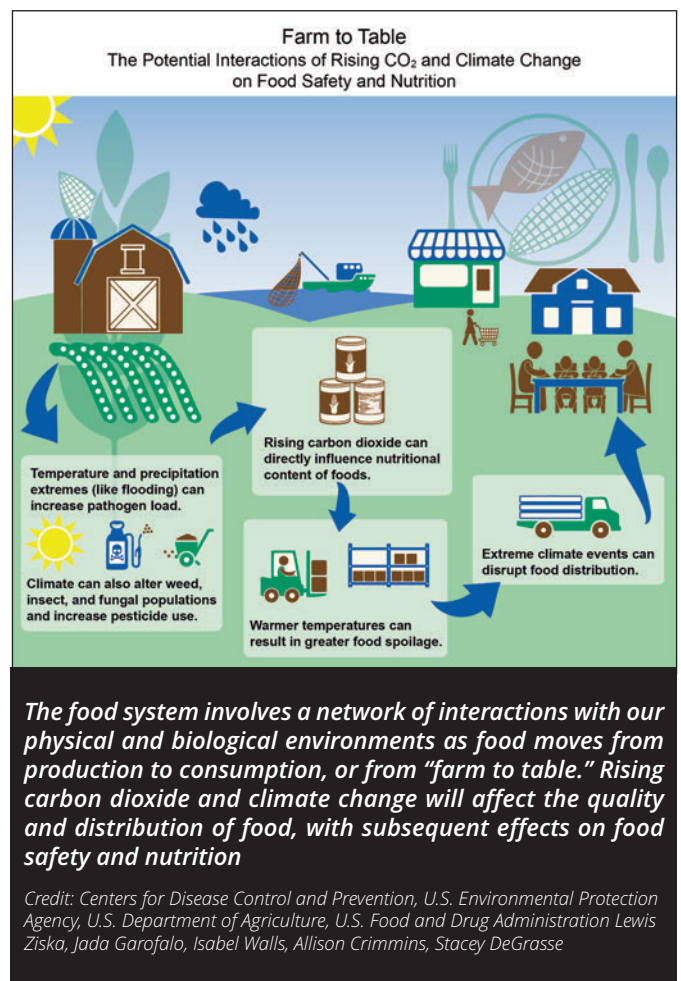
Protecting our food system in a changing climate

Dr. Stephanie Pearl, Science Communicator at the USDA National Institute of Food and Agriculture, highlights a number of food safety measures and how these are integral in an ever changing climate...

A major challenge to our food system is feeding a growing population that is projected to exceed nine billion in just the next three decades. This challenge requires both increasing food production and protecting the safety of our food supply in the face of a changing climate and diminishing land and water resources.

According to a recent report by the US Global Change Research Program, rising atmospheric and ocean temperatures are expected to increase the exposure of food to certain pathogens (disease-causing bacteria, fungi, viruses, and small parasites). For example, significantly warmer coastal waters in Alaska from 1997 to 2004 were associated with an outbreak in 2004 of *Vibrio parahaemolyticus*. This bacterium is one of the leading causes of seafood-related gastroenteritis ("food poisoning") in the United States and is associated with the consumption of raw oysters harvested from warm-water estuaries. Air temperature also affects pathogen levels of multiple species of *Vibrio* in shellfish. For example, *Vibrio vulnificus* may increase 10- to 100-fold when oysters are stored at ambient temperatures for 10 hours before refrigeration, potentially necessitating changes in post-harvest controls to minimise the increased risk of exposure.

To mitigate such threats, researchers are developing methods for predicting and detecting the emergence and preventing the spread of harmful microorganisms such as *Vibrio* species. A team based at the University of North Carolina at Chapel Hill and funded by the U.S. Department of Agriculture's National Institute of Food and Agriculture (NIFA) is developing models that will help seafood producers predict when the public will be at increased susceptibility to foodborne illness from oysters and other shellfish. Other research groups are beginning to use DNA sequencing technologies to



rapidly and affordably identify which microbes are present on the surface of foods. For example, NIFA-funded researchers at the University of New Hampshire have developed a new screen that is based on a set of genetic markers that should improve detection and surveillance of *V. parahaemolyticus* in seafood.

Extreme weather events, such as drought and flooding, may also increase the risk of food exposure to pathogens. Drought can increase the concentration of pathogens in water that is used for irrigation, livestock management,



A Washington State University-led research team member works on the prototype microwave assisted pasteurization system (MAPS) unit. MAPS allows packaged foods to be safely processed more quickly and at lower cost than conventional processes

Photo courtesy of Washington State University

food handling, or storage. Intense bursts of heavy rainfall may lead to flooding, potentially contaminating this water supply with other waters that carry sewage, manure, or other foodborne contaminants. A NIFA-funded research team based at Colorado State University is trying to understand the specific conditions that favor the production of cyanotoxins by certain classes of cyanobacteria that can exist in agricultural ponds. Cyanotoxins are responsible for animal poisonings in a majority of the United States and more than 50 countries globally. Surface temperatures of water have increased due to climate change, leading to a higher frequency of these toxic algal bloom occurrences.

Increased average temperatures and humidity can also increase the prevalence of molds that produce toxic chemicals such as mycotoxins. Prior to harvest, warmer temperatures and drought can stress plants, making them more susceptible to mold growth. Warm and moist conditions favor mold growth and affect the biology of insects that transmit molds to crops. If crops are not dried and stored at low humidity, mold growth and mycotoxin production can increase to very high levels. Once introduced into the food chain, these poisonous toxins can lead to acute and chronic health issues.

Consumer education is a critical piece to ensuring a safe food supply. NIFA-funded researchers at Kansas State University and Tennessee State University found that bagging poultry at the meat counter in grocery stores can reduce the spread of bacterial contamination of other food items, the grocery cart, people, and refrigerators. The same research team also emphasises the importance of using a thermometer to check the doneness of cooked meat. Many kitchens are lit by energy efficient lights that often make meat appear more cooked than it actually is, making visual inspection no longer a reliable test for doneness.

In addition, to protect our food supply from contamination while maintaining the quality of ready-to-eat meals, NIFA-funded researchers at Washington State University have developed microwave-assisted thermal sterilisation (MATS) and pasteurisation systems (MAPS). These systems use a combination of microwave heat and hot water to rapidly heat and briefly hold packaged food at sterilisation or pasteurisation temperatures before quickly cooling the food. These systems currently operate at several locations around the United States, and major consumer food companies in Singapore and India have recently purchased the systems.

Taken together, rising global temperatures and changes in weather extremes are likely to increase the exposure of food to certain pathogens and toxins. It is therefore increasingly important to implement practices that will protect the safety of our food. ■

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Exploring metal resistance in AMR

The increasing use of metal antimicrobials and the importance of research into mechanisms of resistance and toxicity...

The overuse of antimicrobial agents in agriculture is considered one of the key contributors to antimicrobial resistance worldwide. A number of strategies to mitigate this problem have been suggested, including: reducing and eliminating antibiotics in food-producing animals, increasingly monitoring the use of antimicrobial resistant organisms in such animals, and managing practices by implementing alternatives. In fact, one such alternative to organic antibiotics that has received considerable attention is the use of metal ion species with proven antimicrobial activity.

The recurrent use of antibiotics to treat food-producing animals is a prophylactic approach that controls disease in crowded production facilities. A secondary benefit to the use of these antibiotics in agriculture is the enhanced growth of food-producing animals. Yet, the advent of antibiotic resistant super bugs, in combination with the surge of social awareness into the quality of food, has increasingly generated a call for antibiotic and hormone-free animal products. An enhancement to this dilemma is the substantial amount of antimicrobials currently used to control infective microbes that cause plant diseases, predominantly in vegetable and fruit crops.

Prior to the 2000's, research into the mediation of bacterial resistance to various metal ions and so-called

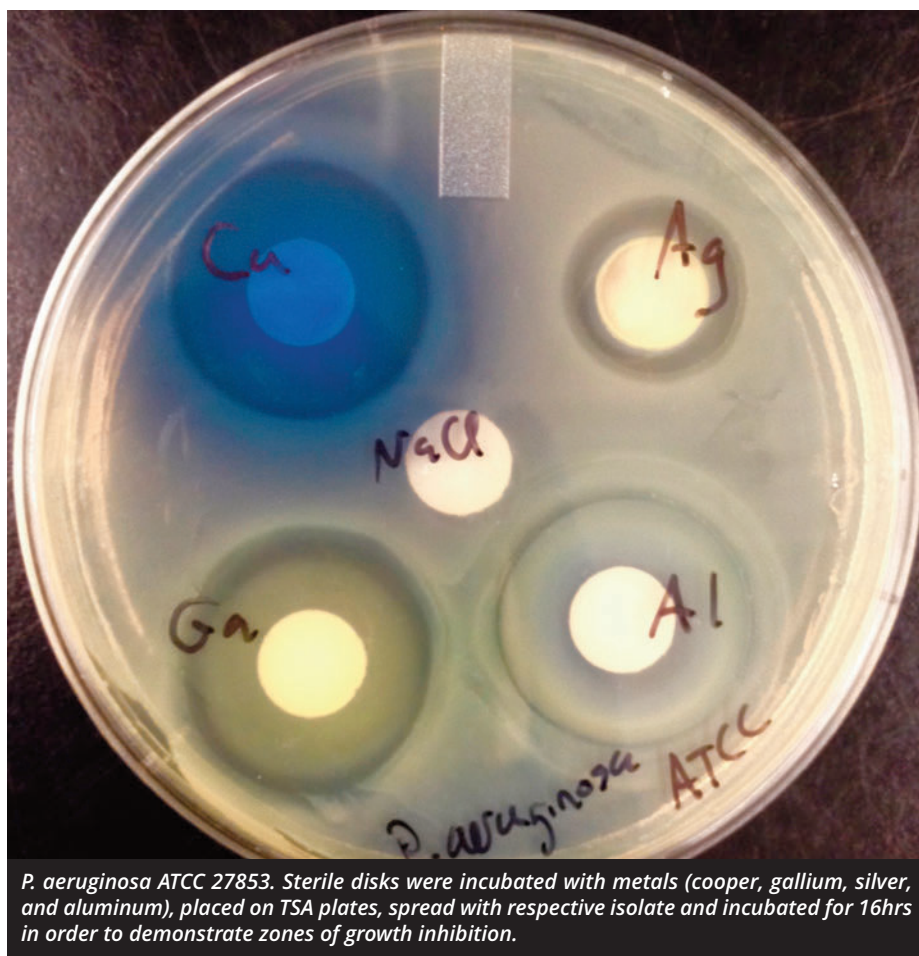
'heavy metals', was the realm of a few dozen scientists worldwide. The scientific world would see more than 50 publications per year on this subject. Furthermore, increased recognition of multidrug resistance in a variety of clinically significant bacterial strains was taking place. This led to an increase in the number of publications in the field of metal-based antimicrobials. Their use is now prevalent, and has continued to increase rapidly since 2010, evident from the hundreds of publications produced each year.

Since the 1960's, researchers have explored bacterial resistance to toxic metals and as a result, numerous genes conferring metal resistance have been uncovered. While no single mechanism delivers bacterial resistance, several simplified strategies can be generalised from the appreciable amount of literature that has interpreted physiological adaptations of metal stress. Firstly, many microorganisms will restrict the influx of metal ions by regulating the expression and activity of proteins involved in metal uptake. Similarly, metal ions facilitating cell toxicity can be removed from the cell through the activation of several efflux systems. Thirdly, the sequestration of toxins in the both the extracellular and intracellular environment can trap metal ions. These metal species become purposely bound to organic biomolecules. Bacterial cells are also capable of repairing damaged biomolecules after a reaction with

metal species. Similarly, several bacteria are adapted to chemically modify metal ion species, altering their reactivity and toxicity in the cell. Lastly, once the activity of a metabolic protein is terminated, bacterial cells are capable of using alternative pathways to bypass such damage.

The mechanisms of metal toxicity are less understood compared to those of metal resistance in bacteria and other microorganisms. Nonetheless, several pathways have been proposed and extrapolated from observations of metal toxicity. Some of these include, the generation of reactive oxygen species, which then cause significant damage to cell structures, protein dysfunction and the loss of enzymatic activity, decreased membrane function through the disruption or detachment of the cellular membrane, interference with nutrient and essential metal uptake, and the incidence of DNA mutations. Our group has repeatedly demonstrated that metals are very effective at killing a wide diversity of microorganisms at low concentrations, yet determining the direct and subsequent downstream effects of metal exposure is not trivial. Understanding the mechanisms of metal toxicity and resistance requires comprehension of the intricate interplay between metal speciation and its chemical characteristics, cell physiology and metabolic diversity, the choice of in vitro and in vivo experimental conditions, and direct and indirect targets.

PROFILE



Now that we are faced with a number of new, re-emerging and recurring community acquired and nosocomial pathogens that are antibiotic resistant, and with the antibiotic development pipelines running dry, the use of metals as antimicrobials is enticing. Use has moved past clinical trials, and metal compounds can now be found in wound dressings, liquid formulations for hand washing, impregnated into consumer textiles, and on medical devices. In the agricultural industry, metals are used as antifungal seed dressings, pesticides, wood preservatives, and as animal feed additives. In fact, several countries have begun to substitute the use of traditional antibiotics with metal compounds, such as copper and silver. On the surface, this strategy appears superior. Yet, their use considerably increases metal load in soils and ponds, notably altering

microorganism communities and the surrounding ecosystem. Furthermore, recent research has noted that even though antibiotics were banned, studies of soil microbes exposed to metals became 'primed' for increased resistance transmission. Although far more research is required to understand if increased antibiotic resistance is facilitated through metal antimicrobials, we cannot help but ask ourselves if we are taking two steps backwards after our perceived step forward. With this in mind, we need to be aware that a solution to the overuse of antibiotics in medicine and agriculture with the replacement of metals may encourage a more intricate problem.

On September 21, 2016, an antimicrobial resistance summit took place at the United Nations General Assembly in New York City; an event that has

only occurred three other times in UN history. The objective of this high-level meeting was to stimulate solid multi-sectorial commitment in addressing antimicrobial resistance. While this plan is now acknowledged, it is time to undertake this responsibility. Overall, we need to progress our stewardship, reduce the use of antimicrobial agents in all sectors of application, such as human and veterinary medicine, household and institutional settings, agriculture, industrial, and in consumer products, and increase public awareness and action. Lastly, it is primary to recognise that the status of antimicrobial resistance, let alone the mechanisms of metal toxicity, is a complex problem, and requires both influence and insight from politicians, physicians, veterinarians, and other stakeholders. Before the use of novel antimicrobials, such as metal-based compounds, is approved, it is imperative that we equip ourselves with solid scientific evidence that exposes the mechanisms of both toxicity and resistance in microorganisms.



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Addressing AMR from a food safety perspective

Renata Clarke, Sarah Cahill, and Jeffrey LeJeune, from the Food and Agriculture Organization of the United Nations, outline the relationship between food safety and antimicrobial resistance...

The development and spread of antimicrobial resistant organisms is a complex phenomenon. Antimicrobial resistance is known to develop naturally but extensive use of antimicrobials in human medicine, animal husbandry, animal health, aquaculture, crop production, food production, and personal hygiene, among others, drives selective pressure for the spread of antimicrobial resistant organisms. Continued effectiveness of antimicrobials is critical for human, animal and plant health: thus the goal is to ensure their correct and prudent use in order to contain the development and spread of antimicrobial resistance and protect the critical benefits to human health, animal health and agricultural and food production.

A 'one health' perspective

Given the scale and the scope of antimicrobial use, the challenges to containing antimicrobial resistance are considerable: there needs to be broad-based commitment across disciplines and sectors to gather, analyse and share information that enables a better understanding of the phenomenon and to examine practices and develop approaches for reducing antimicrobial use. The accumulation of antimicrobial residues and the development of antimicrobial resistant organisms in the environment further complicate the complex routes by which antimicrobial resistance (AMR) can spread. For example, contamination of water and soils with bio solids and animal wastes increases the likelihood of waterborne infections and exposure to antimicrobial resistance bacteria via other environmental pathways.

The impetus for dealing with this complex situation derives from the magnitude of the problem. It is estimated that if current practices continue unchecked, by 2050 there would be 10 million AMR-related deaths annually and that the economic loss would exceed 1%

of global GDP. Widespread awareness of the situation is essential to catalyse concerted global action to combat the spread of AMR.

“Effective food safety management along the entire food chain is an essential element to any programme aiming at the containment of AMR.”

Antimicrobial resistance: how is it related to food safety?

Food is a potential route of exposure to antimicrobial resistant organisms for everyone. The ways foods are produced, harvested, stored, and prepared are important factors in the development and spread of antimicrobial resistance. Food contaminated with resistant pathogenic organisms can result in human illness, which may not respond to the available antimicrobial treatments. Moreover, even antimicrobial resistant microorganisms that do not cause illness can contribute to the problem because they may serve as a reservoir of antimicrobial resistance traits that can be transmitted to pathogenic organisms present in foods or in people. The growing population and changing consumption patterns are putting increased demands on our food supply chains and food systems. The diversity and variety of food production systems provide innumerable niches for the growth of microbial populations and the selection antimicrobial resistant bacteria. Of key concern is the use of antimicrobials in the production of meat and poultry, in aquaculture systems, and in crop production. The use of sanitisers and biocides through the food chain may also further contribute to AMR.

Effective management of food safety is based on the reliable application of good hygiene practices at all stages of the food chain. As such, food safety manage-

ment practices are critical in limiting microbiological contamination and in reducing the occurrence of infection during primary production that leads to reduced need to use antibiotics. The food safety community has a fundamental role in combatting the spread of AMR.

Exploring the role of food safety in addressing AMR

The importance of hygiene

The cornerstone of effective control of foodborne AMR depends on the application of good hygienic practices (GHP) starting at primary production and continuing through to consumption. The Codex Code of Practice to Minimize and Contain Antimicrobial Resistance provides guidance to countries on measures to be adapted, as appropriate, and applied within countries. This Guidance includes proven methods to reduce microbial contamination of foods, such as environmental sanitation and worker hygiene, which also lower the numbers of AMR bacteria entering the food chain. There are many examples of enhanced application of basic hygiene measures during primary production leading to considerable reduction of antimicrobial use and hence a reduction of the pressure for the selection of resistant organisms spreading through the food chain.

Notions of GHP will evolve as more information becomes available on the mechanisms and the routes of the transfer of AMR traits, for instance, and on the development of alternatives to antimicrobial use in agriculture that maintain animal and plant health and productivity. At its 39th Session in 2016, the Codex Alimentarius Commission established a Task Force to consider the updating of its existing Code of Practice as well as other guidance relevant to the containment of AMR.

The need for coherent “food chain governance” at national level

Effective food safety management along the entire food chain is an essential element to any programme aiming at the containment of AMR. Official systems of food control provide guidance and the regulatory basis for these management practices and they also provide the oversight and monitoring necessary to ensure that the practices have the expected impact and they are invested with the authority to take action when problems arise. In many developing countries, national sys-

tems of food control are often fragmented and poorly coordinated, which challenges their capacity to ensure effective management of foodborne risks. Relevant regulation and its enforcement does not pertain only to hygiene practices but also to such things as the authorisation, marketing and use of veterinary drugs and pesticides with antimicrobial functions. Weak regulation enables poor management and misuse of these chemicals is further complicated by easier access to counterfeit drugs. Increased investment in strengthening systems of food control in developing countries is essential.

“The growing population and changing consumption patterns are putting increased demands on our food supply chains and food systems. The diversity and variety of food production systems provide innumerable niches for the growth of microbial populations and the selection antimicrobial resistant bacteria.”

Building and sharing intelligence to better combat AMR

There are still many gaps in our understanding about the origin and spread of AMR along the food chain. It is necessary to gain better insights through integrated monitoring and surveillance systems programs which coordinate testing of samples from food animals, foods and humans for resistant organisms, as well as collating other relevant information such as on management practices, particularly antimicrobial use, and environmental factors.

The sharing of challenges, evidence, and solutions to combat AMR across food and non-food sectors will increase our understanding of the problem and lead to more robust solutions to the threat AMR presents to public health. ■

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Antimicrobial resistance and food safety in Europe

Adjacent Government learns more about the role of the European Food Safety Authority in Europe's fight against antimicrobial resistance...

Antibiotics have been enormously beneficial since they were discovered 70 years ago, but their overuse has contributed to the rise of antimicrobial resistance (AMR), a real global crisis.

Every year across the European Union about 25,000 people die as a direct result of antimicrobial resistance, but the threat is not confined to Europe.

Antimicrobial resistance is a global problem and as such it needs a global solution. It can be tackled only through cooperation and requires a multi-faceted, integrated approach.

“In particular, experts are assessing measures to improve animals' health and welfare and their ability to cope with and react to infections. Experts are also investigating alternatives to antibiotics, such as use of prebiotics and probiotics or bacteriophages (viruses that attack bacteria), as well as recent scientific developments that could lead to promising alternatives.”

AMR and the food chain

Researchers know that there is a link between antimicrobial resistance in animals, people and the environment.

When AMR occurs in bacteria present in animals and food, it can impede the effective treatment of diseases in humans.

But how does this work in practice?

Food-producing animals are often treated with antibiotics. This creates an environment in their guts which favours the survival and multiplication of resistant bacteria. Resistant bacteria can then contaminate food

derived from animals such as meat, milk, and eggs. Resistant bacteria can also spread to crops which are irrigated with contaminated water or fertilised with animal manure.

Cooperation is key

The European Food Safety Authority (EFSA) works closely with other EU agencies to provide policy makers with the best scientific advice on the risks to human and animal health related to the emergence, spread and transfer of antimicrobial resistance in the food chain.

Based on data collected by EU Member States, annual reports on antimicrobial resistance are produced by EFSA and the European Centre for Disease Prevention and Control (ECDC) which illustrate the evolving situation in Europe.

EFSA, ECDC and the European Medicines Agency (EMA) have analysed the link between the use of antimicrobials in animals and humans and resistance to antimicrobials. Moreover EFSA experts provide scientific advice on control options at the request of risk managers or on their own initiative.

For example, they have assessed the public health impact of a strain of MRSA (*Methicillin-resistant Staphylococcus aureus*) found in pigs. Humans mainly acquire MRSA through direct contact between infected people or contact with medical devices. Recently MRSA has been tracked in food producing animals too, especially pigs.

EFSA experts on feed also assess the safety of animal feed additives, including the risks related to antibiotic resistance.

On-going work

Currently, EFSA experts are working on two scientific



documents expected to be finalised by the beginning of next year.

“Food-producing animals are often treated with antibiotics. This creates an environment in their guts which favours the survival and multiplication of resistant bacteria. Resistant bacteria can then contaminate food derived from animals such as meat, milk, and eggs. Resistant bacteria can also spread to crops which are irrigated with contaminated water or fertilised with animal manure.”

One, prepared in cooperation with EMA, reviews the measures that Member States have put in place to reduce the use of and need for antimicrobials in animals.

In particular, experts are assessing measures to improve animals' health and welfare and their ability

to cope with and react to infections. Experts are also investigating alternatives to antibiotics, such as use of prebiotics and probiotics or bacteriophages (viruses that attack bacteria), as well as recent scientific developments that could lead to promising alternatives.

The other document addresses the risk of antimicrobial resistance developing as a result of calves being fed with milk containing residues of antibiotics. Experts will propose possible options to mitigate the risks. ■

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European Food Safety Authority
www.efsa.europa.eu

Monitoring antibiotic resistance in the UK

Antibiotic resistance is becoming a global problem and here in part 2 of an interview with Adjacent Government, Professor Alan Johnson, Head of the Department of Healthcare-Associated Infection and Antimicrobial Resistance at Public Health England, details how it is monitored in the UK and the challenges it can cause in clinical settings...

Antibiotics are key to treating many bacterial infections; however bacteria have found ways to adapt to some antibiotics and survive their effects. This phenomenon, which is known as antibiotic resistance, is a worldwide problem affecting not only the healthcare sector, but also agriculture and food production.

Antibiotic resistance is a concern for patients in all areas of healthcare including the community and acute settings. Inappropriate use of antibiotics, which is a major contributor to their over use, is a known driver of antibiotic resistance. If patients are exposed to antibiotics, bacteria in or on their bodies may become resistant, resulting in the patients becoming what is referred to as colonised with the bacteria. Many colonised patients remain asymptomatic and are probably unaware they are carrying antibiotic-resistant bacteria. However, colonisation with resistant bacteria is concerning as someone colonised (if suffering from an infection or not) can pass the resistant bacteria on to other individuals.

With few new antibiotics being developed, it is becoming increasingly difficult to treat bacterial infections that are resistant to antibiotics. Public Health England (PHE) leads a surveillance programme which helps to identify both which types of bacteria are becoming resistant and the types of antibiotics involved. Collecting this information is important as it can help doctors choose which antibiotics to use when treating patients with infections.

In the [previous edition](#) of Adjacent Government, Professor Alan Johnson from PHE talked about Healthcare Associated Infections (HCAIs) and how PHE is working

with the healthcare system to reduce them and tackle antibiotic resistance.

Here, in the second part of that interview with Editor Laura Evans, Johnson explains how antibiotic resistance is being monitored and further explores the link between antibiotic resistance and HCAIs.

“A patient taking lots of antibiotics who then develops an infection caused by their own (previously harmless) bacterial flora, will therefore have an increased chance of that infection being resistant. This is because the bacteria in the body have already been exposed to antibiotics.”

How important is infection prevention and control in tackling antibiotic resistance?

It is critical to maintain high levels of infection prevention and control, particularly in light of increasing levels of antibiotic resistance. Antimicrobial resistance, or AMR as we call it, is not a new problem; bacteria have been developing resistance to antibiotics since they were first developed, which was around 70 years ago. The way we dealt with the problem over the years was that as bacteria developed resistance to existing antibiotics, new antibiotics were developed that could be used to treat resistant infections.

What is different now is that the pipeline for the development of new antibiotics is at an all-time low, which means that using the next ‘new’ antibiotic may not be a viable option in the immediate future. As a result we must focus on trying to cut out unnecessary and over-use of our existing antibiotics. Ensuring high levels of infection prevention and control is therefore a major



priority, as the more infections we can prevent, the fewer antibiotics we use.

How is AMR being monitored in the UK?

As I mentioned previously, PHE collects data from hospital microbiology laboratories across the country, as part of our national surveillance programme for HCAs. In addition, we collect results on antibiotic susceptibility tests. This means that when a microbiology lab isolates bacteria from patients, they test them and record whether they are resistant to antibiotics, and if so, which ones. PHE collates this data nationally, monitoring trends over time. PHE uses this database to inform hospitals which antibiotics remain active and which are less active as part of national guidelines on treating infections in hospital settings.

When a patient presents with an infection to their doctor it is usually initially diagnosed on clinical grounds. In terms of the probable cause of the infection, the doctor will look at the history of the patient

and assess their signs and symptoms to establish what microorganism they think is most likely to be causing it. Once the doctor has an idea of the type of bacteria likely to be involved, they then have to make a decision as to which antibiotic is likely to work. We call this empirical prescribing, as when a patient first presents with signs of infection, the doctor will not have any lab results available and will have to rely on their medical experience and judgement to decide on the most likely cause. After initial diagnosis, laboratory tests may be undertaken on specimens taken from the patient and then the doctor will get conclusive results on the cause of an infection. Treatment can then be amended if needed. Unfortunately the results of these tests currently may take a couple of days, so by collecting data and making it available to healthcare professionals we can help increase the likelihood that a doctor will make a sound clinical judgement on which antibiotics to use. This is why our work in communicating information as to which antibiotics have a high level of resistance is so important.

Is there a problem with taking antibiotics regularly?

The human body has got millions of bacteria inside it; for example, the contents of the intestine are made up predominantly of bacteria, and there are also bacteria that grow in the throat, the genital tract and on the skin. Any time you take a course of antibiotics the bacteria normally found in the body and which are not causing any harm can adapt and develop resistance to those antibiotics. Problems may arise, however, should these usually harmless bacteria go on, for a range of reasons, to cause an infection.

A patient taking lots of antibiotics who then develops an infection caused by their own (previously harmless) bacterial flora, will therefore have an increased chance of that infection being resistant. This is because the bacteria in the body have already been exposed to antibiotics.

Are there infections that are proving more resistant from the data PHE collects?

In terms of infections, the biggest challenges tend to be seen in clinical environments where we use the most antibiotics, such as intensive care units (ICUs). This is where you have patients who are critically ill and are subject to a lot of invasive procedures which can increase the risk of getting infections. Patients in ICUs therefore need a lot of antibiotics, but the high usage means this group often experience higher rates of resistance. In this sense, the problem is part of a vicious cycle of events. If we are unable to effectively tackle antibiotic resistance and it continues to get worse, the ICU is an example of a setting where the development of resistant infections would be of critical importance.

Are we getting to a point where there are infections resistant to all antibiotics?

Globally there have been reports of strains of bacteria that are pretty much resistant to all antibiotics. These reports have been low in number and fortunately, in many instances, the resistant bacteria were only

colonising patients rather than causing infections. However if a patient is colonised by a strain of bacteria resistant to all antibiotics and that bacteria does go on to cause an infection, we wouldn't have any antibiotics to treat it.

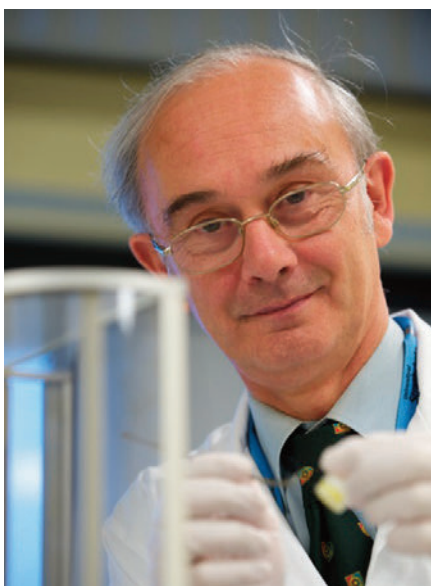
“Antibiotic resistance is a concern for patients in all areas of healthcare including the community and acute settings. Inappropriate use of antibiotics, which is a major contributor to their over use, is a known driver of antibiotic resistance.”

At the moment we have a group of powerful antibiotics called carbapenems, often referred to by the media as our antibiotics of last resort. We reserve these for patients with serious infections. Globally there is a problem with increasing resistance to carbapenems. Currently in the UK the surveillance data says that for blood stream infections caused by common bacteria, the carbapenems still work in the majority of cases. However, there are signs that things might be starting to change and we need to monitor this very carefully. Continuing our surveillance is critical; some other parts of the world have seen big increases in resistance to carbapenems over relatively short periods of time. Italy, for example, went from not having a problem with carbapenem resistance to having quite a severe problem in about three years. Monitoring what is happening in other countries is clearly important; it can provide a warning and remind us that there is no room for complacency. ■

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Science that transcends politics

The impact of the referendum debacle will take time to work through in policy and in practice. Meanwhile those of us like my colleagues at the University of Strathclyde and I will get on as best we can with our ‘world-changing research’, as the University’s website puts it. Indeed much of our current effort is truly global in scope. When we began our Minor Groove Binders (S-MGBs) project some 15 years ago, looking for new medicines for diseases ranging from cancer to clostridium infections, we knew that the project had the potential for major impact, because the basic mechanism of action of these compounds could in principle be tuned to each disease by appropriate use of heterocyclic chemistry. Although you need an optimistic but critical mind-set to be an effective researcher, I don’t think that anyone



*Prof Colin J Suckling OBE DSc FRSE
Research Professor of Chemistry*

in the team thought that we would get as far as we have from a relatively small academic base. One of the things that we pride ourselves in at Strathclyde is strong interdisciplinary

research. Mostly we’ve built teams from our own staff frequently augmented by colleagues from our neighbours at the University of Glasgow and in doing so, have been able to apply our compounds (S-MGBs) to many examples of infectious disease and to cancer. The big change now is that we are expanding our teams globally.

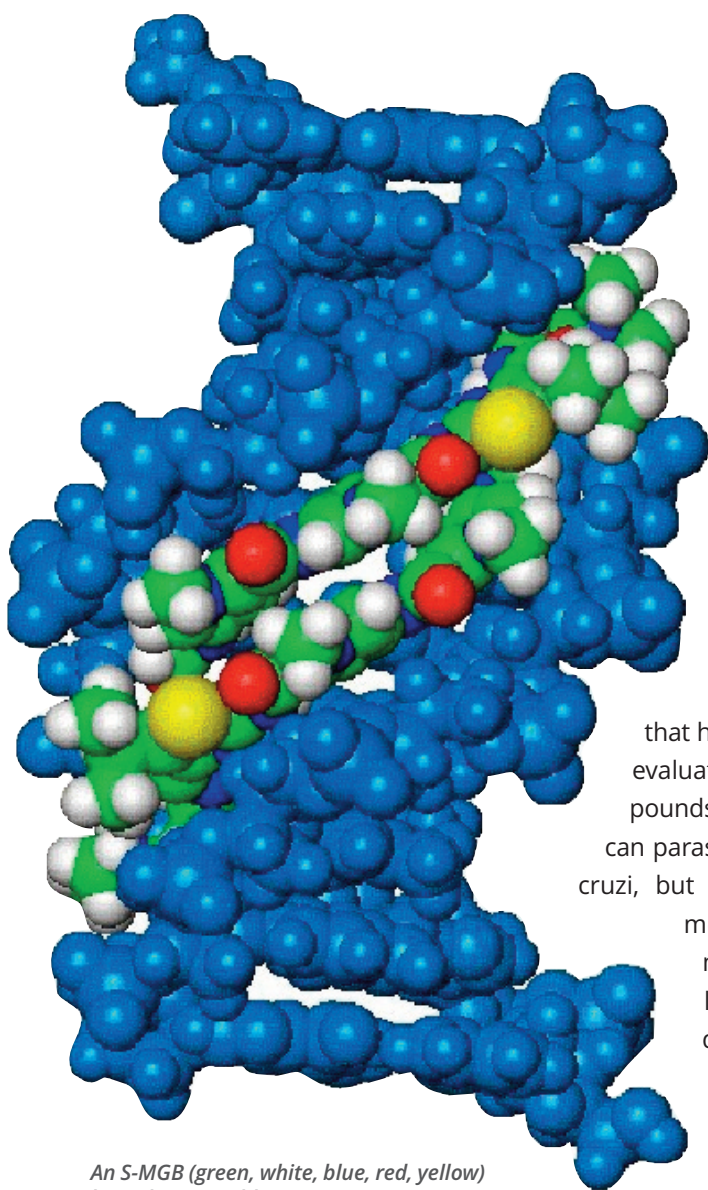
“I’d dare to say that, in my opinion, it [this project] might well matter more to many millions of people [throughout the world] than the misled and misguided population of the United Kingdom. Science in the end is for everyone and must transcend politics and politicians.”

I’ve spent much of the past few weeks engaging with academic colleagues from Brazil, India, and South Africa assembling a project using our S-MGBs and other compounds to tackle problems of global infectious diseases, especially with regard to endemic diseases in countries that have relatively underdeveloped drug discovery capacities. The idea is that we can seed the project with our compounds and then gradually transfer the growth to our partners abroad to make best use of the discoveries we have made and will make during the course of the project. It’s a very ambitious scheme but the benefits could be huge.

For example, we’ve recently identified some S-MGB compounds that are exceptionally active against one of the



PROFILE



An S-MGB (green, white, blue, red, yellow) bound to DNA (blue)

parasites that causes sleeping sickness in cattle in Africa, *Trypanosoma congolense*, but are otherwise remarkably non-toxic. For African diseases (animal African trypanosomiasis) we now have to profile these compounds to see if they are suitable to become candidate compounds for clinical development. This is new to us and we're taking advice from our experienced industrial partner, Galvmed. If things go well, we should be treating cattle in trials within a year.

With this advance in mind, we took the view that it would be wrong not to find ways to extend the potential impact of our compounds to related diseases in other continents, in particular to Chagas' disease in South America. Accordingly, I've been setting up a new partnership with a team in São Paulo, Brazil,

that has the capacity not only to evaluate the activity of our compounds against the South American parasitic species, *Trypanosoma cruzi*, but also to investigate their mechanism of action, information on which is particularly helpful to promote the development and adoption of a new medicine.

I could offer other examples such as treating tuberculosis in South Africa and India and the same principles apply: we want to engage partners in these countries fully in the process from discovery (now) to clinical use (hopefully in not too many years' time). This project matters far more to my work than our political position in Europe. I'd dare to say that, in my opinion, it might well matter more, to many millions of people than the misled and misguided population of the United Kingdom. Science in the end is for everyone and must transcend politics and politicians.

“Indeed much of our current effort is truly global in scope. When we began our Minor Groove Binders (S-MGBs) project some 15 years ago, looking for new medicines for diseases ranging from cancer to clostridium infections, we knew that the project had the potential for major impact, because the basic mechanism of action of these compounds could in principle be tuned to each disease by appropriate use of heterocyclic chemistry.”



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The global challenge of tackling antibiotic resistance

Adjacent Government highlights how the World Health Organization is contributing to the global challenge of tackling antibiotic resistance through their action plan and campaigns...

Antimicrobial resistance has become one of the main global challenges of the 21st Century. However, antibiotic resistance has been a problem for many years now. Worldwide more and more people are becoming aware of the issues that are caused by the wrongful prescribing and administration of antibiotics. Antimicrobial resistance (AMR) occurs when bacteria, viruses, parasites and fungi become resistant to medicines that were previously used to treat them. In 2015, The World Health Organization (WHO) developed a 'Global Action Plan on Antimicrobial Resistance' that has been followed and used as a template for their own plans, by countries worldwide.

The aim of the global action plan is "to ensure, for as long as possible, continuity of successful treatment and prevention of infectious diseases with effective and safe medicines that are quality-assured, used in a responsible way, and accessible to all who need them".

In order to achieve its goal, the action plan sets out 5 strategic objectives:

- To improve awareness and understanding of antimicrobial resistance;
- To strengthen knowledge through surveillance and research;
- To reduce the incidence of infection;
- To optimise the use of antimicrobial agents; and
- To develop the economic case for sustainable investment that takes account of the needs of all countries, and increase investment in new medicines, diagnostic tools, vaccines and other interventions.

"The action plan underscores the need for an effective 'one health' approach involving coordination among numerous international sectors and actors, including human and veterinary medicine, agriculture, finance, environment and well-informed consumers," said WHO Director-General Margaret Chan. "The action plan recognises and addresses both the variable resources nations have to combat antimicrobial resistance and the economic factors that discourage the development of replacement products by the pharmaceutical industry.

"An all-out effort is needed. WHO will work with the United Nations to tackle antimicrobial resistance at the political level. Our strong collaboration with FAO and OIE will continue. The objective [is] to have multi-sectoral national action plans in place by the 2017 World Health Assembly.

"Antimicrobial resistance is a crisis that must be managed with the utmost urgency. As the world enters the ambitious new era of sustainable development, we cannot allow hard-won gains for health to be eroded by the failure of our mainstay medicines."

Taking action to tackle the global challenge

WHO reports that globally, 480,000 people develop multi-drug resistant tuberculosis each year and drug resistance is even starting to complicate the fight against HIV and malaria. As well as providing technical assistance to help countries develop their own AMR action plans, WHO is also working with partners to help to strengthen the evidence base and develop new responses to this global threat.

"Without urgent, coordinated action by many stakeholders, the world is headed for a post-antibiotic era, in which common infections and minor injuries which



have been treatable for decades can once again kill,” said Dr Keiji Fukuda, WHO’s Assistant Director-General for Health Security.

“Effective antibiotics have been one of the pillars allowing us to live longer, live healthier, and benefit from modern medicine. Unless we take significant actions to improve efforts to prevent infections and also change how we produce, prescribe and use antibiotics, the world will lose more and more of these global public health goods and the implications will be devastating.”

Raising awareness of the AMR challenge

In order to raise awareness of the need to avoid further emergence and spread of antibiotic resistance, 14-20 November this year marks World Antibiotic Awareness Week 2016. As one of the key objectives of the plan is to improve awareness and understanding of AMR, campaigns such as this are crucial. In order to ensure that awareness is as widespread as possible, WHO is encouraging all member states, health partners, students and the public to join the campaign.

The Antibiotics: Handle with Care campaign hopes to reflect the overarching message that antibiotics are a precious resource and should be preserved, and used only to treat bacterial infections when prescribed by a certified human or animal professional. They should never be shared or saved for future use.

Through campaigns such as this, WHO are raising essential awareness to the global challenge of tackling antibiotic resistance and the importance of doing so. These are essential steps in order to reduce this problem and help other countries to take action themselves. ■

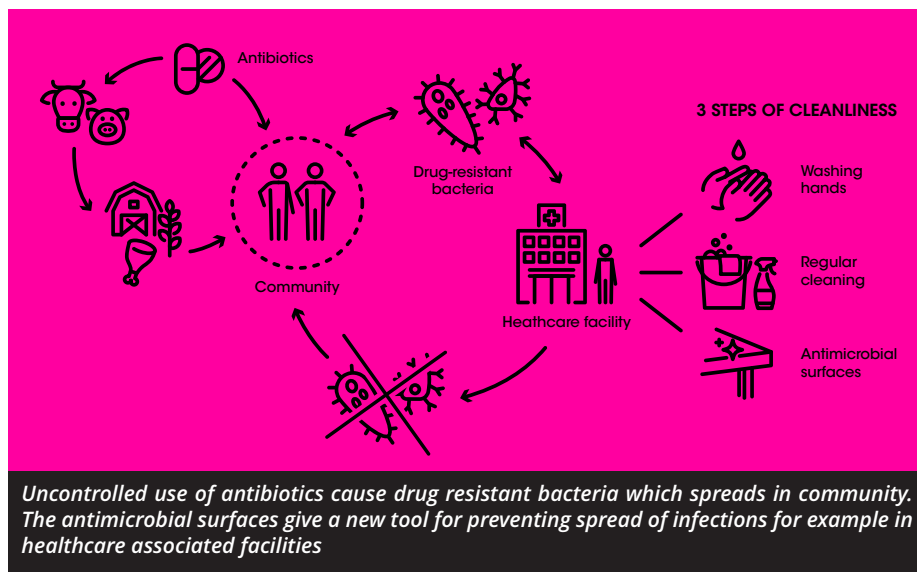
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Preventing infections with antimicrobial surfaces

Antibiotic resistance and super bugs are growing global problems. Kari Soljamo and Anne Laitinen from Isku Interior look at how to prevent the infections, and how to minimise the risk of healthcare associated infections...

Common and life-threatening infections are increasingly becoming untreatable. At the United Nations (UN), for the first time world leaders committed to take a broad, coordinated approach to address the root causes of drug resistant microbes across multiple sectors, especially human health, animal health and agriculture. Resistance against drugs, especially antibiotics, is considered the greatest and most urgent global risk. Today 700,000 people are dying due to hospital-acquired infections and a recent study estimates that amount will increase up to 10,000,000 by 2050. Countries are calling for better use of existing, cost-effective tools for preventing infections. These include, for example, immunisation, good hygiene in hospitals and more appropriate use of existing and new antibiotics.

As well as people are travelling more, urbanization also causes its own share of problems in this challenge. International tourism arrivals have shown an exceptional growth from 25 million in 1950 to 1,087 billion in 2013. The worldwide spread of MRSA and ESBL has been linked to tourism. In urban environments certain pathogens can adapt to the different conditions and thus create new threats for both local governments and the global community. The role of city planning in prevention of the spread of infections is huge. Even more crucial is the ability to take a notice of the buildings



and interior design. 80% of the infectious diseases are transmitted by touch directly or indirectly and the trend to spend more time in shared places is enlarging this problem.

Antibiotic resistance

Antibiotic resistance pathogenic bacteria are becoming a serious problem in healthcare environments. At European level, there are 3-4 million healthcare associated infections yearly, causing 37 000 deaths, 16 million extra hospital days and €7bn of extra cost.

Proper cleaning and good hand hygiene are the most important things to take care of in the battle against drug-resistant bacteria. But, as the recent reports have shown, these actions are not enough to even decrease the problem. Disinfection liquids and strong chemicals are making the situation worse.

Integrated hygiene concept for buildings

HYGTECH projects 2011-2014 (funded by EU Regional Development Fund) and HygLi project 2015-2017 in Finland, have been researching and showing how the built environment and the building itself could work against the spread of bacteria. Research was conducted in full scale pilot buildings. The integrated hygiene concept for buildings has taken into account the air (terminal devices, cooling elements), water (electronic tap, agion faucet aerator, water microbial quality control, disinfection equipment, network materials) and surfaces (antimicrobial surfaces like copper and silver additives, as well as touch free technology). Ongoing HYGLI-project's end product will be an RT Building Information File for professionals to take into account an integrated hygiene concept in

PROFILE



The antimicrobial and ergonomical design doesn't have to be boring. Design Antti Olin, Isku Interior

buildings. The RT File in Finland is a source of information for the building industry regarding contract building, design, construction, repair, maintenance and building products. Building Information File is a common tool for all the participants in a building project – the builder, designer, contractor and building official – and is used regularly by 40,000 building professionals.

Isku Interior's innovation

Isku Interior's Health products increase indoor environmental cleanliness and safety. We spend a great deal of time in various spaces where we are in contact with surfaces and furniture. Hospitals, schools, kindergartens, and institutions are the main domain of bacteria. Many studies, such as HYGTECH-project, have shown that the indirect spread of infectious diseases through surfaces, even caused by drug-resistant bacteria, can be reduced using antimicrobial touch surfaces. Isku has a holistic approach in co-operation with Copper Development Association and BioCote to develop antimicrobial materials and a broad range of ergonomic and aesthetic furniture to cover practically all furnishing needs in public premises.

Further product development in co-operation with other Finnish companies enable Isku to offer a broader range of solutions for antimicrobial touch surfaces and touch free applications in buildings.

Making the shared spaces safe

While the office interior trends are moving strongly towards shared working stations, it is on the responsibility of the furniture manufacturer and designer that the environment is made as safe as possible. The office premises are an extremely important part of the company identity and brand; therefore there shouldn't be any compromises needed when choosing the design, office layout and safe antimicrobial materials in shared places. Isku feels the responsibility to make the premises clean, safe, comfortable and good looking while changing the inevitable furniture purchase into investment. With the antimicrobial furniture, companies can reduce time taken for sick leave and gives a strong message of caring of its clients and employees. In the school world new activity based learning environments have caused the need for cleaner touch surfaces. According to the research conducted

by BioCote together with Coventry University (UK), the absenteeism reduces by 20% in school rooms, where main touch surfaces were antimicrobial. This brings efficiency to the learning, but also well-being to the school environments, students' families and makes teachers working place safer.



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Sweden's fightback against AMR

Gabriel Wikström, Swedish Minister of Healthcare, Public Health and Sports, discusses the need for leadership and action in the global fight against AMR...

For the first time, antimicrobial resistance (AMR) is being actively discussed on a much wider stage than just by health experts and scientists. A high-level meeting on AMR was recently held during the UN General Assembly – with good reason.

In 1945, Alexander Fleming held his Nobel Lecture in Stockholm City Hall, having recently won the Nobel Prize in Medicine for the discovery of penicillin. “One note of warning,” he said. “It is not difficult to make microbes resistant to penicillin in the laboratory [...] and the same thing has occasionally happened in the body.”

Unfortunately, far too many decades passed before enough momentum had gathered for this problem to be addressed.

Sweden has a long tradition of working to combat AMR. A combination of highly engaged individuals and a coordinated ‘One Health’ policy has largely been successful. Today, the situation in Sweden is relatively favourable in both the human and animal sectors. But much still remains to be done. In a globalised world, people, animals, food and other goods cross borders every day. This means that health threats do as well.

The Alliance of Champions

A growing momentum – and an increasing number of allies in a growing number of countries – in combination with hard work eventually led to the Member States of the World Health Organization (WHO) adopting a global action plan on AMR in May 2015. At the same time, a call for a high-level meeting in the UN General Assembly was made, and an initiative taken by Sweden and the United Kingdom resulted in founding the Alliance of Champions – including over a dozen health ministers – to work towards the high-level meeting and the implementation of the global action plan.

Later that year, the UN Food and Agriculture Organization and World Organisation for Animal Health adopted the same global action plan. And we eventually brought about the high-level meeting.

Is AMR worthy of such attention? Undoubtedly, yes. The AMR review by Lord O’Neill showed that by 2050, the number of deaths due to resistant microbes will have increased from about 700,000 per year today to around 10 million. This is more than the current annual death toll from cancer.

“We need to cooperate and provide support to other countries in order to tackle AMR. In this regard, the European dimension is valuable.”

Importantly, we are also starting to get better data on the economic and social consequences of AMR. The World Bank recently published a report demonstrating that drug-resistant infections have the potential to cause a level of economic damage comparable to that caused by the 2008 financial crisis.

The report also shows that low- and middle-income countries are being hit the hardest.

National action plans are key

This is part of the reason why the fight against AMR is so closely connected to the work of implementing the 2030 Agenda for Sustainable Development. And not just Goal 10 on reducing inequalities within and among countries, but more particularly Goals 1, 2 and 3 on poverty, food security and health. Naturally, other goals are also connected to this work.

So, what do we need to do? An integral part of the work ahead is the development and implementation of the national action plans that all countries have committed



Image: © Kristian Pohl/Regeringskansliet

Gabriel Wikström, Swedish Minister of Healthcare, Public Health and Sports

to. Specific measures need to be adapted to different countries' varying circumstances and across different sectors, with a clear One Health perspective. Sweden, for example, recently adopted an updated national strategy to complement its existing action plan. The national action plans must be linked to the general development of strong health and veterinary systems. Strong systems are the only way we can ensure access to antibiotics for those in need and yet avoid excess and unnecessary use.

Surveillance to inform public health action is an important part of health systems. The Public Health Agency of Sweden is contributing to the recently launched Global AMR Surveillance System via both WHO and bilateral cooperation. And a WHO Collaborating Centre was recently inaugurated at the Agency. Sweden is also

involved in other efforts, and other countries are doing their part, for example, concerning funding for new antibiotics.

A long road ahead

We need to cooperate and provide support to other countries in order to tackle AMR. In this regard, the European dimension is valuable. The EU has been an important actor and provides a platform for European countries to exchange experience and coordinate amongst themselves. In addition, legislation in some crucial areas is partially decided at European level, for example in the agricultural and pharmaceutical sectors.

“Is AMR worthy of such attention? Undoubtedly, yes. The AMR review by Lord O’Neill showed that by 2050, the number of deaths due to resistant microbes will have increased from about 700,000 per year today to around 10 million. This is more than the current annual death toll from cancer.”

But everything currently being done to combat AMR is not the end, nor even the beginning of the end, of the battle. It is rather the start of a long period of hard work ahead of us. The resolution from the high-level meeting gives us a good foundation, and the ad hoc interagency coordination group and the Secretary-General’s follow-up report to the General Assembly are essential parts of this.

Now, we just need to get out there and do it. Otherwise, the 2030 Agenda, or even more than that, will be at risk. ■

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Fighting antibiotic resistance - the beginning of a long journey

Professor Mike Sharland, infectious disease expert at the Royal College of Paediatrics and Child Health, and Professor in paediatric infectious diseases at St George's University, looks at the effect antibiotic resistance is having on the health of the nation's children...

Antibiotic resistance is finally starting to get the attention it deserves both in the UK and on an international platform. In September the United Nations hosted a 'high level' meeting on the threat of antibiotic resistance and barely a week goes by where you don't see a senior health figure in the media discussing the issue. Whilst this publicity is great, I feel that we should have begun actions to tackle this problem much earlier.

“Without antibiotics you cannot have many treatments that are common place in medicine today, with surgery and treatments for a range of several common infections all effected.”

From the birth of antibiotics we knew there would be issues with resistance. Accepting the Nobel Prize in Physiology and Medicine for the discovery of penicillin in 1945, Alexander Fleming warned of the potential dangers of antibiotic resistance in the future, but it has been in the last few years that the global threat of multi-drug resistant infections has really been recognised.

Drug-resistant infections already directly cause an estimated 700,000 deaths each year worldwide. Although for many people resistance may just mean you are ill for a day or two longer, for some, particularly neonates and young children, this can be life threatening. Without antibiotics you cannot have many treatments that are common place in medicine today, with surgery and treatments for a range of several common infections all effected.

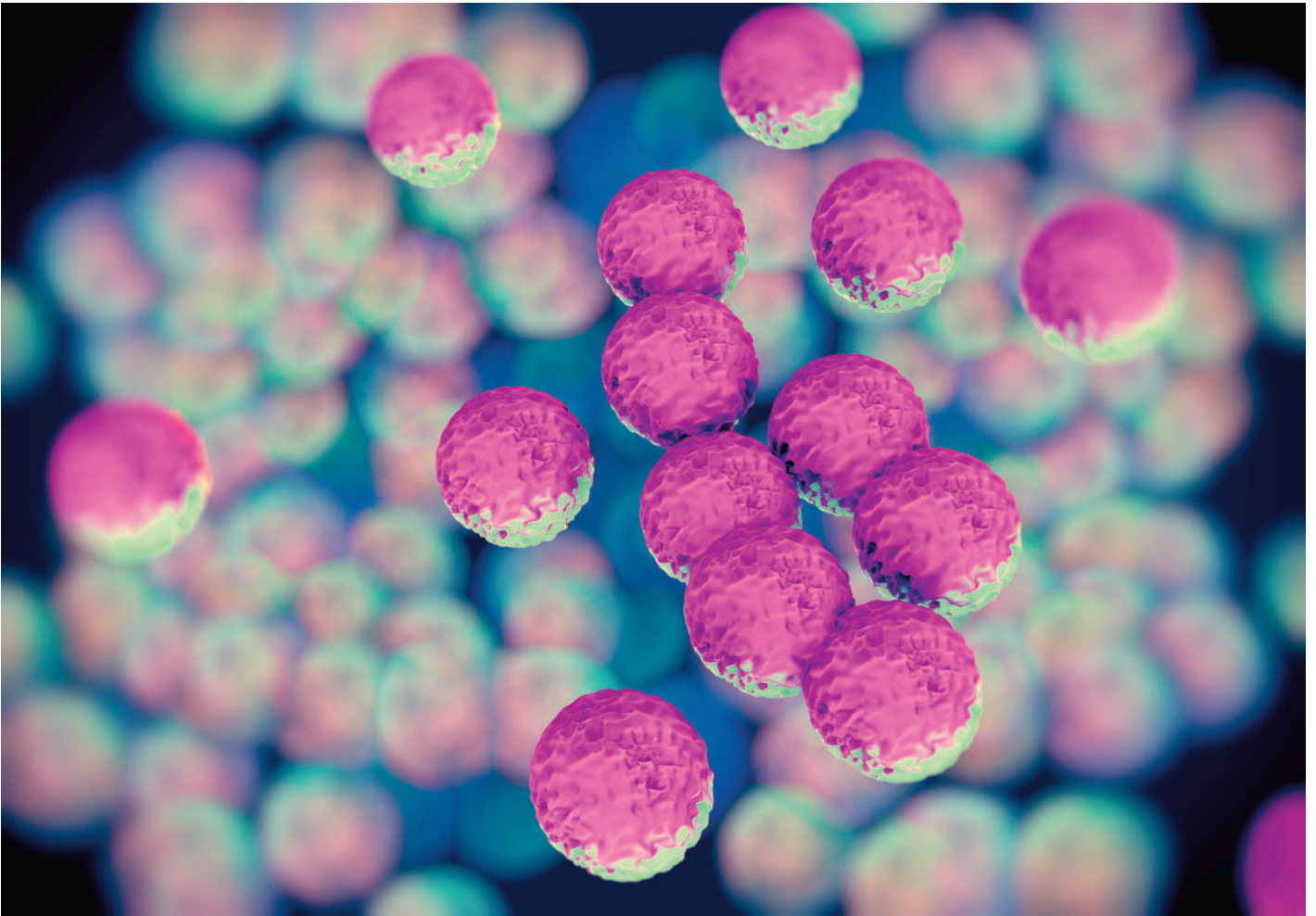
As a paediatrician, I work with children, and it is they who are, alongside the elderly, most prone to infections. A government commissioned report by Jim O'Neil, who was until September a Conservative treasury minister,

found that by 2050, when the children of today will still be of working age, there could be an estimated 10 million deaths a year worldwide related to antibiotic resistance, with an estimated cost to the world's economy of an eye watering \$100 trillion. So it is important we work together to find a solution to this problem now.

With that said, we are beginning to see some much needed work in this area. In the UK, the Longitude Prize, a £10m fund commissioned by Nesta, asks for entries to develop a diagnostic test that will help conserve antibiotic use. Although it may be some time until we find a winner, this provides an excellent opportunity for researchers in this field to work together towards a shared goal which if achieved, will be life changing. The government recently made £4m available to enable greater research in antimicrobial resistance within the UK and on a global scale. The World Health Organization (WHO) released its 'Global Action Plan' last year, calling on all member states to have an action plan to deal with antibiotic resistance within 2 years of the plan publishing.

The UK government, in its response to the O'Neil report published in September of this year, has said that it was 'determined' to support the World Health Organization's plan on tackling antibiotic resistance. But this alone will not overcome this monumental problem. Governments globally must provide yet further funding, and we should take the WHO plan as an opportunity to make the UK a world leader in antibiotic resistance.

Of course, it isn't just about money. Parents and the general public also have a role to play in helping prevent antibiotic resistance from becoming more widespread. As doctors we are encouraged not to overprescribe but we need to get better at explaining to patients why that



is. The recent BBC documentary 'The Doctor Who Gave Up Drugs' gave good insight into this with the programme showing some patients attending their GP appointment went with the sole aim of walking away with antibiotics, even when they weren't necessarily needed. It was clear that patients weren't aware of the risks associated with antibiotic use. Raising awareness of these risks will be key to tackling this problem – that's where health professionals like me, as well as the media, have an important role to play.

“Drug-resistant infections already directly cause an estimated 700,000 deaths each year worldwide. Although for many people resistance may just mean you are ill for a day or two longer, for some, particularly neonates and young children, this can be life threatening.”

As with many global health problems, there is no one group or individual that can solve this. It is down to healthcare professionals, patients, international agen-

cies, the media and most importantly, government working together to support some of the brightest minds in our country to develop ways of overcoming antibiotic resistance. We are at the beginning of a long journey, but with government's support and an international collaborative approach we can work together to tackle this complex problem. ■

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Redefining Child Health for the 21st Century

Dr. Benjamin Van Voorhees discusses strategies for redefining child health for the 21st century in clinical practice, education, research and beyond...

Since its inception more than 100 years ago, the Pediatric Program at the University of Illinois at Chicago (UIC) has worked to stay at the forefront of the ever-changing practice and study of child health. Today it is home to an academic medical faculty of more than 70 (specialising in 16 subspecialties), a newly designated 98-bed Children's Hospital, and a growing, nationally-ranked paediatric research program. It is housed within the largest medical school in the United States – the University of Illinois College of Medicine. UIC Pediatrics is also in a unique position in the ever-growing, ever-competitive metropolitan child health landscape.

Chicago and Cook County, US, are home to eight designated children's hospitals and nine accredited Pediatric Residency Programs. At the heart of all of this, positioned in the centre of Chicago's north, south, and west sides, lies the Illinois Medical District (IMD). The IMD is home to 1,900 hospital beds, 9,000 health sciences students, and four hospitals, one of which is UIC. The Program exists within a saturated healthcare market; however, the demand and need continue to far outweigh the supply.

Greater Chicago is home to more than 1.1 million children and adolescents under the age of 18 (US Census Bureau), all of whom are deserving of high-quality, holistic care. The primarily

African-American and Latino communities that surround the IMD are some of the most economically disadvantaged and most vulnerable to health inequities. And yet, despite the number of institutions in proximity, they do not have access to a central child health community that is specifically designed to address all of their needs. The quality of care for the children of these neighbourhoods suffers as a result of this fragmentation. As such, UIC Pediatrics has spearheaded an initiative to address these issues.

“...in order to address the physical, social and environmental issues that most profoundly affect children living in adversity, UIC Pediatrics has developed strategies to provide comprehensive, customised care to their communities.”

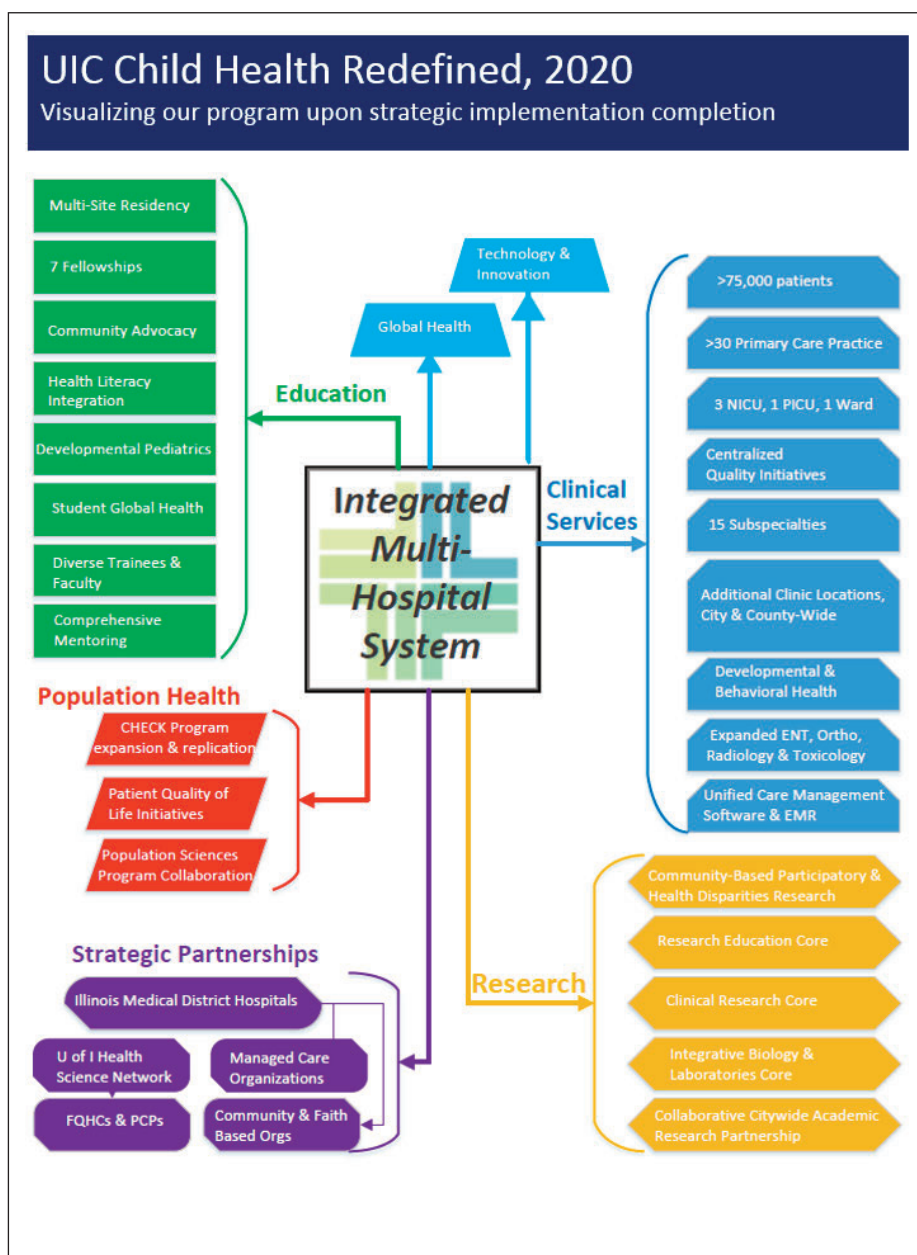
UIC Pediatrics is dedicated to creating an integrated, multi-hospital system that builds upon the current assets offered by the Program and the Children's Hospital, and implementing a new model of care delivery. To accomplish this, UIC's Pediatrics Program has completed a strategic review that included comprehensive analysis, consensus building with IMD partners, multiple rounds of assessment and engagement with more than 100 key stakeholders. The result is a five-year strategic plan designed to create strategic partnerships and guide the Program into the next decade. The development of this plan was inspired

by five core values relevant to the needs of the community: authenticity, collaboration, diversity, innovation, and quality. It is designed to improve and refine internal clinical operations, business practices, educational opportunities and research portfolio, while also challenging the global common practice in paediatric medicine.

Seven strategic design teams analysed the current state of child health at UIC, while also keeping in mind the rapid evolution of healthcare, in order to develop strategic priorities. A major component of the analysis was guided by an ecological model that considered micro, macro, and mezzo trends in child healthcare delivery. Our priorities are to:

1. Optimise clinical growth and increase subspecialty development;
2. Leverage & grow research portfolio and programmes;
3. Promote educational excellence;
4. Foster external strategic partnerships;
5. Impact population health programs through CHECK; and
6. Build new centres in global health and technology innovation.

Key faculty and staff have been assigned to each priority to lead



process. The complexity and enormity of this landscape is a strength in strategy. Neighbouring institutions serve as motivators, models, and current and future partners and collaborators. It is the vision for truly integrative partnerships which serves as the lynchpin for the UIC Pediatrics plan for 2020.

“Seven strategic design teams analysed the current state of child health at UIC, while also keeping in mind the rapid evolution of health-care, in order to develop strategic priorities.”

In summary, in order to address the physical, social and environmental issues that most profoundly affect children living in adversity, UIC Pediatrics has developed strategies to provide comprehensive, customised care to their communities. This plan unites stakeholders in creating a medical community that is reflective of the needs of the 21st century. UIC Pediatrics is at the forefront of the dramatic changes taking place in the provision of healthcare, as is reflected in its adoption of strategies that will redefine child health for the 21st century, in Chicagoland and beyond.

Co-Authors: Mary E Johnson, AM, LSW and Allison Stinson, MPH(c)

teams in carrying out pre-established goals, objectives, and action items, as demonstrated in the figure.

Some of the major anticipated outcomes of strict implementation of the plan, among many others, include:

1. More than 75,000 patients under care;
2. Integrated, 2-4 hospital system;
3. Multi-site residency;

4. New centres in global health and technology innovation;

5. A leading education model for advocacy; and

6. A model population health programme being replicated in other institutions.

The programme’s leadership will continue to take its unique position within the greater Chicago market and IMD into consideration at every stage of the



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Brain disorders and the burden of diseases

Frédéric Destrebecq, Executive Director, and Vinciane Quoidbach, Public Health and Policy Project Manager at the European Brain Council, explain the socio-economic impact of interventions and the importance of early diagnosis with regard to brain disorders...

Depression, stroke, dementia, alcohol dependence, schizophrenia or anxiety will affect at least one in three European citizens during their lifetime – currently 165 million people in Europe (estimated 38.2% of the EU population annually)¹. Brain disorders are highly prevalent medical conditions, being the seat of many chronic disabling diseases²: today, mental disorders and other brain disorders represent 35% of the burden of all diseases in Europe³. Out of 10 individuals with a brain disorder, from 3 to 8 remain untreated although effective treatments exist⁴. And the burden of diseases is increasing.

The relentless demand for healthcare services is set to continue for the foreseeable future, fuelled by population growth and increased longevity. However, since 2010, health systems reforms in Europe are calling for more with high societal value. A key policy driver, therefore, is the need to look at the outcomes or health benefits and to optimise healthcare service delivery (with high quality standards, better use of resources and interaction). This is particularly challenging for brain disorders considering the management of long-term conditions including co-morbidities and occurrence of acute episodes.

From the patient perspective, early detection and diagnosis are unnecessary pain and suffering. Early diagnosis and treatment make not only clinical but also economic sense. Diagnostic testing is an integral part of the healthcare system, providing essential information to enable providers and patients to make the right clinical decisions. Indeed, some 75% of clinical decisions are based on a diagnostic test⁵. Demand for access to quicker, more accurate diagnosis is rising. Making detection more efficient, timely and accurate will contribute to generate the savings required by health systems.

Improved diagnosis can also reduce the scale and cost of treatment. For instance, computed tomography (CT) and magnetic resonance imaging (MRI) have revolutionised the study of the brain by allowing healthcare practitioners and researchers to look at the brain noninvasively. These diagnostic imaging techniques evaluate the brain structure, allowing healthcare providers to infer causes of abnormal function due to different diseases. A large body of research links early diagnosis to measurable health gains, such as improved survival rates and lower treatment costs. However, effective implementation of early diagnosis and treatment varies widely across health systems and many European countries are still lagging severely behind.

“Although brain disorders were until recently associated with disciplinary fragmentation in research and practice using different concepts and approaches, there is today greater awareness on their burden and challenges to manage them, and even to prevent some of them...”

Therefore, the following questions are raised to examine the best options to improve patients’ quality of life and reduce the socio-economic burden: what is the amplitude of current unmet needs (obstacles such as misdiagnosis, delayed treatment, affordable access to care and pricing) in health care in Europe, not only within the provision of medicines but also within health care systems and services? What is the socio-economic impact of targeting these gaps? What are the potential benefits for integrated, coordinated care combining effective team care and care planning? What are the new research developments? A large number of reviews highlight that health systems can respond to the burden of brain disorders by implementing proven, costs-effective interventions. It has proved essential to put scientific evidence into care standards.



More research evidence to develop better prevention and treatment options definitely appear to be necessary, such as :

- The availability of biological markers (biomarkers) for early disease diagnosis will impact the management of Alzheimer's Disease in several dimensions; it will 1) help to capture high-risk individuals before symptoms develop, a stage where prevention efforts might be expected to have their greatest impact; 2) provide a measure of disease progression that can be evaluated objectively.
- Treat early and effectively new treatment paradigm: early diagnosis and disease-modifying treatments (DMTs) at the early stage of the disease to slow down the progression rate are available to manage relapsing-remitting multiple sclerosis.

In this context, the EBC Research Project on the Value of Treatment for Brain Disorders (2015-2017) is exploring through case studies analysis the potentials for early diagnosis and new treatment paradigm, generating evidence on the socio-economic benefits of healthcare (pharmacological and psychosocial) interventions, and assessing optimal strategies such as integrated, seamless care to close the treatment gap in Europe.

Value of treatment research project: Objectives and vision towards policy development

The Value of Treatment research project draws from the EBC Report "The Economic Cost of Brain Disorders in Europe" published in 2005 (Balak and Elmaci 2007) and updated in 2010 (Gustavsson et al. 2011) that provided a solid estimation on the costs of brain disorders at around €800bn per year in Europe.

In order to use data to inform policy recommendations, case studies analysis will be conducted for the following disorders: mental illness comorbidity, schizophrenia, dementia, idiopathic normal-pressure hydrocephalus, AF-related stroke, Parkinson's disease, epilepsy, headache, multiple sclerosis, and restless legs syndrome. Scientific publications with detailed outcomes of each individual case study will also be released in the course of 2017.

“The relentless demand for healthcare services is set to continue for the foreseeable future, fuelled by population growth and increased longevity. However, since 2010, health systems reforms in Europe are calling for more with high societal value. A key policy driver, therefore, is the need to look at the outcomes or health benefits and to optimise healthcare services delivery (with high quality standards, better use of resources and interaction).”

The vision is clear: mental and neurological disorders, or “disorders of the brain”⁶ are complex and interlinked with hundreds of specific diagnosis, codified in diagnostic classifications systems (WHO International Classification of Diseases, ICD-10⁷ and American Psychiatric Association Diagnostic and Statistical Manual of Mental Disorders, DSM-V⁸). Although brain disorders were until recently associated with disciplinary fragmentation in research and practice using different concepts and approaches, there is today greater awareness on their burden and challenges to manage them, and even to prevent some of them (modifiable risk factors reduction), emphasising the need for developing an EU-wide Plan to address brain health in a comprehensive and collaborative way⁹. ■

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8 The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) is the 2013 update to the American Psychiatric Association's (APA) classification and diagnostic tool.

9 EBC Call to Action launched in 2015, advocating for the development of National Brain Plans (NBP) to reduce the burden of diseases and disabilities under the umbrella of an EU-wide plan addressing brain health and covering the whole spectrum of care from surveillance (patient registries) to prevention, care and support, access to treatment, evaluation and research.

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Stroke and neuroplasticity: A multiscale insight

After a stroke, neuroplasticity contributes to spontaneous recovery; exactly how, Professor Francesco Pavone and colleagues are investigating...

Cerebral stroke often leaves victims with significant psychical and physical impairments – from vision problems to aphasia and motor deficits. It is the number one cause of adult disability worldwide, and has a huge impact on public health.

The metabolic distress and long-term neuronal cell loss associated with stroke originate from ruptured blood vessels (haemorrhagic stroke) or aggregates of platelets and blood cells that clog cerebral blood vessels (ischemic stroke) and cause a shortage of glucose and oxygen. The destruction process is complex since it originates from cellular damage, evolves to the network level, and eventually extends to connected regions in distal areas.

Only very early intervention (within a few hours) with thrombolysis can dampen ischemic stroke damage. Currently, only about 10 per cent of all stroke patients reach a hospital early enough or fulfil the criteria for receiving thrombolysis in the therapeutic time window. Prognosis and recovery depend mainly on the location and extent of the lesion.

For many years, people have thought of brain wiring as a rigid structure and once injuries such as stroke occur brain areas and functions are lost forever. This old paradigm of the adult brain as a static structure has recently been replaced by a much more

dynamic view where growth, connectivity changes and remodelling can occur after injury and play a crucial role in recovery and functional repair. Stroke patients show various degrees of spontaneous recovery weeks to months after the incident.

Among the most obvious factors that contribute to the extent of spontaneous recovery are infarct size, infarct location, and age. Most spontaneous recovery tends to occur within the first 3 months. While patients with milder deficits achieve spontaneous recovery more quickly, the pattern of spontaneous recovery can also differ within the same patient for different functions. So far, efforts to summarise this process have been frustrated due to variability across subjects and across neurological domains.

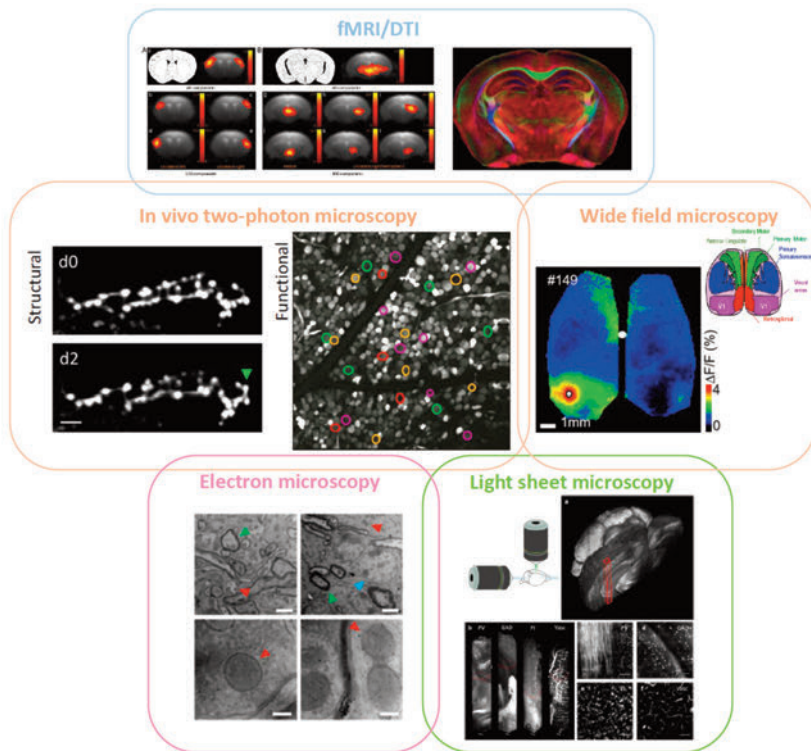
The brain consists of billions of nerve cells and circuits whose rewiring happens at multiple levels, from single cell-to-cell contacts (synapses) to small circuits and functional macro-areas. In order to understand the mechanism of rewiring after stroke – the variability of which eventually leads to very different recovery outcomes – neuronal plasticity after stroke needs to be tackled layer by layer and reorganised through an organic view. Indeed, since neurological disorders affect brain structure and functionality at multiple levels, we believe that a great effort should be directed into coordinating different techniques that can get to

different layers. Accordingly, appropriate animal models are needed to investigate stroke and guide the development of effective therapeutic strategies.

My lab focussed on the development and combination of different imaging modalities to visualise complementary aspects of brain structure and function. The correlative imaging approach we used gave access to fundamental insight into different spatial and temporal scales of brain functionality. The small though solid bridge it provides between different types of data can be promisingly expanded towards a unified approach covering most perspectives. A great deal of information can be gained on a neurological disease like stroke by following a multi-layer pipeline (depicted in Figure 1). Stroke alters and triggers changes in intra- and inter-hemispheric connectivity; this rewiring aims at compensating for the loss of function.

fMRI on (human and) mouse brains affected by stroke can tell the progression of the pathology over time, showing the plastic remapping of distant regions over the whole brain. Magnetic resonance imaging does not have enough resolution to infer what the cellular trigger of this remodelling is; simultaneously-performed two-photon fluorescence imaging of labelled neuronal cells could reveal the structural and functional rewiring underlying fMRI signals in the newly activated cortical

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area of the same mouse with subcellular detail. Optical imaging on stroke animal models is capable of providing fundamental insight into neuronal remodelling and synaptic plasticity while accurately depicting the functional remapping of the damaged cortex, and revealing angiogenesis and hemodynamic adaptation over time. Alterations in long-range projections underlying inter-hemispheric plasticity can be studied *ex vivo* on the same brain by applying ad-hoc clearing treatments that make it transparent.

Moreover, stroke-induced expression of several molecules and proteins, like growth-associated factors and inflammatory chemokines, can be addressed with multi-round immunohistochemistry over the entire clarified brain by light-sheet microscopy or similar techniques. Once we have the big picture in terms of long-term dynamics and wide-range remodelling, fine details like the presence of synaptic contacts on regenerated axons are available by electron microscopy on targeted regions of the same sample. Informatics tools

to align data at different scales within a common framework (i.e. stereotaxic atlases of murine and human brain) and big data storage facilities need to be further implemented and routinely used. Big transnational research partnerships like the Human Brain Project are working in this direction by “developing the integration and algorithmic reconstruction processes required for high fidelity reconstruction of the mouse brain across all levels of biological organization, from genes to cognition”. (<https://www.humanbrainproject.eu/project-objectives>).

Finally, as described in the European Research Grant I was recently awarded, new optical tools like optogenetics can be used to test and finely tune the activation of specific brain areas. Within this project, we will investigate all-optical brain-to-brain information transfer in a mouse model of stroke to boost more efficient recovery of motor function.

Since a completely integrated correlative approach implies that the same

animal should be studied by multi-level analysis on several devices, the possibility of having this wide set of tools near to each other, e.g. in the same campus, is not a negligible issue. Multidisciplinary facilities provided with the above-described imaging devices are an essential requirement for setting up this working strategy. In addition, considering the intrinsic difference between individuals (even between mice of the same strain), a multi-level investigation of the same sample would be extremely beneficial to reduce statistic variability, and to cut the number of animals used in the experiments.

In our opinion, this multi-dimensional hybrid strategy could be extremely useful in the investigation of complex brain diseases like stroke, and would speed up the translation of neurobiology studies to clinical settings. Moreover, the setup of pharmacological treatments would crucially benefit from this multi-level investigation given the multitude of information that can be gained at once. We believe this kind of cross-disciplinary multi-scale study will definitely boost our knowledge of the brain.



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Interception therapies for neurodegeneration, the promise and the challenge

Duncan McHale, Vice President, Head of Global Early Development at UCB highlights new therapies for neurodegenerative diseases such as Alzheimer's disease...

Neurodegenerative diseases are a growing global challenge as medical advances ensures more individuals live longer. By 2020 there will be more than 40 million individuals in the world with Alzheimer's disease and by 2040, without the development of truly disease modifying drugs this will grow to more than 80 million. Similar trends are also seen for Parkinson's disease. The annual treatment and social care of individuals with neurodegenerative diseases is estimated to be more than \$1 trillion by 2050, making it one of the most important socioeconomic challenges of this century. Research spending in this area is currently running into billions of dollars per annum. Discovering and developing disease modifying drugs, i.e. those that prevent progression of the disease has been very challenging with many programs failing.

This growing healthcare challenge has been a focus of biomedical research in most developed nations leading to large investments in research from both public and private funders. Significant biological findings have been discovered and new diagnostic tools have been developed increasing our ability to identify the disease early and even predict subjects at significant risk before significant symptoms begin. We are approaching an era where we can identify subjects who have a neurodegenerative disease, but do not yet have any of the symp-

toms. We will have therapies which in theory will prevent or at least substantially delay the onset of symptoms but we have a development and commercial framework which does not support this approach.

Interception Therapies

Since the mid-19th century and the work of William Farr, our understanding and classification of disease has been based on the identification of disease based on symptomatology and overt clinical signs. Therapies have been focussed on reducing symptoms and treatments started after the disease process has damaged the body to the point of impaired function.

The latter 20 years of the 20th century saw a shift toward disease prevention with some limited success. The aim here was to modify people's lifestyles so they reduce the risk of a disease occurring. These interventions were often general e.g. increase in exercise, stop smoking, reduce alcohol intake etc. There have been some pharmacological interventions in this area but these have been limited and often with uncertain outcomes, e.g. use of low dose aspirin for primary prevention of cardiovascular disease or use of statins in subjects with normal LDL levels in primary prevention of cardiovascular disease.

Advances in disease understanding and the use of biomarkers is now offering an opportunity which could

be the best of both worlds. Biomarkers are currently being discovered and qualified which allow the detection of a disease process before any symptoms or overt clinical signs are present. These subjects have a high (and sometimes very high) risk of developing a symptomatic disease, although this may be a few years in the future. Good examples of this include the detection of increased amyloid deposition in the brain before cognitive impairment occurs in individuals with pre-symptomatic Alzheimer's disease, individuals with anti-drug antibodies to insulin and beta islet cells before they develop type 1 diabetes. Our ability to detect these very early pre-symptomatic disease processes will only increase in the future, e.g. the use of mobile phone technology to detect early Parkinson's disease through texting speed or voice analysis. The development of therapies to intervene at this very early stage in a disease process is being termed as interception therapies. There is a great hope that these therapies will significantly improve population well-being by delaying or preventing the symptomatic phase of the disease developing. It is well established in many conditions that early intervention results in improved outcomes and this is a further extension of that. In neurodegeneration, where significant cell death causes the symptomatic phase and AD in particular, it is clear from recent failed studies that early and ideally pre-symptomatic

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treatment is going to be required to gain the benefit of these new therapies aimed at preventing disease progression.

The Challenge

This appears a straightforward opportunity which patients, healthcare systems, regulators, payers and industry would be able to seize and deliver on. However, the current drug regulatory and reimbursement system does not support or incentivise developing interception therapies.

From a regulatory perspective new drugs are evaluated against a standardised set of clinical outcome measures. These measures are well established and despite imperfections are trusted. The clinical outcome measures are generally based on symptomatic scoring systems which may be enhanced by the use of clinical signs, e.g. joint swelling. The whole aim of interception therapies is however, to prevent these symptoms from developing. Therefore, a complete new set of regulatory qualified tools are required based on the prediction of the onset of symptoms and the reduction in a disease process rather than on symptomatic improvement. A clear example here would be the demonstration of a reduction in amyloid plaque load or more likely a reduction in the accumulation of plaque load. At present this is just a supporting biomarker, but it needs to be the primary endpoint of the randomised control trials and even this may take 1-2 years per subject to detect a treatment effect.

From a payer / reimbursement perspective the challenge is a temporal one. The need to pay now for savings

on healthcare and social care costs several years in the future creates a real challenge. This is challenging enough in a single payer publically funded system, such as the UK National Health Service (NHS) but amplified in a private insurance based system where individuals regularly change their provider.

“By 2020 there will be more than 40 million individuals in the world with Alzheimer’s disease and by 2040, without the development of truly disease modifying drugs this will grow to more than 80 million.”

True Partnership and Shared Risk and Reward

In our current drug development and commercialisation framework the biopharmaceutical companies take the vast majority of the risk and this is coupled with the reward driven through high drug pricing for new branded therapies. The development of interception therapies will require the use of larger cohorts and longer studies if definitive proof of impact on currently recognised symptomatic scoring systems is required before drug approval. This increase in length and size of trials combined with the reduction in patent life of novel therapies will drive the cost of medical innovation even higher. These costs are likely to be unsustainable and so the benefits to patients of these new biological understandings will go unrealised.

We require a new paradigm where the healthcare systems and subsequently patients share some of the risk and enjoy the rewards of better health through the use of interception ther-

apies. The cost of clinical trials needs to be reduced and be seen as an investment in future medical innovation by healthcare providers and funders rather than a potential short term revenue generator. Regulators and patients will need to understand that initially these type of therapies may be licensed, based on proven reduction disease processes and mechanisms and that proof of symptomatic benefit will only be obtained in a real world setting several years after launch. The reward for patients is access to medical innovations much earlier and at an affordable price to the healthcare system. Biopharmaceutical companies must accept that this is a sharing of risk through a reduction in their cost to get these innovations to patients and this reduction in cost and hence risk must be accompanied by changes in approaches to pricing so that we develop an affordable strategy to develop interception therapies.



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Lessening the burden of traumatic brain injury

Drs. Elizabeth Theriault, Ramona Hicks and Patrick SF Bellgowan shed light on the burden of traumatic brain injury and the need for better diagnosis and treatment...

Given the high socio-economic burden, traumatic brain injury (TBI) has become one of the major priorities in the medical research agendas of many countries¹. A recent Canadian study examined the socio-economic burden of 14 neurological conditions, data based on records of hospitalisations, and reported that next to Alzheimer's and other dementias, TBI is and will continue to be, the second highest neurological condition requiring informal care². The indirect costs due to working age disability will be the greatest for TBI of all the conditions studied. In fact, sustaining a TBI has a very large effect on employability as well as on subsequent homelessness: in Canada, 65% of adult homeless have sustained a TBI, in most cases prior to becoming homeless³, findings corroborated in a study conducted in the UK⁴. Among homeless youth aged 19-24, 49% have suffered a moderate-to-severe TBI, a quarter of them suffer depression and three-quarters are drug-dependent³. A study of homelessness in Minnesota demonstrated 43% of homeless adolescents had TBI, including an earlier age of homelessness and higher incidence of psychiatric symptoms and poorer Activities of Daily Living (ADL) standards⁵.

Although an intensive effort is underway to develop modern diagnostic criteria to index the severity of traumatic brain injuries⁶, the clinical standard remains the Glasgow Coma Scale⁷, which assesses a patient's level of consciousness, and employs a mild-moderate-severe classification system. The incidence of moderate to severe TBI can be tracked epidemiologically, however 80% of TBIs are classified as "mild", and the associated costs and incidence are more challenging to capture since most cases do not reach the hospital. "Mild" TBI is also commonly referred to as concussion, and while recent media coverage of sports-related concussion has garnered the public's attention, the vast majority of concussions in North America and Europe (70%) are

caused by motor vehicle accidents and falls. At the same time, "mild TBI" is an oxymoron: it is not 'mild', rather it is a traumatic injury to the most complex organ in the body: the brain. Critically, in a subset of cases, concussion can also result in "second impact syndrome" and death⁸.

An increased understanding of the deleterious long-term cognitive, behavioural, substance use, and mental health effects of repeated head impacts and concussions has been brought to light through recent players' associations litigations in collision sports such as football and hockey in North America. The proper diagnosis, prognosis and treatment of concussion remains an important research challenge, although there is some recent progress in identifying the 10-15% of children who will go on to have post-concussion syndrome or PCS⁹. Currently there are no scientifically validated treatments for concussion (due in large measure to poor control populations and/or baselines, and poor prognostic indicators), but there are many unproven interventions.

In 2012, in an effort to combine resources and focus on improving outcomes and lessening the global burden of TBI by 2020, the European Union, the United States and Canada formed a pragmatic, cooperative consortium of funding agencies called the International Initiative for TBI Research (InTBIR)^{10,11}. The 3 founding members, the Health Directorate of the European Union, the National Institutes of Health's National Institute of Neurological Disorders and Stroke, and the Canadian Institutes of Health Research and other Canadian partners, plus two new members: One Mind for Research (joined in 2015) and the US Department of Defence (joined in 2016), have collectively invested more than \$160m USD since InTBIR's formation. At the fifth annual meeting of InTBIR, held at the Embassy of Canada

in Washington, DC October 11-12, 2016, InTBIR working groups, consisting of clinicians and researchers, reported significant progress in the use of Common Data Elements, Comparative Effectiveness Research, and a priori statistical analyses for the understanding and development of TBI-related fluid biomarkers, genetics, imaging, and outcome assessment.

“An increased understanding of the deleterious long-term cognitive, behavioural, substance use, and mental health effects of repeated head impacts and concussions has been brought to light through recent players’ associations litigations in collision sports such as football and hockey in North America.”

The power of these efforts will be significantly enhanced by this international collaborative in data sharing and advanced analytics, critical for developing a more precise classification system and a personalised medicine approach for TBI. Data sharing will be essential and will accelerate global improvements in outcome by making it possible to compare research findings across multiple health care settings and patients of various ages and ethnicities to determine which treatments are effective and for whom. InTBIR is breaking new ground in identifying resources for data archiving and analytics that adhere to local and international rules and regulations. This is particularly challenging given the various stages of development and evolution of data science policies in various countries. Data curation of highly granular, multimodal data is another essential, and the InTBIR teams of scientists are working to develop quality assurance measures to address this need. A major publication in the Lancet Neurology in the spring of 2017 will address the collective global efforts to date, and a summary report on the fifth Annual Meeting of InTBIR will be available on the InTBIR website in January 2017 (<https://intbir.nih.gov>).

Never before has there been such a concerted effort to lessen the global burden of TBI, and despite the challenges, InTBIR outperforms expectations and demonstrates the power of international collaboration. ■

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Remembering repeated events

Dr Kim Roberts, Professor at the Wilfrid Laurier University outlines how they are conducting research to discover how children use their memories when recalling traumatic events...

Think of a very special day in your life. It could be your wedding day, the birth of a child, the day you got your first bike, for example. What do you remember? Now, think about something you do regularly such as, driving to work, checking email, or cooking dinner. Can you see any differences in what you remember about a special day versus a regular activity? Do you remember more about one of them than the other? Is one memory more vivid, or contain more contextual information such as the time, and place? What about conversations, colours, the way things felt?

Memories of unique events that happen infrequently are quite different to memories of events that are repeated many times. We can remember the details of unique events quite well, although this fades over time. In contrast, when we remember something that has happened over and over, we do not really recall the exact details – can you remember what you wore the last time you drove to work, and the time before that, and the time before that? I certainly cannot. But I do remember the route I took (it's always the same), that the radio was on, and that I parked next to my building. I may not remember exactly which radio station I listened to, or which particular parking spot I used. In other words, I can remember generally what my drive to work is like, but cannot really recall a particular time and the particular details associated with that time.

Scientists call this type of memory a schema which is a cognitive structure that helps us store information efficiently. It's as if our brains realise that if we have the same experience over and over, we should retain what usually happens and not worry about the precise details each time.

Schemas sound quite sophisticated, and so can children develop schemas? The answer is yes. Further, they can do this from a very young age! Children aged just 2.5 years can develop schemas about a day at the day care, a bedtime routine; in fact, any experience that is repeated can develop into a strong memory of what usually happens driven by a well-formed schema. Even when the exact details fade from memory, schema recall can still be quite good.

In the Child Memory Lab at Wilfrid Laurier University, my students and I have been studying how we can maximise the accuracy of children's memories in forensic investigations. In cases of alleged child sexual abuse, child complainants are routinely asked to describe a specific incident. If there have only been one or two incidents, then children are able to describe some precise details (although much depends on the skill of the investigative interviewer, of course). The sad reality is that many children, over 50% of child victims, have been abused on many different occasions. And what happens to our memories when an



Kim P Roberts PhD, Professor

experience is repeated? A schema develops. Children can recall the common things that happen even after long delays, delays that are commonplace between the incident(s) and children's disclosure of abuse, and delays between investigation and prosecution. However, many investigators must try and elicit information about individual incidents for several reasons: 1) The police need to know what charges to lay; 2) the defendant has a right to defend him/herself and knowing the exact day may provide an alibi; and 3) the court needs to pass appropriate sentences based on the charges. None of this can be done if children can only talk about what usually happens and, perhaps worse, jurors and judges find children less credible if they cannot provide exact details of the alleged crimes. In some

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countries, charges can be made that span a particular amount of time (e.g., “from May 2003 to December 2011”), and this occurs more often with historical abuse cases, that is, when an adult makes allegations of child abuse many years after childhood. These incidents are often impossible to date precisely.

So what happens when children are asked to describe a particular instance of a repeated event? Dr Martine Powell (Deakin University, Australia) and I have studied this question for over 15 years. The good news is that children rarely intrude false information such as describing actions that never happened in any of the repeated events. Further, most of what they describe are details that did actually happen. So in one sense, they are quite accurate – the majority of what they say is true. Here’s the bad news: Although they

describe things that did happen, they are very confused about which details go with which particular incident. So if asked what happened “the time your sister was there”, a child might provide information that came from three other times when s/he was abused but not the time the sister was there. This means that a defendant may be able to provide an alibi, not because the alleged incidents didn’t happen, but because those things did not happen on the particular day under discussion.

At one time, interviewers were cautioned to avoid discussion of ‘what usually happens’ and focus on individual incidents. However, doctoral research by Sonja Brubacher in my lab has shown that if children are allowed to recall a schema before they are subsequently asked about individual incidents, they are more accurate and provide more information than when

first questioned about individual incidents. It is as if the schema provides a framework that children can then rely on to structure their recall of individual incidents.

“The sad reality is that many children, over 50% of child victims, have been abused on many different occasions. And what happens to our memories when an experience is repeated? A schema develops.”

Children should not be further victimised for being children who are still developing their memory skills. But it is essential we discover innovative ways to use the abilities they do have. I and my students are indebted to the research agencies for providing funds for us to do this research. Good science provides the evidence needed to form developmentally-appropriate interviewing techniques when children are involved in investigations of child sexual abuse. It’s a win-win.



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Funding key research for Alzheimer's disease

Melinda Kelley from the National Institute on Aging in the US, speaks to Editor Laura Evans about raising awareness of Alzheimer's disease and how funding for research is allocated to the National Institutes of Health...

Alzheimer's disease is a global health challenge. The most common form of dementia, Alzheimer's disease, affects an estimated 46.8 million people worldwide in 2015 with that number expected to double every 20 years. In the USA alone, in 2013¹, 5.2 million people – aged 65 years and over – were affected by this condition. It is reported that by 2030, that figure will grow to 8.4 million and 13.8 million by 2050.

The United States' National Institute on Aging (NIA) is one of 27 institutes and centres of the National Institutes of Health (NIH). NIA is at the forefront of research activities dedicated to understanding the nature of aging, supporting the health and well-being of older adults, and extending healthy, active years of life for more people.

Adjacent Government Editor Laura Evans talks to NIA's Melinda Kelley to find out more about the work they do to support research into and raise awareness of Alzheimer's disease.

"What is really critical is the fact that the drugs currently approved to treat Alzheimer's don't really address the underlying disease's process. Most people feel like the really big goal ahead of us is developing either preventative therapies or interventions for people who are living with the disease already."

"There is a lot of information out there. We, as well as some very large Alzheimer's groups in the US and around the world, provide a lot of health information. But people may not be getting the information they need, about how important it is to go to your doctor. At the same time, we are reaching out to health care providers, providing them with assessment tools and clinical trial information. However, I do think people

recognise that the disease is a critical issue for many of us personally and for society in general."

In 2012, [the National Plan to address Alzheimer's disease](#) in the US was unveiled. The Plan's main aim is to address the major challenges presented by Alzheimer's, and it outlines and tracks the various goals and activities involved – from advancing scientific collaboration to improving patient care.

"The NIA, NIH, and the US government are tirelessly working towards their goal of treating or curing Alzheimer's by 2025. However, there are still challenges and hurdles and one of the main challenges is getting people to see their doctor, should they have memory issues."

"The National Plan goes beyond what we do at the NIH and the NIA," says Kelley. "It includes research, but also care and services and there are other parts of the Federal government – as well as non-governmental organisations – here in the US that help address the needs of people with Alzheimer's disease and their families."

"It's not just about the need for future successes in preventing and curing Alzheimer's, because we have lots of people who right now need supportive care and community services. The NIH funds caregiving research, but there are many parts of the Federal government that address care and support issues, and that's all part of that National Plan," Kelley explains.

"But NIH, and in particular NIA, leads the way in making sure the research gets implemented. The main research goal is prevention or intervention for Alzheimer's by year 2025 – which is coming up quickly from a research perspective. Clinical trials can take a number of years –



running the trials themselves and recruiting enough people to take part take time.”

The recent released, US legislatively mandated report – [Stopping Alzheimer’s Disease and Related Dementias: Advancing our Nations’ Research Agenda](#) – is separate from the National Plan. However, it is a US government document – a “bypass budget” – that lays out the NIH’s estimates for the funding needed to implement its research plans, as Kelley explains.

“In 2011 when the initial legislation was signed by President Obama – the National Alzheimer’s Project Act – it made Alzheimer’s more visible and we at the NIA started to see boosts in Federal funding for Alzheimer’s research.”

“Initially, it was a redirection of money from the NIH Director, but by fiscal year 2014 we started to see increased Congressional appropriations – more money from the US Congress – directed to the NIA – to share across the NIH, and then we received a big increase

(\$350mn) in fiscal year 2016, which is the year we are in now.”

“The President puts out a budget each year and Congress decides how much to give us. However, the bypass budget allows the NIH to report, through a separate professional judgement process, how much additional money it would take to reach that goal of treating or curing Alzheimer’s disease by 2025,” Kelley adds.

“We have now presented the second bypass budget for Alzheimer’s disease [the Stopping Alzheimer’s Disease and Related Dementias report referenced above],” she says. “We put out a bypass budget for future fiscal years, but if funding comes “early,” then we have to accelerate the research as much as we can – this is what happened last year.”

As well as research funding, the NIA within the NIH also provides a great deal of information for the public on Alzheimer’s disease. It’s important to raise awareness and reduce the stigma that still seems to be attached

to various types of dementia, including Alzheimer's. One of the major challenges, Kelley agrees, is getting people to discuss memory problems with their doctor.

"I think people are certainly aware of Alzheimer's and know what a huge public burden it is. Everybody knows someone who has had Alzheimer's or one of the related types of dementia – there are a number of Alzheimer's-related dementias, such as frontotemporal dementia, Lewy body dementia, and vascular cognitive impairment/dementia. People know family, friends and others in their community – but there is definitely a stigma," she says.

"What is really critical is the fact that the drugs currently approved to treat Alzheimer's don't really address the underlying disease's process. Most people feel like the really big goal ahead of us is developing either preventative therapies or interventions for people who are living with the disease already."

"You probably heard about the actor Gene Wilder who died recently. The US press reported that he didn't want anyone to know he had Alzheimer's, so he was a recluse as the disease progressed, because he didn't want to frighten children who might have seen him in some of his roles.

"There is still a stigma attached to the disease and reducing that stigma and getting people who have memory issues to go to their doctor and talk to them is really important. Even though there is no curative treatment available at present, it's important for people to recognise what is happening," Kelley stresses. "There are also things you can do to support caregivers, to give them a break and help affected individuals and their caregivers plan for the future."

Clinical trials are key to understanding the disease further and help with early diagnosis. However, as Kelley explains, getting the numbers of volunteers required for effective clinical trials is one of the many hurdles to get over in order to reach their 2025 goal.

"The challenge of recruitment for clinical trials is looming ahead of us in order to reach that goal in 2025," she says. "It's very difficult to recruit for all clinical trials across the board and for Alzheimer's in particular; we need thousands of people screened. Most critically, we need people to join prevention trials who don't have cognitive impairment or memory issues.

"We want to see people in their 40s and 50s who might be just at the start of the process, as it is believed that the disease starts decades before you have memory problems – with the build-up of the proteins that cause the biological issues. We want to intervene right at the start, before they even visit their doctor with symptoms. We want to test the effectiveness of giving therapy to people at this very early stage of the process. Expanding the recruitment to this stage could be a challenge."

The NIA, NIH, and the US government are tirelessly working towards their goal of treating or curing Alzheimer's by 2025. However, there are still challenges and hurdles. The NIA provides a great deal of information for the public in order to wipe out the stigma and help people to tackle Alzheimer's head on (see: <https://www.nia.nih.gov/alzheimers>). It's about everyone involved coordinating and working together to help fill the gaps. ■

1 https://www.alz.org/downloads/facts_figures_2013.pdf

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Alzheimer's disease: Treatment failures and future directions

A paradigm shift is needed if researchers are to find a successful for treatment for Alzheimer's disease, argues Ai-Ling Lin of the Lin Brain Lab...

Alzheimer's disease (AD) represents the most common cause of dementia, accounting for 50-75% of all dementia cases. AD is becoming increasingly common as the global population ages. It is estimated that currently 44 million victims of AD dementia exist in the world and that this will grow to more than 100 million cases by 2050. Pharmaceutical companies have been developing drugs to combat the disease. However, there are currently only a few interventions that have been approved for the treatment of AD. None have shown a clear effect on disease progression. A recent study looked at how 244 compounds in 413 clinical trials fared for AD between 2002 and 2012. Of those 244 compounds, only one was approved. The researchers report that this gives AD drug candidates one of the highest failure rates of any disease area – 99.6%. In the last thirteen years no new drugs have been released and existing drugs only stabilise symptoms temporarily in some patients, but do not slow progression of the disease.

Several factors have been suggested as responsible for the failures. First, it could be the animal models used for testing the drugs. Much traditional AD research has been based on the use of animal models, e.g. transgenic mice, in an effort to recapitulate genetic and pathological traits of human disease. However, transgenic animals, despite presenting several of the typical AD traits, do not develop

the clinicopathological complexities of human AD. Moreover, treatments that seem to work in such models have not translated to humans. This indicates the existence of a clear disconnection between the animal model and the human condition.

Second, the treatment target has also been a concern. Until now, companies have mostly gone after the same target – amyloid-beta ($A\beta$) proteins that form aggregates or plaques in the brain of AD patients. However, comorbidity is very common in AD. Evidence shows that brain vascular and metabolic dysfunctions are also present in AD patients, and may even occur before $A\beta$ appears. A recent study has shown that if only targeting $A\beta$ without considering vascular defects, a new testing drug failed to improve memory in an AD mouse model. As past failed clinical trials have done, targeting $A\beta$ may not be enough to stop the disease progressing.

Third, timing. It may have been too late to treat the disease when patients were already showing cognitive impairments, such as memory loss. At this stage, the AD patients may already have lost brain cells, particularly in the cerebral cortex – the brain area responsible for processing thoughts and many of the higher functions, including memory. When the brain cells have already died, it is almost impossible for any treatment to resurrect them and restore their functions.

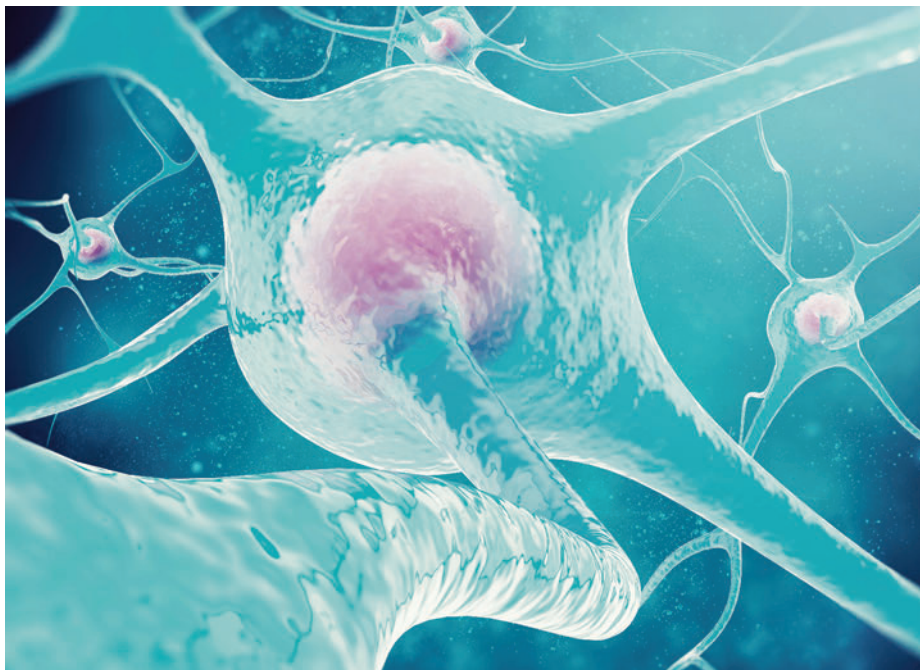
Ironically, nowadays, the majority of patients are not be diagnosed with AD until they show memory loss.

“Although genetics and advancing age are the major risk factors for developing AD, nutritional factors, physical activity, cognitive stimulation, and education level are all directly related to AD risk. Therefore, it is imperative to have lifestyle-related interventions to prevent AD or delay the onset of the disease.”

Learning from the failures, a paradigm shift in dealing with AD is a pressing need. In particular, a shift in focus to prevention strategies should be encouraged. Although several lifestyle-related risk factors have been shown to play key roles in the onset and progression of AD, research support and effort in these domains remains disproportionately low; only 3.4% of average annual funding is supported by the National Institute on Aging. Although genetics and advancing age are the major risk factors for developing AD, nutritional factors, physical activity, cognitive stimulation, and education level are all directly related to AD risk. Therefore, it is imperative to have lifestyle-related interventions to prevent AD or delay the onset of the disease.

In the Finnish Geriatric Intervention Study to Prevent Cognitive Impairment and Disability (FINGER), researchers used a multi-domain lifestyle interven-

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tion (diet, exercise, cognitive training, vascular risk monitoring) to assess the potential to prevent cognitive decline in at-risk elderly people. Between 7 September 2009 and 24 November 2011, they recruited 1260 participants, aged 60–77 years, and randomly assigned them into either the intervention group or control group (with general health advice). The Inclusion criteria were CAIDE (Cardiovascular Risk Factors, Aging and Dementia) Dementia Risk Score of at least 6 points and cognition at mean level or slightly lower than expected for age. After the two-year trial, they determined the participants' change in cognition through comprehensive neuropsychological test battery (NTB) Z score. They found that the intervention group has 25% improvements in the NTB test compared to the control group. The study results clearly indicated that a multi-domain intervention could be effective to improve or maintain cognitive functioning in at-risk elderly people from the general popu-

lation. (The trial is registered at ClinicalTrials.gov, number NCT01041989).

With advanced technology, the efficacy of lifestyle intervention can be monitored in real-time using novel, non-invasive neuroimaging. Magnetic resonance imaging (MRI) and positron emission tomography (PET) have been successfully applied to assess in vivo the effects of specific nutritional interventions. For example, using high resolution MRI, researchers have shown that a Mediterranean diet can protect brain volumes and cognitive functioning in older individuals at high risk for AD. The combination of lifestyle intervention and neuroimaging technology could be a powerful strategy to prevent the onset of AD.

To achieve these innovative and paradigm-shifted investigations, there is an urgent need to increase funding for epidemiological and clinical studies, focused on the impact of specific

nutrition, level of physical activity, and level of educational attainment in the onset and progression of AD. With awareness in society as a whole (researchers, governments, and general population), it is our hope that the risk of AD can be reduced and the onset of AD will ultimately be prevented.

“AD is becoming increasingly common as the global population ages. It is estimated that currently 44 million victims of AD dementia exist in the world and that this will grow to more than 100 million cases by 2050.”



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Alzheimer's as a spectrum disorder: The promise of precision medicine

Emory University's Stuart Zola considers the case for classifying Alzheimer's disease as a spectrum disorder and the promise of precision medicine as an intervention

Alzheimer's disease (AD) traditionally has been viewed as a one-size-fits-all medical condition. Thinking of Alzheimer's as a single disease state assumes that there is a single "magic bullet" that once found will effectively treat or cure all patients. However, as we know, there is no disease-modifying therapy for AD yet, and despite several decades of research no cure and no effective treatments have been forthcoming. Interventions to stop, slow, or prevent the progression of AD are a worldwide healthcare imperative. In this regard, the present commentary proposes two points for consideration:

- Alzheimer's disease should be reframed as a spectrum disorder (much like the reframing of autism), and as such individual AD patients will need to be profiled differentially to maximise the efficacy of treatment and preventive measures.
- Precision medicine now holds the best promise for clarifying the clinical and biological complexity of AD as a spectrum disorder and for the possibilities of developing treatments and interventions.

Alzheimer's disease as a spectrum disorder

While earlier measures for diagnosing AD were based on clinical criteria alone, new criteria for AD have been recently established that now include the clinical characteristics of AD, as



Precision medicine (PM) is a medical model that proposes the customization of healthcare, with medical decisions, practices, and/or products being tailored to the individual patient.

well as the pathological features of the disease. The new criteria include the use of imaging and other biomarkers to aid in diagnosis and in understanding the underlying neurologic and genetic bases for behavioural changes associated with AD. Additionally, clinical features of AD are now being supplemented with innovative behavioural assessment tools that currently are being validated and that can inform us further about the spectrum of AD.

A number of studies have begun to reveal varied patterns of behavioural changes and abnormalities in AD patients. Many of these studies point to the fact that not all patients exhibit the full range of behavioural abnormalities associated with AD (as was

discovered some years ago for the condition of autism, precipitating its reframing to autism spectrum disorder), and many behavioural changes do not seem directly correlated with impairments in cognition. For example, in a study of behavioural changes in AD where the frequency and severity of 10 commonly reported behaviours were assessed, it was reported that the most common behaviour was apathy, exhibited by 72% of the patients, followed by agitation (60%), anxiety (48%), dysphoria (38%), and disinhibition (36%). Agitation, dysphoria, and apathy, were significantly correlated with cognitive impairment, but many other behavioural measures were not. These findings, and others point to the idea that despite having a diagnosis of AD, individual patients can have

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quite different clinical/behavioural profiles, and while some behavioural changes can be linked to cognitive alterations, others are not. Patterns of behavioural changes can be variable from patient to patient, even within a diagnostic category, e.g., mild, moderate or severe AD. It is in this sense that AD should be reframed as a spectrum disorder. Moreover, considering AD as a spectrum disorder sets the stage for the application of one of the most promising and innovative approaches in modern medicine – precision medicine.

Alzheimer's disease and the promise of precision medicine

Precision medicine, sometimes called personalised medicine, refers to the tailoring of medical treatment to the individual characteristics of each patient. Several core components of precision medicine have been identified, including comprehensive risk assessment, tools for preclinical detection of pathophysiological processes, and interventions tailored to an individual's drivers of disease. These components, and others, speak to the potential power that precision medicine could have both in identifying specific profiles of AD, and in turn developing more effective interventions and treatments that can be targeted at specific aspects of the disease.

Considerable AD research is focused on understanding genetic risk. However, it is likely that environmental factors will also be key to risk assessment and to understanding and developing the most effective interventions. For example, it is well known that trau-

matic head injury increases the risk for AD. There are now established protocols for treating traumatic head injury, as well as individual counselling protocols to reduce the future risk in cases, including patient management, and frequency of surveillance for pre-clinical AD. While treatment options can alter the course of vulnerability to AD for some individuals, it is less effective for others. Precision medicine can begin to help us understand why, by uncovering how head trauma might interact with existing but undetected or latent pathophysiological processes and certain genetic dispositions that aim some individuals toward AD vulnerability.

Two other core components of precision medicine, tools for preclinical detection of pathophysiological processes, and interventions tailored to an individual's drivers of disease have been viewed by many as interventions purely at the molecular level. These include, discoveries of a range of identified biomarkers that might correlate with behavioural changes. More recently, however, there has been recognition of the potential impact of behavioural assessment tools, because they link so directly to the most obvious defining characteristic of AD, cognitive decline. New and innovative behavioural assessment approaches have been developed which are aimed at preclinical detection of oncoming cognitive decline, based on our understanding of the underlying neurology of memory function. These behavioural assays are fast becoming part of precision medicine approaches because of their ability to selectively target dysfunction

in particular brain regions and even specific brain structures. This kind of behavioural information will become invaluable in uncovering the relationships between symptoms in pre-clinical and established AD, biomarkers, genetics, and pathophysiological processes underlying the disease.

Conclusion

The time is ripe for the convergence of two ideas, i.e., reframing Alzheimer's disease as a spectrum disorder, and the application of precision medicine to Alzheimer's disease as a spectrum disorder. We must come to the realisation that there are many profiles of AD. The application of precision medicine will be the most effective and efficient way for us to discover and unpack the underlying neurology and genetics of the many AD profiles so that effective individualised treatments and interventions can be developed.



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Pharmacogenomics in neuropsychiatric disorders

Over the past decades, important progress has been achieved in the field of pharmacogenomics. However, pharmacogenetics is still in its infancy and its concept has evolved into a broader spectrum subsequent to the completion of the human genome project. Pharmacogenomics accounts for 30-90% variability in pharmacokinetics and pharmacodynamics; however, pharmacogenetics alone does not predict all phenotypic variations in drug response. Individual differences in drug response are associated with genetic and epigenetic variability (DNA methylation, histone/chromatin modifications, miRNA regulation) in pathogenic, mechanistic, metabolic, transporter, and pleiotropic genes involved in the pharmacogenomic cascade.

From a global health perspective, important issues to be addressed with regard to neuropsychiatric disorders (NPDs) and Neuropsychopharmacology are (i) disease burden (DALYs: disability-adjusted life years; YLDs: years lived with disability; YLLs: years of life lost); (ii) the costs (direct, indirect) of disease; (iii) the impact that the identification of presymptomatic biomarkers may have on disease burden in the future, and (iv) more immediately, the effect that the implementation of pharmacogenetic procedures may have on drug efficacy and safety in NPDs. NPDs (mental, neurological, substance use disorders) contribute approximately 10% of the global burden of disease. About 30% of all YLDs are assigned to NPDs, especially depression (11.8%), alcohol use disor-

ders (3.3%), schizophrenia (2.8%), bipolar disorder (2.4%), and dementia (1.6%). The proportion of global disease burden increased from 7.3 to 10.4% between 1990 and 2010. There was a 41% increase in absolute DALYs caused by NPDs (from 182 to 258 million DALYs), together with an increase in excess deaths and suicides. Worldwide DALYs (%) of major NPDs include the following: 5.3% schizophrenia, 41.9% mood disorders, 2.2% conduct disorder, 2.3% anxiety disorders, 1.6% autism, 0.2% attention-deficit hyperactivity disorder, 0.4% intellectual disability, 8.7% migraine, 6.8% epilepsy, 4.4% dementia, 6.9% alcohol use disorders, 7.8% illicit drug use disorders, and suicide and self-harm (1.47% of Global Burden of Disease, GBD). NPDs are the leading cause of disease burden, responsible for 7.4% of global DALYs and 22.9% of global YLDs. Within NPDs, mental disorders account for 56.7% DALYs, followed by neurological disorders (28.6%) and substance use disorder (14.7%).

A global cost of NPDs is projected to be about \$6 trillion by 2030. An estimated 8 million deaths annually are attributed to mental disorders. Approximately 127 million Europeans suffer brain disorders. The total annual cost of brain disorders in Europe is about €386 billion, with €135bn in direct medical expenditures (€78bn, inpatients; €45bn, outpatients; €13bn, pharmacological treatment), €179bn in indirect costs (lost workdays, loss of productivity, permanent disability), and €72bn in direct non-medical costs. Mental disorders represent €240bn (62% of the total cost, excluding

dementia), followed by neurological diseases (€84bn, 22%).

Depression is the third most important cause of disease burden worldwide, with a prevalence of 5-10% for females and 2-5% for males, and a lifetime risk of 10-25% in women and 5-12% in men. According to the National Health and Nutrition Examination Survey, nearly 8% of persons aged ≥12 years (6% of males and 10% of females) report current depression (suicide deaths per 100,000 population: 13.0). Depression is the most common type of mental illness, affecting more than 26% of the U.S. population. It has been estimated that by the year 2020, depression will be the second leading cause of disability throughout the world, second only to ischemic heart disease. The worldwide prevalence of schizophrenia ranges between 0.5% and 1%, with the first episode at 21 years of age in men and 27 years of age in women. Approximately one-third of the cases will attempt suicide and, eventually, about 1 out of 10 will take their own lives. Global costs for SCZ are estimated to be over \$6bn in the USA. Anxiety disorders (panic disorder, generalised anxiety disorder, post-traumatic stress disorder, phobias, and separation anxiety disorder) are the most common class of mental disorders present in the general population, with an estimated lifetime prevalence of 10-15%, and an annual cost of over \$40 billion in the USA. Direct treatment costs for each mental disorder represent 1-2% of total national health care costs, and serious mental illness is associated with an annual loss of earnings totaling \$193.2bn.

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Dementia (Alzheimer's disease, vascular dementia, mixed dementia) and Parkinson's disease are among the top 15 conditions with the highest increase in burden. Neurological disorders constitute 5.5% of YLDs (42.9 million YLDs), with migraine, epilepsy and dementia representing over 50% of neurological YLDs (2.9% of global YLDs).

Approximately, 45-50 million people suffer dementia (75 million in 2030; 145 million in 2050; 7.7 million new cases/year). The global economic cost for dementia is over US\$604bn, equivalent to 1% of the global gross domestic product. In terms of costs, Alzheimer's disease (AD) accounts for \$226bn/year in the USA and €160bn/year in Europe (>50% are costs of informal care, and 10-20% are costs for pharmacological treatment). It is estimated that in the USA alone the direct cost of AD in people older than 65 years of age could be more than \$1.1 trillion in 2050 (from 2015 to 2050, the estimated medical costs would be about \$20.8 trillion).

Antidepressants were the third most common prescription drugs taken by Americans in the past decade. From 1988-1994 through 2005-2008, the rate of antidepressant use in the USA increased by nearly 400%. Eleven percent of Americans take antidepressant medication.

Prescription of antidepressants varies widely between European countries despite no evidence of difference in the prevalence of affective disorders, and only 30-40% of depressed patients treated with medication achieve full remission.

Cost-effectiveness of interventions in NPDs ranges between \$100 and \$2,000 per healthy life year gained. However, drug effectiveness is lower than 30% in most NPDs.

Intervention priorities for NPDs, as proposed by commissioned authors of the World Bank practically neglect genomic intervention either as prevention strategies or personalised treatments. However, it seems clear that multiple genomic defects, interacting with environmental factors and epigenetic phenomena, are at the basis of the pathogenic mechanisms underlying most NPDs. Therefore, the elucidation of disease pathogenesis at molecular levels is a fundamental issue in order to identify suitable biomarkers for an early diagnosis or, even better, presymptomatic markers for disease prevention. Furthermore, 60-80% of psychotropic drugs are metabolised via CYP pathways; and only 20% of the Caucasian population are normal metabolisers for the tetragenic cluster integrated by the CYP2D6-2C9-2C19-3A4/5 genes, this indicating that, by trial and error, the possibility of prescribing the wrong medication to a particular patient, ignoring his/her pharmacogenetic profile, is over 70%. In fact, over 60% of depressive patients are receiving an inappropriate medication according to their pharmacogenetic background, and community psychiatrists are more accurate in their psychotropic prescriptions when they know the CYP profile of their patients.

At the present time, pharmacogenetic testing is currently available for NPDs and a wide range of medical conditions. Tangible benefits to patients and reduced total health care costs have been observed. However, pharmacogenetic-guided therapy faces many barriers to full integration into clinical practice and acceptance by stakeholders, whether practitioner, patient or payer.

In practical terms, biomarkers for early detection/intervention in NPDs might reduce disease burden by

5-15% during the first 5-year period of application; and disease-specific pharmacogenomic procedures would be able to help in (i) reducing acute side-effects by 20-30% and drug-related chronic toxicity by 25-40%, (ii) attenuating global DALYs by 5-10%, and (iii) developing anti-pathogenic drugs rather than conventional symptomatic compounds.

It is likely that the change in mentality that requires the implantation of genomic medicine in NPDs will force some reluctant peers to assume that something is always better than nothing before reaching an unattainable perfection.

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Investing in dementia research

Dr James Pickett, Head of Research at the Alzheimer's Society outlines how research plays a key role in treatments for dementia and ultimately finding a cure...

There is no cure for dementia and there have been no new treatments for the condition in nearly 15 years. Yet, the number of people with dementia is staggering – in less than 5 years over a million people in the UK will have dementia, with the number set to rise to 2 million by 2051. With an ageing population, soaring social care costs and limited treatments available, the need to find new drugs is more urgent than ever.

The current treatments for Alzheimer's disease and other forms of dementia can temporarily alleviate the symptoms. As yet, no drugs are available that interfere with the disease process and, by doing so, slow its progression. While drug treatments are important the benefits are shorter-term and they should only ever form part of a person's overall care. Non-drug treat-

ments, support, and person-centred care are just as important in helping someone with dementia to continue living well. For those with vascular dementia, frontotemporal dementia and some rarer types of the condition, there are currently no available treatments.

Since the Prime Minister's Challenge on Dementia and the G8 Dementia summit in 2013, there has been growing momentum to boost dementia research. This year saw a historic £250m investment into the UK's first ever Dementia Research Institute, with Alzheimer's Society pledging £50m towards this total.

Research is vital to improve the lives of people affected by dementia. It is only through research that we can fully understand the causes, develop effective treatments, improve care, and work to find a cure. Finding

a treatment that could delay the onset of the condition by 5 years would halve the number of deaths from dementia, saving 30,000 lives each year.

Dementia research funding is still dwarfed by grants available for other conditions – this doesn't reflect the very high personal, economic, and social impact of the condition. For every person living with dementia in the UK the annual cost to the economy is £30,000, yet only £90 per person is spent on research.

There is also still a relatively small workforce of researchers, clinicians and care professionals with dementia expertise. Moving forward, the government needs to ensure we have the right infrastructure and attractive career paths to draw and retain talented individuals to the field. This will increase the number and quality of research studies that will drive improvements in dementia diagnosis, treatment, care and prevention.

It's not all doom and gloom; researchers working on dementia now have a much better understanding of the different kinds of dementia and so are able to select the right people to take part in clinical trials. Evidence is increasing that targeting the condition as early as possible is most likely to be of benefit and researchers are working on ways to enrol people in studies in these early or even pre-symptomatic stages. Interesting first signs have recently emerged that an antibody treatment given to people in the early stages of Alzheimer's might slow disease progression – but still larger clinical trials are needed to see if this treatment truly works.

If one of these treatments in development is found to be successful at targeting the underlying causes of Alzheimer's disease, the next big challenge will be to develop a robust way of identifying people with dementia in early enough stages or before symptoms appear. We know that dementia-related changes often occur in the brain years before symptoms appear so this provides a window of opportunity to target the disease before it drastically affects memory and thinking.

Drug repurposing is also an exciting area for dementia as it may speed up the search for new, effective treatments by as much as ten years. Several drugs already in use for other conditions such as type 2 diabetes, small vessel disease and arthritis have shown promising results for the treatment of dementia and are now being tested in clinical trials. Alzheimer's Society is leading the development of several repurposed drugs and currently funding or part-funding three clinical trials.

Investment in the search for better treatments and a cure is vital for us to eventually defeat dementia, but it will not deliver change for people with dementia for many years to come. Alzheimer's Society is investing heavily in all types of dementia research, including projects that aim to provide better dementia care, improve diagnosis, and understand risk factors so we can find ways to prevent the condition. These studies have the potential to deliver life-changing impact for those living with dementia now as well as helping us achieve our mission of a world without dementia.

None of this can, of course, be done without the input of people with dementia. Treatments always needed to be tested in clinical trials to get a clearer idea of whether it is effective. Many trials are recruiting participants with mild memory and thinking problems. Find out your eligibility for dementia research studies via the Join Dementia Research service:

www.joindementiaresearch.nihr.ac.uk . ■

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Better tailored care for people with Parkinson's

My PD Journey – a project from the European Parkinson's Disease Association (EPDA) looks at how challenges need to be tackled better at a European level in order to drive changes and improve diagnosis...

On the occasion of Parkinson's Awareness Month in April 2016, President of the [European Parkinson's Disease Association \(EPDA\)](#) Knut-Johan Onarheim highlighted that, "We face significant hurdles to effective diagnosis, treatment and care, including a profound lack of information and education and poor access to healthcare professionals with a specialty in Parkinson's".

2017 marks the 200th anniversary of the discovery of Parkinson's disease by Dr James Parkinson. Despite the passage of two centuries, the disease remains incurable. In addition, sufficient progress has not been made to help people with Parkinson's and their families overcome challenges in their daily lives, from tremors, rigidity and constipation to fatigue, depression and psychosis. The last study estimating that there are 1.2 million people living with Parkinson's in Europe was conducted in 2010¹, which shows that statistics being used in 2016 are very outdated and more regular statistical updates are needed to get a full picture. This significant knowledge gap reflects the need to intensify data collection efforts.

Believing that current challenges could be better tackled at the European level, '[My PD Journey](#)' was launched in 2014. The groundbreaking, multi-stakeholder initiative led by the EPDA aims to drive changes in policy and healthcare systems that can improve diagnosis and access to treatment and care. Multiple representatives across the entire Parkinson's disease community are engaged in the initiative, including European umbrella healthcare organisations, distinguished European Parkinson's specialists, patients, carers, members of the multidisciplinary healthcare team and industry representatives.

My PD Journey focuses on a series of flagship projects:



pan-European research on care pathways and gaps in healthcare systems (the European inventory), a new, simple composite scale that can facilitate clinical diagnosis of motor and non-motor symptoms, and promoting awareness of and supporting a number of national Parkinson's coalitions across Europe which address country-specific challenges.

The projects are designed to improve understanding of the different hurdles that negatively impact the treatment of Parkinson's progression, and develop solutions that contribute to comprehensive and individualised management of the disease.

The European inventory research – identifying shortcoming in existing Parkinson's care pathways and national examples of good practice

The first major activity was the development of a '[European inventory](#)', a research project completed in 2015. The research consists of primary (qualitative and quantitative) and secondary evidence, which presented a more comprehensive picture of the Parkinson's care and management situation in Europe compared with previous studies. The research was used to develop a

series of European-wide ‘good practice’ recommendations applicable within a national or regional setting to effect improvements in the management of Parkinson’s and, at the same time, offer potential socio-and health economic benefits to healthcare systems, Parkinson’s care pathways, people with Parkinson’s, their families and carers.

The Composite scale – taking into account patients’ quality of life and measuring the severity of symptoms

My PD Journey has also developed an innovative and easy-to-use [composite scale](#) for people with Parkinson’s. The aim is to facilitate early diagnosis and manage disease progression, and ultimately ensure that care plans reflect and respond to patients’ individual needs.

The scale is the first of its kind to score not only motor symptoms such as dyskinesia, tremor, and gait, but also non-motor symptoms such as fatigue, pain, memory loss and depression. The first results were presented in the European Parliament in February 2016 and the scale is currently being tested and measured in a second validation study in different European countries². The scale will be rolled out across Europe next year with the aim of more effectively determining the severity of symptoms.

National coalitions – providing support at national level

To highlight solutions to address country-specific challenges to the timely diagnosis, treatment and care of Parkinson’s, My PD Journey supports national stakeholder coalitions across Europe. Nine [national coalitions](#) currently exist, which are developing and implementing pilot projects to facilitate improvements to diagnosis, treatment and care in their countries. They involve a wide variety of stakeholders from across the Parkinson’s community, including EPDA [member organisations](#), Parkinson’s specialist neurologists, patients, carers, hospital managers, industry partners and national and local politicians.

Political advocacy

As part of My PD Journey’s initiatives to raise political awareness around Parkinson’s at European level and propose concrete solutions, 14 European and national policy [recommendations](#) were developed and presented during a high-level event in April 2015 at the European Parliament. This was followed by My PD Journey Summit in February 2016, which marked the launch of the composite scale. Advocacy activities are ongoing, with a composite scale workshop taking place in Brussels on 15 November 2016.

Looking ahead

My PD Journey will continue to actively promote and drive progress for people with Parkinson’s moving forward. The coalition’s major objectives for the next year are to publish the European inventory research in a peer-reviewed journal, explore options for further data collection and analysis, and complete the second validation study and roll-out of the composite scale in clinical and patient settings across Europe. ■

1 Gustavsson A, Svensson M, Jacobi F, Allgulander C, Alonso J, Beghi E, et al. Cost of disorders of the brain in Europe 2010. *European Neuropsychopharmacology* 2011;21(10):718-79.

2 For more information about the second validation study, please contact secretariat@mpdj.eu.



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Protecting and restoring dopaminergic nerve cells in Parkinson's disease

Parkinson's disease is a slow but progressive neurodegenerative disorder. About 1% of people aged above 50 are affected worldwide. In Europe alone 1.2 million people suffer from Parkinson's disease, 127,000 of whom reside in the UK. According to Imperial College London, the direct and indirect costs to British society are roughly £2 billion each year. These costs are expected to rise with increasing life expectancy.

Parkinson's disease

The hallmarks of Parkinson's include general slowing and paucity of movement, increased rigidity, reduced facial expression and an emerging tremor in one or both hands. While these symptoms are instrumental in diagnosis, the disorder is – by then – already ongoing for several years. Before being diagnosed with Parkinson's disease (PD), patients will have suffered a number of prodromal symptoms such as loss of smell, constipation, depressive periods, sleep disorders, lack of motivation, cognitive decline and more for several years. Each separate symptom may not have been worth visiting the GP and the symptoms do not present themselves in every patient nor in any specific sequence. Somewhere between 50 and 60 years of age, however, patients eventually develop tremors and will be referred to a neurologist and diagnosed.

In the late 1950s and early 1960s, Hornykewicz and fellow neurochemists demonstrated a clear depletion of the neurotransmitter dopamine in striatal

tissues (called caudate-putamen in man) of Parkinsonian brains. Moreover, correlating the extent of depletion with clinical records, it became clear that by the time patients got diagnosed with PD, 60-80% of dopamine was lost when compared to healthy people of the same age. Moreover, this depletion of dopamine was matched by a 40-60% loss of dopaminergic cell bodies in the substantia nigra, the origin of the dopaminergic nerve cells projecting onto the striatal brain tissue. Two important conclusions are that by the time PD is diagnosed, the patient has already lost their erstwhile massive dopamine reserve. Secondly, about 50% of dopaminergic cells are still alive and offer a promising basis for protecting these cells and restoring adequate dopamine neurotransmission, which is the basis for Genecode's innovation.

Pharmacological developments for Parkinson's disease

With the neurochemical basis for PD in hand, many research groups worldwide quickly built a comprehensive framework to monitor dopaminergic neurotransmission and to create methods that compensate for the progressive loss of dopamine in PD. Why dopaminergic cell loss speeds up in some people is still unknown. However, patients have benefited greatly from the use of the dopamine precursor L-DOPA which is converted into dopamine in the brain.

With such replenishment patients regain control of voluntary movements

and tremors and ancillary symptoms are limited. As L-DOPA therapy turned out to have a limited window of opportunity, the introduction of dopamine-mimetic drugs like Pergolide, Lisuride, Pramipexole and Talipexole, proved to be very effective to normalise motor symptoms in PD patients and to delay the need for L-DOPA as the final recourse to suppress PD symptoms.

Looking back on more than 50 years of Parkinson research, and appreciating the enormous progress that has been achieved, still, neurologists have little option but to treat symptoms only.

Neurotrophic factors

Victor Hamburger and Rita Levi-Montalcini found in their research on neurodevelopment that certain humoral factors could control the development of neural contacts. These factors were secreted by target organs such as muscle and stimulated connections between the nerve cells and their target organs. Levi-Montalcini and Stanley Cohen subsequently identified the prototypic neurotrophic factor Nerve Growth Factor (NGF), which quickly expanded with the identification of BDNF, CNTF, NT-3, NT-4, CDFN and MANF. We now know that the target-derived neurotrophism is a universal principle with the peripheral nervous system. It is logically assumed that this also applies to the formation of neural circuits in the brain to initiate and maintain neural circuits. This complex interplay between various cell systems and its dynamics during

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development and adulthood makes a challenging landscape and is extremely relevant for neurodegeneration as well.

In that context, Lin et al. in the biotech company Synergen, discovered glial cell-line derived neurotrophic factor GDNF – a dimeric complex of glycosylated proteins – that was able to rescue dopaminergic neurons in vitro. This was quickly confirmed and extended towards animal experiments. Based on the accumulated preclinical data on GDNF, several clinical trials were subsequently conducted to demonstrate GDNF's importance in Parkinson's. Although some clinical benefits were seen in a few small phase I/II open-label studies with GDNF and its close congener Neurturin, the placebo-controlled large scale trials failed to reach their primary end-points. As GDNF protein does not pass the blood-brain barrier and as local brain injections do not warrant adequate distribution, the therapeutic use of GDNF appears complicated.

Genecode and small molecule GDNF-mimetics

While neurotrophic factors were being discovered, other research groups focused on their receptors. Mart Saarma and coworkers at the University of Helsinki (Finland) and a few other research groups independently identified the GDNF receptor. The GDNF receptor is made up of a signalling moiety RET and a ligand-binding moiety, called GFR α . Together they form a high-affinity receptor for GDNF. Shortly thereafter, three more GFRs were identified which show preference to either GDNF (GFR α 1) or three of its close congeners, Neurturin (GFR α 2), Artemin (GFR α 3) and Persephin

(GFR α 4). These GFRs all need RET to exert their effects upon activation.

As GDNF protein is not practical as future PD therapy, Mart Saarma and Mati Karelson (University of Tartu, Estonia), together with Mehis Pilv and Tom Waldin founded Genecode to identify small molecules that mimic GDNF and trigger neurotrophic signalling in dopaminergic neurons. High throughput screens made by Maxim Bepalov in Saarma's laboratory delivered several hits activating GDNF receptors. Subsequent optimisation of these hits by computational modelling methods by Mati Karelson and his team improved their biological activity. Yulia Sidorova and coworkers in Saarma's lab demonstrated that some compounds showed neuroprotection and promotion of neurite outgrowth, similar to the effects of GDNF. Surprisingly, in animal models selected GDNF-mimetics were found to restore dopaminergic neurons weeks after they were lesioned by neurotoxins. Thus, GDNF-mimetic small molecules can protect and regenerate dopaminergic innervation patterns in striatal brain areas which results in normalised motor behavior.

Future considerations

With protection and restoration of dopaminergic neurons by small molecule GDNF-mimetics, Genecode has established the GDNF receptor as a druggable target. With the advent of GDNF mimetics, the degeneration and death of remaining dopaminergic neurons can be stopped and surviving cells can be stimulated to reinnervate the striatum and restore adequate dopamine levels to regain movement control. The present compounds are

in the process of further preclinical development but they need to be further improved and thoroughly evaluated for both efficacy and safety before they can be tested clinically in man.

With its GDNF-mimetics, Genecode opened a novel chapter in PD research with the hope of actually curing Parkinson's disease. For patients and their treating neurologists, future therapy would consist of GDNF-mimetic drugs alone or in combination with dopamine-mimetic drugs. Genecode believes that with GDNF-mimetics PD patients may continue an active lifestyle without Parkinsonian symptoms, thereby effectively curing an otherwise progressive neurodegenerative disorder. Improved monitoring of prodromal symptoms would further contribute to neuroprotective therapy and would positively impact on the burden to society.

This work has received public support from the EU FP7 612275, Parkinson's UK Innovation grant K-1408, CIMO, the Lundbeck Foundation and the Sigrid Julius Foundation



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Neurodegenerative diseases

Neurodegenerative diseases are a growing global challenge as medical advances ensures more individuals live longer. By 2020 there will be more than 40 million individuals in the world with Alzheimer's disease and by 2040, without the development of truly disease modifying drugs this will be more than 80 million. Similar trends are also seen for Parkinson's disease.

The annual treatment and social care of individuals with Neurodegenerative diseases is estimated to be more than \$1 trillion by 2050, making it one of the most important socioeconomic challenges of this century.

Discovering and developing disease modifying drugs i.e. those that prevent progression of the disease, has been very challenging with many programs failing. One of the reasons why the biopharmaceutical industry is having challenges in converting the emerging science in these diseases is the way we classify them. This is referred to as the disease taxonomy.



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Who cares for the carers?

David Mowat, Minister for Community Health and Care at the Department of Health, highlights the Carers Strategy, and how it gives carers the recognition and support they deserve...

As a constituency MP I meet a whole array of people who need my help and support: a woman caring for her husband who has dementia, or a father with his autistic child. They form part of a silent army of carers, who do what they do because they love the person they care for. Many don't even see themselves as carers.

With an ageing population, the demands on our health and care system are growing. The incredible job that these unpaid carers do, supplementing services and giving their own time to provide much needed support, will only become more important. But who is caring for the carers?

I was appointed this summer as the Minister for Community Health and Care – and I am determined to use this post to make sure our new Carers Strategy is as ambitious, effective and comprehensive as it can possibly be.

When we launched our call for evidence in March, we wanted to understand the reality of being a carer in England – what people need and want, to help them continue to care while leading fulfilling and happy lives.

Clear themes have emerged from the call for evidence. Carers have said that they often feel that health and care professionals do not involve them in discussions about their loved ones' care, despite them often having the best insight. Wider than this, there seems to be a more general sense that society as a whole does not recognise or value their caring role. Carers often feel hidden away and forgotten by communities.

Many carers disregard their own health needs because of their continuing focus on the person they care for. By the time they seek help, it is so often in a moment of crisis.



David Mowat, Minister for Community Health and Care at the Department of Health

Carers deserve and want a life outside of caring, and yet the reality is that so many miss out on opportunities – whether it be keeping a job that allows them the flexibility to carry on caring, continuing education, or even maintaining friendships.

Even though personal sacrifices are made each and every day, many carers have told us that they derive immense satisfaction from being the primary source of comfort for friends or loved ones. This satisfaction though must not be at the expense of their own mental and physical health.

We've listened to carers, and the professionals in health and social care they so often interact with, and it's now my responsibility to deliver a strategy that can have a meaningful impact on their lives.



Our wide-ranging strategy will look at everything from how we can make the whole health service more carer-friendly, to how we support carers to balance caring and employment in the way they would wish. And it will also consider how we can make sure young carers are aware of and benefitting from all the support available.

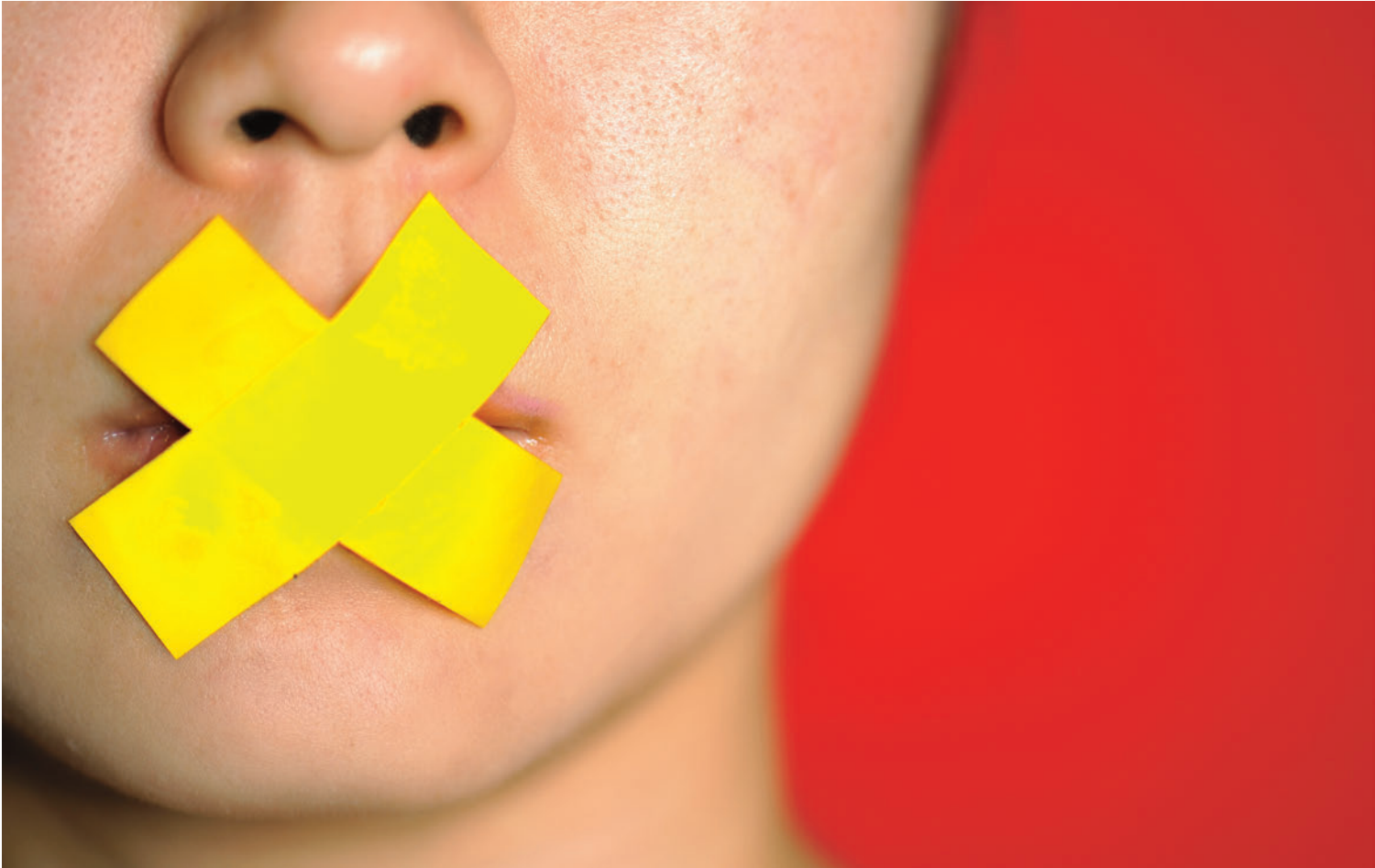
“I was appointed this summer as the Minister for Community Health and Care – and I am determined to use this post to make sure our new Carers Strategy is as ambitious, effective and comprehensive as it can possibly be.”

But in order to deliver meaningful change for carers, all of us – government, health and care services, employers, or those working directly with carers and their families – have a role to play in leading the change we want to see. This means working imaginatively, and in partnership, to remember the needs of carers in all we do.

It is my hope that the strategy will bring us a step closer to a society where all carers get the recognition and support they deserve, to help them and their loved ones live better, more fulfilling lives. ■

.....
David Mowat
Minister for Community Health and Care

Department of Health
[www.gov.uk/government/organisations/
department-of-health](http://www.gov.uk/government/organisations/department-of-health)
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Advocates: Naughty troublemakers or compliant conformists?

Advocacy is about speaking up. It is about ensuring people are heard, taken seriously and are involved in decisions about their life. Advocacy is concerned with protecting people's rights to access services, participate in decisions and enjoy basic human rights to make choices.

Not everyone who receives a service is able to understand choices and clearly express their views, wishes and preferences. The reality for many people is that there are too many barriers to prevent them from speaking up and being heard. Assumptions about behaviours, communication

needs, disability or mental health, past experiences of not being listened to, finding systems overwhelming or confusing and feelings of low self-esteem can also prevent a person from expressing themselves.

Are health and social workers advocates?

Yes, but there are limits which mean that you are not always able or free to solely promote a person's voice. If the person wants something that you think is harmful, or not in their best interests, then as a health or social care professional you have a duty to balance views with what is in the persons best

interests. Advocates do not have such pressure and are solely there to be on the person's side in expressing their goals and outcomes.

It is natural for health and social care professionals who are used to working within multi-disciplinary teams to seek consensus from people involved in a person's life when it comes to making decisions. However advocates do not make decisions: advocates are there to make sure the person at the centre of the decision participates in the decision. This means advocates will help people to speak up for themselves, will represent a person and will chal-

PROFILE

“Not everyone who receives a service is able to understand choices and clearly express their views, wishes and preferences. The reality for many people is that there are too many barriers to prevent them from speaking up and being heard.”

But advocates – and health and care workers – need to be careful that compliance does not meander into taking on a bystander role. This is a role that lazily follows expectations without questioning ‘are these working for my partner?’ Bystanders create cultures that lead to poor decision making such as one local authority who agreed to fund overnight care twice a month because a person’s medical condition meant on average they would be likely to fit during the night twice a month.

By taking on an advocacy role, you may have to switch allegiance from your organisation (with its demands and aims) and sit in a shared space with your partner, taking time to understand the world as they experience it. By taking on this different perspective, advocacy demands that you ask questions.

Poor advocacy is challenging decisions without discrimination. We have all met the angry anarchist whose goal is to argue, to fight, to disagree. Great advocacy is questioning if the process is working for the person at the heart of the decision, and if it isn’t, change it. Don’t make the person fit the system (like the social worker who insisted a young person’s review was held on a particular day because that was the only day she could make it, despite the young person having a GCSE exam at that time). Make the system fit the person.

Challenging decisions or processes that do not reflect the person’s desired outcomes. Challenging in this context means questioning – not insisting that decisions go in a certain way.

To comply or not to comply

Within all people, (whether you are a doctor, social worker, care home manager or advocate) is the tension between conforming to standards and expectations made on you, or whether you should question these and push back.

Compliance is a good thing; without it our lives would be chaotic. Society values it for it to function effectively. The requirement to comply with regulations, rules, and policies keeps us, our colleagues and ultimately the people you work for, safe.

Cut through the haze, and get through to the truth of your partner. What is it they want to achieve? Understand why this is important. What are their goals – and, how do these differ from your goals as a professional?

Remember, the more you try to fix, the less you listen.

Speaking out is a precious and valuable skill which benefits the societies we live in. If you ever questioned it’s fundamental importance just consider the quote of Martin Niemoller, who spoke up against Adolf Hitler.

First they came for the Socialists, and I did not speak out – Because I was not a Socialist.

Then they came for the Trade Unionists, and I did not speak out – Because I was not a Trade Unionist.

Then they came for the Jews, and I did not speak out – Because I was not a Jew.

Then they came for me – and there was no one left to speak for me.



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Reviewing adult social care in England

Following the publication of the Care Quality Commission's (CQC) State of Care report in October, Andrea Sutcliffe, Chief Inspector of Adult Social Care, sets out how adult social care is approaching a tipping point and why we need to take action now to sustain good, quality care in the future...

This year's *State of Care* was CQC's second report since we introduced our new approach of monitoring, inspecting and rating services in 2014. It is based on the most comprehensive evidence base of the quality of care we have ever assembled and is a compelling read for anyone interested in the future of adult social care, which should be all of us. That includes commissioners and funders as well as providers and their staff. The future of adult social care will depend on all of us working together, listening to and acting on the needs and views of people using services, their families and carers.

Our latest ratings for adult social care show over 70% of services are providing good or outstanding care – a positive increase on last year – and three quarters of those services originally rated as inadequate are getting better following re-inspection. That is positive

news and I am pleased that the vast majority of people, their families and carers, are experiencing services that meet the Mum Test – care that we would wish anyone we love to receive. Congratulations and thanks are due to all the staff who work in these services for their dedication and commitment.

Despite the good and outstanding services we see, *State of Care* highlights the stark reality that great care is not the norm for everyone, with around a quarter of adult social care services not consistently providing safe, high quality and compassionate care – and we are seeing too many services struggle to improve.

The latest trends show that nursing provision has stalled, increasing numbers of people are not having their care needs met and growing numbers of providers are handing back local council contracts



Andrea Sutcliffe, Chief Inspector of Adult Social Care

because they are worried that good quality care isn't possible on the money available. We also know the sector has difficulties recruiting and retaining the capable, confident staff we need.

These are not abstract, academic points. These challenges are happening at a time when we need good quality adult social care more than ever. People are living longer with individual needs becoming more complex, and if adult social care isn't there or isn't good enough, the pressure shifts to other parts of the health and care system. We are undoubtedly seeing this happen in the NHS with increases in A&E attendances, emergency admissions and delayed discharges.

We mustn't forget that the impact of these problems on people using services, their families and carers can be devastating and distressing. In many ways the system as a whole is failing the Mum Test – with too many people facing a situation we would not want anyone we love to experience.

It is encouraging that despite all these challenges, there are still so many services providing good and outstanding care. But our analysis of the pressures and the fragility of the adult social care sector causes concern for the future. Are we confident that the good quality care we see now can be sustained and the improvements necessary delivered? Hand on heart, I am not as confident as I would like to be, or indeed need to be.

Given the pressures highlighted in State of Care the worry is that people's individual needs are not always prioritised, providers may be tempted to cut corners when it comes to quality, and services are now at greater risk of deteriorating.

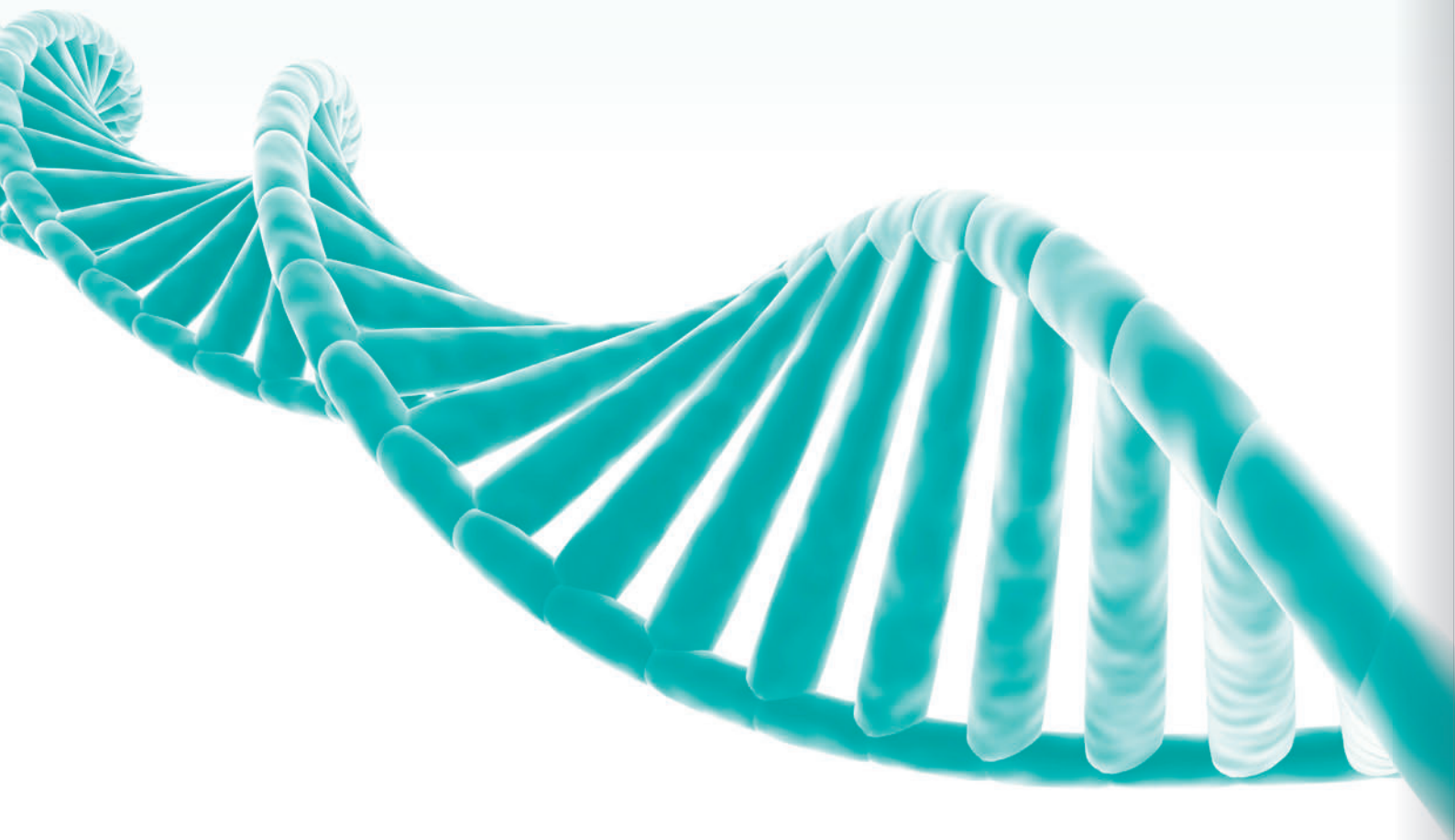
The message from State of Care is clear. Unless the system finds a better way of working together then we are likely to see more poor care, less improvement – and the impact this all has on people's lives, their families and carers, is what worries me most.

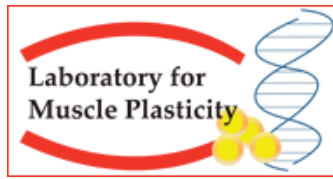
We have got to make adult social care the priority it deserves to be. ■

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Andrea Sutcliffe
Chief Inspector of Adult Social Care

Care Quality Commission's (CQC)
www.cqc.org.uk
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A Quest into Muscle Plasticity





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Care Act advocacy: A new right for vulnerable people

Pete Fleischmann, Head of Co-production at the Social Care Institute for Excellence and Karen Newbigging, Senior Lecturer in Health Care Policy and Management at the University of Birmingham, highlight Care Act advocacy and its role in offering support for vulnerable people...

Imagine being unable to express yourself, and having no one to turn to. All too often in recent years, people who need care and support haven't had anyone there for them to communicate what they want to say. In other words, an advocate. We've perhaps all needed one at times in our lives, but when you are struggling to navigate the health and social care system, the need for independent advocacy can become critical.

“An advocate is truly independent. They're impartial, they're available, they're reliable, they're person-centred and they're knowledgeable about the sector.”

In social care, advocacy sees an independent person representing the views of service users or carers over their social care or health needs. Advocacy “helps people say what they want, secure their rights, represent their interests and obtain services they need.” That description was taken from Action for Advocacy's Charter. It goes on to say that advocacy promotes social inclusion, equality and social justice.

And now, advocacy is a right. [The 2014 Care Act](#) contains a new right for people who use care services to be given access to an advocate. The law now requires that local authorities must offer a Care Act advocacy service to all eligible service users and carers. However, Care Act advocacy is a specific approach, defined by the 2014 legislation. Nowadays, local authorities must involve people in decisions made about them and their care and support. It does not matter how complex a person's needs are; the local authority must support people to express their views and feelings, and to help them make choices. The advocacy duty applies if someone has care and support needs or if they are judged to have substantial difficulty in understanding

information and communicating their wishes and if there is not an appropriate person who can represent them. If these conditions apply then the local authority must find an independent advocate.

Challenges

The implementation of Care Act advocacy has not been without controversy. Some organisations have claimed that the funding set aside in the legislation for advocacy has been insufficient. Also the funding has not been ring-fenced. On top of that it has also been anticipated that it might be hard to estimate the level of demand for Care Act advocacy. Some people also feel that giving the responsibility to local authorities to commission advocates and to provide referrals is an inherent conflict and might compromise the independence of the advocacy service. This is because the advocacy role includes, at times, challenging local authority decision-making. There are also fears that the service is not being implemented consistently across the country. There have already been several legal challenges against local authorities.

It is now almost 18 months since the new right came into force, so how has the implementation of care act advocacy worked in practice? SCIE commissioned some research from the Universities of Birmingham and Central Lancashire to look at what has been happening since April 2015 and to identify examples of positive practice. This study involved surveys of commissioners and providers; interviews; documentary analysis; and a roundtable discussion involving a range of stakeholders to identify improvements in the commissioning of Care Act advocacy.

Understanding need

The research team, which included an independent service user consultant, found evidence of positive



practice in commissioning Care Act advocacy, with several local authorities adopting a cautious 'wait and see' approach. Respondents highlighted the difficulties in estimating demand for this service, despite Department of Health guidance. During this first year, local authorities had worked with local stakeholders, including people using social care and providers, to refine their understanding of need and what the options for provision might be.

However, under half of the local authority respondents reported involving people using, or likely to, use social care and / or family carers in the commissioning process. Effective commissioning of Care Act advocacy see local authorities having a good understanding of the role of independent advocacy. It also sees them appreciating the contribution that other forms of advocacy can make to realising the Care Act principle of well-being. A single gateway is emerging, as the preferred model, to enable access to different forms of advocacy, although this is not appropriate for all contexts.

It is also clear that despite training, a major barrier to the uptake of Care Act advocacy is the understanding or reluctance of frontline staff to ask for it. So frontline staff need to ensure that people who need advocacy

are informed and then made able to access the form of advocacy that's appropriate to them. Understanding the underpinning values and principles of advocacy can not only strengthen the commissioning and provision of advocacy, but it can also promote the well-being of people using social care.

The new SCIE report on Good practice in commissioning Care Act advocacy will be available on our website shortly. ■

Pete Fleischmann
Head of Co-production

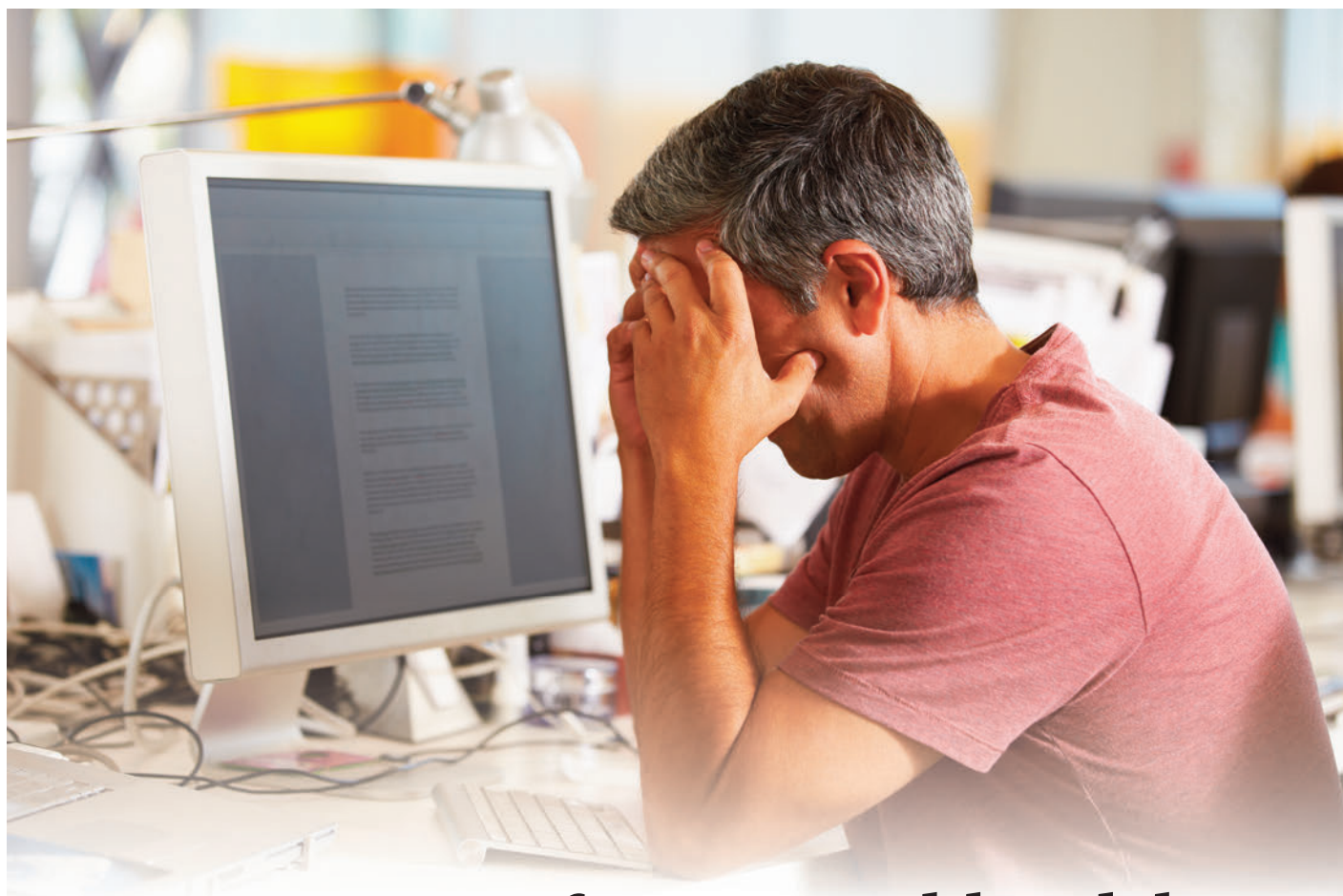
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Managing for mental health

Bob Grove, Senior Policy Adviser, Mental Health Europe, outlines how mental health can impact a workplace and why it's important to ensure your workers are mentally healthy...

The costs to employers and to national economies associated with mental ill health in the workplace are huge. However when figures of hundreds of billions of euros are quoted then the numbers are often too large to be meaningful. A few years ago in a landmark paper¹ the Sainsbury Centre for Mental Health in London looked at all the available evidence on the costs to employers and how they could be broken down into cost headings (ie sickness absence, staff turnover etc.) The paper also looked at the average cost per employee per year. They calculated that on average mental ill health cost every employer in the UK an average of around £1000 per employee per year. This is a significant sum, but what caught the eye most was the fact that, even using very conservative estimates, the greater part of the cost was in lost productivity from people who were not off sick but functioning below their best while remaining

in work. This was characterised as presenteeism and the finding produced a raft of papers looking at how these hidden cost could be reduced².

Creating a mentally healthy workplace

The more hopeful finding in this paper was that using relatively simple interventions around one third of these costs could be prevented. The key to success was board level recognition of the problem and leadership from a senior level which involves the whole organisation promoting positive mental health and learning how to manage mental ill health without losing valuable employees. Employers can be sceptical of gimmicky programmes that offer to improve productivity and reduce sickness absence by increasing employee wellbeing. And yet leading economists from the London School of Economics have shown a cost/benefit ratio of 1:8 from even a simple programme which encourages

employees to look after their own mental health and that of their fellow workers³. There are many ways of doing this but what they all have in common is that mental health is no longer a taboo subject at work and caring about it becomes a topic of conversation and a focus for shared activity – a walk, a shared lunch, a talk on how to look after your own mental health when under pressure – all raising awareness and subtly making the link between good all round health and performance. With the launch of its [Each of Us](#) campaign, Mental Health Europe hopes to raise awareness about mental health in the workplace, specifically by developing a training on mental health for managers and employees.

Managing mental ill health

When an employee starts to show signs of mental distress it is often colleagues or managers who are the first to spot it. Uncharacteristic behaviour or visible distress does not mean that a person has a mental illness but if it lasts a couple of weeks it may be an indication that they have a problem for which they need help. The trigger for this may not be associated with work and in fact according to surveys most mental ill health which is visible at work is due to events or circumstances outside the workplace. However it must be managed – and the most important thing is not to ignore it or pretend not to have noticed until it gets much more serious. We are all vulnerable to being knocked off course by things that happen in our lives and the response of managers, colleagues and friends is vitally important for two reasons. Firstly the person experiencing the distress may feel they are letting people down or that admitting “weakness” is shameful. If they are to get help to get their working and personal lives back on track then openness and acceptance by those we see every day is very important. Secondly employers are in a good position to signpost the individual to sources of help or even provide professional counselling support if it is a sufficiently large organisation. Managers at all levels can be trained to initiate conversations and respond quickly and positively to an employee who is not performing for reasons of mental distress⁴. If someone does need to go off sick, managers can also be trained to keep in touch and to reassure the individual that work is still interested in them and that they are expected to get better. This is vitally important because belief in ultimate recovery can be a self-fulfilling prophecy. Given the right support the overwhelming majority of people will recover completely

and return to full productivity without any special interventions. More serious or longer term mental health problems can often be managed by making small, maybe temporary, adjustments to working schedules or other adaptations at work. Not only will the person be able to resume a full working life but for the employer long periods of reduced productivity often followed by long absences and maybe job loss can in most cases be avoided – to the great benefit of the bottom line!

Making an organisational commitment to mental health

Becoming a mentally healthy workplace where people are helped rather than stigmatised is not something that can be achieved by lecturing individuals on how to behave differently. It requires commitment right across the organisation and must be championed at board level. Many major companies now find ways of measuring the mental health and wellbeing of their workforces and most importantly the results are reported at least annually to the directors. Even better senior executives – often those who have experienced mental ill health themselves or in their families – now participate visibly in the drive to make the culture of the organisation one that values positive mental health and is supportive where there is mental distress. It may be that a mentally healthy workplace does not in itself produce a good business, but a good business will always benefit from a mentally healthy and cohesive workforce where people look out for each other. ■

1 Mental health at work: developing the business case (2007) Sainsbury Centre for Mental Health (now the Centre for Mental Health) London

2 Managing Presenteeism (2011) Centre for Mental Health London

3 Mental health promotion and mental illness prevention – the economic case. (2011) Knapp, M., McDaid, D. & Parsonage, M. Eds. London. Department of Health

4 Responding to mental distress at work. (2010) Lockett, H. & Grove, B. Occupational Health [at Work], 7 3 (20-23).

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Senior Policy Advisor

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Experts by experience

Intermediates between patients and therapists...

“Do you know what it’s like to hear voices, to have fear of death out of a sudden or to feel a deep inner emptiness?” Doctors, therapists or nurses can rarely answer this question because they cannot fall back on the personal experience of being mentally ill. In order to balance out this lack of experience of professionals, Pfalzlinikum for Psychiatry and Neurology in Klingenstein, Germany, has trained former affected people to share their experience and accompany acutely ill people on their way to recovery.



In a joint project, Pfalzlinikum and the “state association of ex-users of mental health services” in the Palatinate (Landesverband Psychiatrie-Erfahrener, LVPE), have adapted the EU-funded program “EX-IN” that has already been successful in other countries like Norway and Sweden.

EX-IN stands for Experienced-Involvement. People who have experienced how it feels to be mentally ill and who are now stable, work as intermediates between patients and therapists. In a special training they have learnt to understand their own experiences and competences, to gain and convey expertise and to become confident in their role as “recovery companions”.

The training is based on twelve modules. It covers the whole range of modern psychiatry, psychology, practical knowledge, crisis intervention, consulting and self-inquiry and is finished by two internships and an

evaluation. With this training completed, the “recovery companions” have an EU-wide acknowledged qualification as employees in mental health services or as lecturers for qualification and further training.

Currently, three EX-Ins are working in Pfalzlinikum in different areas, depending on their personal experience with mental illness – amongst others, in the fields of psychosis or dual diagnoses, i.e. psychoses that are interdependent with addiction. Patients and professionals benefit from the EX-Ins’ work: they complement therapy sessions, hold group sessions, or seek the personal exchange with the acutely ill patients. Falling back on their own experience they can “translate” the view from patients to professionals and vice versa. This sensitises the way of their mutual communication and understanding. While working with the patients, the recovery companions

also share their way of coping with their illness and give practical tips for the everyday life.

Pfalzlinikum plans to qualify further EX-Ins and to fully establish the program within the next years. The long-term aim is to shift the perspective of therapists and patients from handling the acute illness to developing a healthy way of life in general.



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Mental Health

acute and community based services for the Palatinate



Foodborne, waterborne, and zoonotic disease in the North

Dr. Sherilee Harper and Dr. Ashlee Cunsolo look at the need for integrated environment and health surveillance...

Foodborne, waterborne, and zoonotic disease is a major public health priority in the Circumpolar North, especially considering rapid climatic and environmental changes experienced in this region. Recent research by Dr. Sherilee Harper and her research team uncovered the highest rates of self-reported enteric illness (i.e. diarrhea and vomiting) reported in the world to be the Canadian North. Infectious diarrhea and vomiting can be caused by contaminated drinking water (i.e. waterborne disease), contaminated food (i.e. foodborne disease), contact with animals (i.e. pets, wildlife), or person-to-person contact. To reduce the high rates of diarrhea and vomiting in Northern Canada, we must identify the pathogens causing illness to understand what are responsible for illness and how people contract the illness.

Endemic levels and outbreaks of enteric illness transmitted by contaminated food and water contribute to considerable morbidity, mortality, and economic costs, in particular among high risk populations, including Indigenous populations living in remote communities across the North, including in the Canadian Arctic. Given the high prevalence of enteric illnesses, the impacts on individuals and communities, and the economic burden to the health system, environmental and public health practitioners continue to prioritise surveillance approaches to monitor the burden of illness, detect and control outbreaks, and evaluate



Boats in the Iqaluit Harbour, Nunavut, Canada

Image: © Anna Manore (2016)

control measures. Indeed, surveillance systems that monitor enteric illness provide critical data to inform the prioritisation of public health actions, program planning, interventions, and research for disease prevention and health promotion. In the context of Indigenous health, there has been a strong and repeated call for enhanced public health surveillance that uses novel approaches, incorporates new types of data, and integrates environmental data.

People, Animals, Water, and Sustenance: Establishing the PAWS Project

Responding to the call for integrated surveillance systems, in 2014 representatives from the Government of Nunavut, health practitioners, policy makers, and researchers came together to create the People, Animals,

Water, and Sustenance (PAWS) project. The goal of this project is to design and implement a participatory, community-based surveillance system to understand, respond to, and reduce the burden of foodborne and waterborne enteric pathogens in Iqaluit, Nunavut, Canada. This information will be important to help understand why rates of diarrhea and vomiting in Northern communities appear to be high. Northern collaborators are actively contributing to all phases of the research design, data collection, analysis, interpretation, and results dissemination process.

Community-Based & Community-Led Data-Gathering: Working Together to Set Priorities

Community, health professional, and government stakeholder participation is an essential component of the PAWS

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project, which forms the basis on which the transdisciplinary team of community leaders, veterinarians, epidemiologists, health scientists, and social scientists forms its data-gathering approaches. Indeed, through ongoing consultation and feedback from partners such as the Department of Health, Iqaluit Public Health, Nunavut Research Institute, and the Public Health Agency of Canada, community stakeholders and policy makers identified the priority pathogens to study and measure, and it was determined that *Cryptosporidium* and *Giardia* posed the most serious concern for the community and for the Territory. Furthermore, these partners identified key suspected environmental sources of infection: house, guard, and sled dogs; water gathered from various rivers around Iqaluit where untreated drinking water is collected; and clams gathered from various locations in the Iqaluit harbor. Currently, these sources are being tested using microbiological and source attribution techniques.

Additionally, it was also identified that in order to fully understand the relationships among people, food, water, and pets in the community, and to provide culturally-appropriate contextual understanding to the epidemiological testing and findings, it was essential to work with Inuit knowledge holders in the community to understand the physical, mental, emotional, and spiritual connections that people have with the land, food, dogs, and water. As a result, in-depth iterative qualitative interviews were conducted with 10 Inuit community members, representing a diverse cross-section of the community. These interviews were structured around 3 main themes: the historical, contemporary, physical, mental, emotional, and spiritual con-

nections people had with food, water, and dogs. Each of the interviews were conducted conversationally, in peoples' homes, over 3 separate time periods, allowing for in-depth consideration, reflection, and discussion of each of the themes. This qualitative research not only provides rich, powerful, and poignant narratives of Inuit knowledge, wisdom, and lived experience, but also ensures that the quantitative research findings can be interpreted and understood within a larger socio-cultural context.

“To reduce the high rates of diarrhea and vomiting in Northern Canada, we must identify the pathogens causing illness to understand what are responsible for illness and how people contract the illness.”

Knowledge-to-Action:

Mobilising PAWS Research for Evidence-Based Decision-Making
On-going and meaningful collaboration with Indigenous stakeholders, health professionals, and Indigenous organisations is essential to develop and evaluate a culturally acceptable and effective knowledge translation program to reduce foodborne, waterborne, and zoonotic enteric illness. The PAWS project is end-user driven; as such, moving research results to action at individual, household, community, and government levels is an explicit objective. This research has important implications for healthcare provision policies, procedures, and planning. In the North, enteric-illness related decisions are typically based on the best available information from Southern, non-Indigenous locales, which might not be applicable in Indigenous communities. The PAWS research will provide a baseline understanding of the unique epidemiology

of enteric illness in Northern Indigenous communities. This information is critical to developing new or enhancing existing public health planning, programming, and policy to effectively reduce the high reported burden of enteric illness.

Project Team

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Accessible healthcare for all

Sarah White, Policy and Partnerships Manager (Health) at the national disability charity Sense outlines the importance of healthcare being accessible for people who are deafblind...

At some point in our lives, we will all need to access the healthcare system; whether through our GP, pharmacist, other healthcare professionals or specialist teams based in hospitals. From minor ailments to acute and specialist services, healthcare is vital for the health of our nation – with over 1 million patients being seen every 36 hours¹.

In a recent report, Sense outlined the experiences of people who are deafblind in accessing healthcare services and what the benefits of accessible services would bring.

There are 358,000 people in the UK who have a sight and hearing impairment and are therefore described as 'deafblind'. Deafblindness can create difficulties with accessing information, communication and mobility – all of which can impact on how someone accesses a healthcare service. Whilst many people who are deafblind will use healthcare services relevant to their sensory impairment (for example an audiologist or ophthalmologist), many also access healthcare services related to other conditions – 69% of people with sight and hearing loss have 2 or more additional long term conditions².

If services are not accessible they will not be able to meet people's needs. This may mean that people fail to seek treatment and their health care needs and treatment options will not be understood. It can also lead to poor patient/clinician relationships and lack of confidence in services and individuals.

A strong theme in our qualitative research was that many felt inaccessible healthcare services led to a reduction of control and independence. They needed to rely on friends and family members to be able to access services, resulting in a loss of privacy and dignity.

There are many different types of information formats and communication methods that people who are deafblind might use – depending on their levels of sight and hearing. For example, some people may need information in large print, braille or audio formats, or need a British Sign Language or deafblind manual interpreter to enable them to converse with their healthcare professional.

Accessing information is a key part of how we interact with healthcare services – for example, information on which services are available, public health awareness campaigns, information on screening, appointment letters and information on how to manage healthcare conditions.

“For many, the need to rely on others is disempowering and limits confidence and independence. Enabling people to access services independently and to engage directly with staff and services will lead to an increase in confidence and independence.”

Not being able to get this information can create barriers at all stages of the healthcare journey; from accessing a service in the first place, to being able to make an information choice about treatment options following a diagnosis. Of the deafblind people we asked, 85% reported that they don't get information about their healthcare appointments or other information in a format that they could access. Most reported that they needed to rely on someone else to read their letters for them to find out what was in them.

When interacting with healthcare services, people who are deafblind may need to use different forms of communication, as for example, using the phone may not be accessible. In our research, very few people



- Have a consistent flagging system;
- Share the identified information and communication needs of the individual when appropriate;
- Meet the communication and information needs identified.

A fully accessible healthcare system will benefit not only those who are deafblind but also their family members and friends – effective communication benefits us all. It will also benefit health providers as they will be able to meet the needs of those who use their services and ensure that they get the right treatment at the right time and in the right way. ■

To read a full copy of the Equal Access to Healthcare report visit: www.sense.org.uk/healthreport

For more information on the Accessible Information Standard visit: www.sense.org.uk/ais

For more information on how to make your healthcare service more accessible visit: www.sense.org.uk/italaddsup

- 1 <http://www.nhs.uk/NHSEngland/thenhs/about/Pages/overview.aspx>
- 2 Annual Report of Chief Medical Officer, 2012, On the State of the Public's Health; www.gov.uk/government/uploads/system/uploads/attachment_data/file/298297/cmo-report-2012.pdf

Sense is a national charity that supports people who are deafblind, those with sensory impairments and those with complex needs, to enjoy more independent lives. The charity's expertise in supporting individuals with communication needs benefits people of all ages, as well as their families and carers. Sense provides information and advice, offers a wide range of flexible services and campaigns passionately for the rights of the people it serves.

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Sense
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reported that, when they were required, interpreters were arranged – with many having to arrange themselves or use family members as interpreters. While some people who are deafblind need interpreters, other people – who may lip read or use hearing aids – can be greatly helped by using good communication tactics.

For many, the need to rely on others is disempowering and limits confidence and independence. Enabling people to access services independently and to engage directly with staff and services will lead to an increase in confidence and independence. If people who are deafblind feel confident to access services and know that their needs would be met, they are more likely to use these services.

It is clear that a lack of accessible information and communication support are the key barriers for many deafblind people in accessing healthcare. The Accessible Information Standard is therefore a welcome step in tackling these barriers head on.

The Accessible Information Standard sets out what health and social care providers must do to meet the information and communication needs of those who access their services. There are 5 key steps that providers must take:

- Identify the communication and information needs of those who use their service;
- Record the communication and information needs they have identified clearly and consistently on the individual's record;

Devo-health: How to make it work

Jos Creese, Principal Analyst of the Local Government Executive Briefing Programme at Eduserv, asks whether devo-health with local government could solve the problems of care integration...

Integration of health and social care is one of the government's major programmes of reform. At its heart, it is about ensuring that everyone can get the right care and support, whatever their needs, at each point in their care journey. But it is also about efficient, joined-up, digital services.

However, the track record in the UK of joining up these vital service areas across the NHS, social services and the voluntary sector using technology, is not particularly good. Projects are often too large, yet too narrowly defined around existing organisational structures and professions. They are also often dominated by primary and secondary NHS functions, rather than designed around the individual, location and 'whole care system'. Many large IT health programmes have struggled with delivery and public trust.

Case studies appear almost daily and show what is possible with digital delivery – better coordination across related services, simpler, faster and safer care pathways, and improved efficiency. But these can be hard to generalise or to scale. Moreover, the current fragmentation of public policy, service access, governance, professional practice, resources, standards and technologies makes the idea of having a single, all-embracing health and social care record, for example, fraught with challenges.

Integrated care services in the widest sense, depends on fundamental change in order to succeed. For example, by pooling health and social care resources at a community level and targeting these on individual service user outcomes. This will not only improve services, but it can also reduce the untenable pressures on over-stretched primary and secondary care services.

Devo-health

Health devolution has the potential to be the catalyst



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for new models of collaborative care to emerge. Wellbeing boards will, we hope, simplify both accountability for care services, as well as the prioritisation of investment by pooling resources.

However the recent devo-health report by IPPR has raised concerns, suggesting that the move to give Greater Manchester control of health spending, for example, is in practice closer to delegation than devolution, because of Whitehall's reluctance to relinquish power:

"Rhetoric appears to be running ahead of reality, history shows structural changes rarely deliver in terms of efficiency or health outcomes. There are very real concerns that devo-health will ultimately lead to finger-pointing between central and local government as the next round of public sector cuts hit."

There have also been concerns that local government is not sufficiently involved in change planning and the prioritisation of digital care programmes, despite a clear case that this is a significant oversight and risk. The recent and welcome Wachter review of the role of IT in care is a case in point, with little or no mention of non-NHS digital care.



demands more than this. It means designing care services in areas and locations, built on national services but reflecting local differences. One size does not fit all around the country, and issues of geography, demography, infrastructure and even climate can have a significant impact.

Place-based delivery will also help to dismantle a culture of professional silos that still resist integration beyond a reluctant national cooperation, since it will require locally integrated care governance, shared resources and joint service commissioning. Devolution is therefore very welcomed, as long as it genuinely move resources, autonomy and delivery to a much more local focus, coordinating national delivery locally.

There is room for optimism. It will be health and social care integration which will define and shape the role of technology in future public services design more than any topic. It will drive innovation, efficiency, service improvement and better management of risks. And it is a clear priority. Increasingly, local authorities and the NHS are working together on transformation programmes and local, place-based, 'Sustainability and Transformation Plans' (STPs), to improve the quality of care, wellbeing and efficiency. That is a good start – but only a start.

The independent [Eduserv research](#) in this area describes the range of things that must change if the UK is to move forward with care services which are fit for the 21st century. Our next piece of work will build on this and seek to define the digital architectures necessary for a truly integrated local care service.

Give your opinion and contribute to the next report by completing this short [survey](#). ■

The argument for local government leadership involvement in the redesign of care services is strong. Local government has a political mandate and an understanding of local services. They have a track record of successful shared services and private partnerships. Across the public sector, local government has set a lead for the successful redesign of services using digital methods. And they are at the centre of wider devolution.

Culture not technology

The comments from the IPPR highlight the need to address cultural and structural barriers before technology can be implemented. Many previous health IT programmes in particular have received poor press, failing to meet expectations. They typically concentrate on digitising services, not on creating new digital service models.

Even basic information sharing between health, social care and the voluntary sector is currently problematic, with different standards and expectations of what is, and is not, allowed. Concern for patient safety, data privacy and 'access for all', leads us into information governance complexity with good intent, but which results in inertia or paralysis.

Changing the model will impact the roles of care professionals. The technology is the easy bit – dealing with the human issues is the main obstacle.

Place-based design

Designing for national service delivery is essential – specialist care services cannot be in every town in the UK after all, and harmonising standards and professional employment helps to ensure consistency and efficiency. However, a 'whole system' approach to care

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Encouraging research excellence in Canada

Adjacent Government highlights how Canada is making strides to become a world-leader in research and innovation...

The government of Canada understands the importance of science and research in order to tackle some major global challenges. As a nation of innovators, Canada understands the role science can play in the economy and in the effort to create sustainable solutions.

“By supporting world-class research excellence, our government is demonstrating the value it places in science and our scientists,” said Minister of Science in Canada, Kirsty Duncan.

The Science Minister recently announced \$900m worth of funding to support research in the country, and help universities across Canada become world-leaders in various fields. The funding from the Canada First Research Excellence Fund (CFREF) aims to invest in key research strengths and help the country to respond to some critical issues. Created in 2014, the CFREF aims to support postsecondary institutions such as universities, colleges and polytechnics to compete with the best in the world for talent and partnership opportunities.

“The Canada First Research Excellence Fund will equip Canada to respond to some of the most pressing issues it will face in the future: brain health, sustainable food and water supplies, environmental concerns, future energy supplies,” said Duncan when the recipients of the funding awards were announced. “The research supported through this Fund will make the country stronger.”

Chair of CFREF’s steering committee Dr Ted Hewitt said: “Today’s investment by the Government of Canada enables our leading post-secondary research institutions to capitalise on areas in which they excel.

“It promises to make them world leaders in these areas

and to strengthen Canada’s position as the destination of choice for innovation and cutting-edge research.”

The \$900m fund will be shared between 13 institutions across Canada to help strengthen their research centres. These include: McGill University; Laurentian University; Dalhousie University; Polytechnique Montreal; Queen’s University; Université de Montreal; University of Alberta; University of Calgary; University of Guelph; University of Saskatchewan; University of Waterloo; Western University, and York University.

Each of the initiatives was selected for funding following an open competitive process among Canadian postsecondary institutions. The competition was judged by a panel of Canadian and international scientific experts.

This is the second Canada First Research Excellence Fund competition. In July 2015, 5 initiatives received funding worth \$350mn in total.

The government are also keen to promote the role of innovation in the country and support global research excellence. The [Innovation Agenda](#) was launched earlier this year, which aims to create jobs, drive growth across all industries and improve lives. The main aim of the Agenda is to build Canada as a global centre for innovation.

At the launch in June, Minister of Innovation, Science and Economic Development, Navdeep Bains, [highlighted in a speech](#), the role of innovation in Canada and its importance to help the country thrive.

He said: “We need to position Canada as a world leader in turning ideas into solutions, science into technologies, skills into job and start-up companies into global successes. That’s what innovation is all about.”



“We want to support global science excellence,” he went on to say. “We want to invest in world-class science and research. And we want Canada to be the destination of choice for the best and brightest people from around the world.”

Minister Duncan also spoke at the launch, highlighting how science is key to the country’s future and the importance of making Canada a more innovative and globally competitive nation. And in order to make this a reality, investment is needed.

“I am proud to serve a government that values science – and our scientists,” she said. “Our government understands that investments in science are key to making Canada a more innovative and globally competitive nation.

“That’s why Budget 2016 invested heavily in the sciences:

- \$2bn for the Strategic Investment Fund, which will accelerate innovative infrastructure projects at universities and colleges across Canada;
- \$95m for the granting councils;

- \$237m for the Genome Canada; and
- \$12m for the Stem Cell Network.

“We respect science and scientists, as well as the important work they do. We are working hard to build connections between science and innovation.

“The Innovation Agenda will look at how to strengthen applied research while promoting partnerships with businesses so that the knowledge and discoveries generated in the lab make their way to the market.

“In other words, support for world-class research is critical to making innovation a national priority. The launch of the Innovation Agenda is good news for everyone.” ■

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Understanding ecosystems in British Columbia

Ellen L. Petticrew and Philip N. Owens from the Landscape Ecology Research Group at the University of Northern British Columbia, assess the resiliency of a large watershed in British Columbia to the catastrophic failure of a mine tailings storage facility...

In August 2014, the tailings storage facility of the Mount Polley gold-copper mine in British Columbia, Canada, failed, releasing approximately 25 million m³ of tailings and overlying water from the storage facility, as well as scouring surface materials, into receiving rivers and lakes in the Quesnel watershed. While the event has been identified as one of the worst mining disasters in Canadian history, it provides a unique opportunity for scientists to understand how ecosystems respond to the delivery of such a large amount of water, solids and chemicals. The Quesnel watershed is more than 11,000 km² in area and is regionally important as it was relatively pristine, with a low residential density, and supports important populations of animals including salmonids. Indeed, it is estimated that approximately 800,000 sockeye salmon were passing through Quesnel River and Quesnel Lake in the month after the spill. Most of the spill materials entered Quesnel Lake, which is ~100 km long and more than 500 m deep in places, making it one of the deepest lakes in North America.

The University of Northern British Columbia (UNBC) operates a field-based research facility in the Quesnel watershed near to where the breach occurred. The Quesnel River Research



Sampling of lake bottom sediments and tailings, Quesnel Lake, July 2016

Centre (QRRC) had been undertaking research on the Quesnel watershed for over 10 years prior to the breach. Students and staff at the QRRC were able to respond to the spill within a matter of hours and started collecting samples of water and sediment in the vicinity of the breach and from the lake. This has developed into a monitoring program whereby QRRC staff, students and faculty have collected routine samples of the sediment and biological indicator species such as

zooplankton in Quesnel Lake and River. They have also monitored the physical conditions of the water column in the lake, such as temperature, conductance (a measure of dissolved chemicals), fluorescence (a measure of lake productivity) and turbidity. Much of this work involved on-going collaborations with faculty from the University of British Columbia (UBC), and the federal Department of Fisheries and Oceans (DFO), who had also been working on the lake prior

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to the breach. This initial monitoring work in the first few years following the spill was supported by funding from UNBC, in recognition of the role of the university in contributing expertise to such a disaster, and from local community groups and NGOs concerned with the environmental impacts of the spill. Recently, they have received funding from the Government of Canada's department of Environment and Climate Change Canada (ECCC), through the Environmental Damages Fund to investigate the resilience of the Quesnel watershed, and the lake ecosystem in particular, to such a large disturbance event. This has enabled the research team to expand their scope and involve collaborators from the University of Lethbridge in Alberta who are interested in aspects of the food web, especially in relation to the quantities of copper released into Quesnel Lake. For example, copper is known to influence the behaviour of aquatic organisms such as salmonids at levels below lethal concentrations by affecting their chemosensory functions. One exciting recent development funded by the ECCC money is the collection of cores to sample tailings and sediment from the bottom of the lake. The nature of this deposited material means that most coring devices are not able to preserve the structure of the material at the sediment-water interface, which is the critical area at which important chemical reactions and biological processes, such as microbial uptake and release, occur. These processes are key in controlling how chemicals like arsenic, copper, mercury and selenium may be released to the overlying water column allowing them to enter the food web. Collaboration with the

Bedford Institute of Oceanography (DFO) enabled a specialised corer and technician to be shipped nearly 5000 km from eastern Canada to Quesnel Lake, where QRRC-UNBC and UBC researchers were able to collect over 30 cores of the tailings and sediment throughout the lake this summer.

University field stations within Canada, such as the QRRC, and around the world provide a significant resource for the collection of long-term data bases that provide baseline data for a broad range of issues, including impacts due to climate change, land-use changes and specific localised events, such as this mine tailings failure. While field station collaborations and networks for long-term climate and vegetation monitoring have been initiated in Canada and elsewhere the funding to maintain long-term monitoring is not readily available to allow field stations to participate. Funding sources for integrated sampling programs should be provided at national levels as it would also facilitate collaborations between government scientists, academics and research students. Luckily this type of collaboration existed for Quesnel Lake before the mine spill occurred, albeit the focus of the research was on lake physics and its impacts on the salmonid populations, but they were adept in using the previous knowledge to design and implement a sampling strategy to assess the lake impacts in the early days on the back of other ongoing projects.

Government response to this catastrophic event indicates the need for more extensive background data in environments where resource devel-

opment is planned. Environmental impact assessments are often too short in duration and not designed at the scale influenced by these types of catastrophic events. Worst case scenarios should be considered and evaluated as part of the preliminary evaluation for development. There were obvious data gaps in knowledge and a lack of suitable monitoring of the downstream, near-pristine lake system which accidentally became the receiving environment for this mine spill.

While the Canadian federal government was able to provide funding to assess the impacts of this event there was, and currently is still, no mechanism for independent research scientists to obtain funding quickly following a significant event. Emergency funding, which could be obtained quickly for urgent scientific studies, should be made available from federal or provincial governments. Delays in funding, due to having to wait for competition deadlines, results in the loss of valuable data at a time when it is often most needed.



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The innovation pipeline needs fixing – redefining STEM in Canada

It is time to abandon the innovation pipeline concept and embrace a dynamic model of research and discovery in Canada, says NSERC President Dr. B. Mario Pinto...

Canada – and the world – is on the brink of an exciting future. Science, technology, engineering and mathematics (STEM) can help make sure we get there, but only if we fully mobilise Canada’s discovery and innovation ecosystem. Fresh thinking about how innovation works, and how players in the system can work together, is required to solve this challenge. The potential benefits are substantial.

To start, we need to abandon the traditional concept of an innovation pipeline. In this model, innovation occurs in a linear process with a clear division of labour, with discovery and innovation as separate endeavours. With talk about an emerging “Fourth Industrial Revolution”, this paradigm does not reflect today’s technological reality.

The research and innovation ecosystem has become much more collaborative, interdisciplinary, dynamic and non-hierarchical than before. Consider the dramatic changes in the education and training of students. Students continue to be trained in the art of creative and critical thought. But with this as a foundation, they are now exposed to interdisciplinarity, experiential learning, international experience, and entrepreneurial culture. This modern pedagogy will give them the skills to assess and respond to opportunities and challenges in a rapidly-changing landscape.

If asked, these emerging leaders would firmly reject the idea of an innovation pipeline because it does not reflect the dynamic interplay of discovery, invention and innovation. A different way to think about the relationship between discovery and innovation is as a single loop with numerous entry points and feedback mechanisms. Information flow is bi-directional. Many different players are involved, but they act in a highly integrated and purposeful way.

For example, graphene, a revolutionary nanomaterial 200 times stronger than steel, was the result of discovery research. As is often the case, however, efforts by industry to explore the capabilities of this material and to reduce production costs for market deployment have triggered fundamental new questions that can only be addressed by further discovery efforts. This interplay of discovery and innovation has opened up an astonishing range of potential applications for graphene, from new battery technologies to graphene-reinforced silk.

“In Canada, we need to continue to provide equality of opportunity so that diverse academic institutions can pursue research areas in which they are leaders – areas that match the needs and strengths of their region. These constitute primarily undergraduate institutions, research-intensive universities and colleges or polytechnics.”

Awareness of this new model is only the first step; we must find better ways to optimise the system and raise the level of play for both researchers and industry. The current system is too complex and filled with redundancies. It fails to coordinate and leverage our resources, expertise and best practices.

Full mobilisation requires an attitude shift, one that is honest about redundancies, that eliminates them, and that embraces the diversity of expertise to deliver innovation. As NSERC moves ahead with its new strategic plan – NSERC 2020 – we have made it a priority to foster such a system.

We are focused on stimulating R&D&D – research and development and delivery – going the distance to ensure the full delivery of innovation for broader economic and societal gain.



Getting there will require NSERC to more formally pursue a convener role bringing all players together. Currently, we invest heavily so that Canadian researchers can develop world-leading discoveries and ideas. As well, we have programmes to facilitate close connections and partnerships with business to ensure that discovery research is constantly mixing with and enriched by industry and market perspectives.

“To start, we need to abandon the traditional concept of an innovation pipeline. In this model, innovation occurs in a linear process with a clear division of labour, with discovery and innovation as separate endeavours. With talk about an emerging “Fourth Industrial Revolution”, this paradigm does not reflect today’s technological reality.”

Being a convener also means that NSERC programmes must reflect and support greater diversity across business sectors, academic institutions, gender and culture. With diversity, we are more likely to be bold – even audacious – in discovery research, creating

opportunities that those with a more homogenous perspective will miss. In Canada, we need to continue to provide equality of opportunity so that diverse academic institutions can pursue research areas in which they are leaders – areas that match the needs and strengths of their region. These constitute primarily undergraduate institutions, research-intensive universities and colleges or polytechnics.

If we continue to push the frontiers of discovery research and if we embrace innovation with an informed perspective, I am confident that STEM will play a pivotal role in creating a brighter future for all. ■

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Dr. B. Mario Pinto
President

Natural Sciences and Engineering
Research Council of Canada
www.nserc-crsng.gc.ca

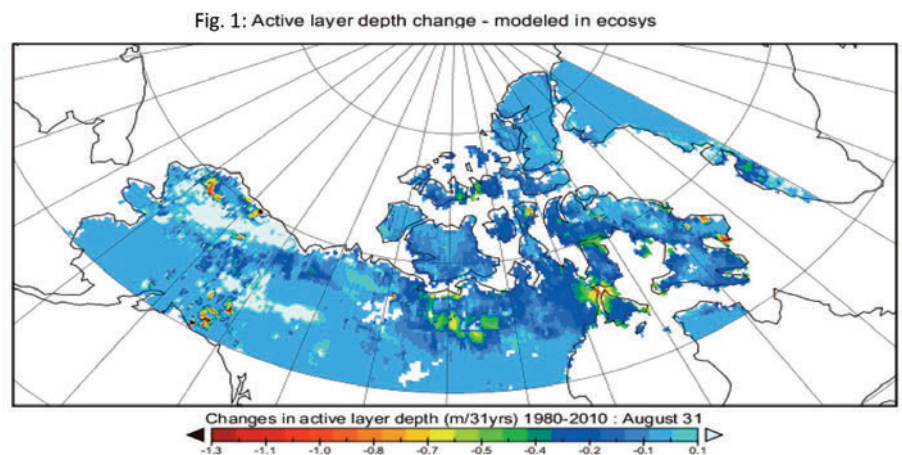
How can we use maths to predict the impacts of climate change?

Robert Grant, Professor at the University of Alberta looks at predicting the effects of climate change on terrestrial ecosystems with a mathematical model...

Changes in climate are causing widespread impacts on hydrology and productivity of terrestrial ecosystems and will continue to do so in the future. Consequent changes in greenhouse gas (GHG) exchange with the atmosphere may hasten future climate change. Process-based simulation models are therefore needed to anticipate changes in terrestrial productivity and GHG exchange under changing climate and disturbances, both natural and anthropogenic.

The research program described here meets this need by developing and testing a mathematical model (*ecosys*) of natural and managed ecosystems. This model is distinguished from other such models by the comprehensiveness and detail of its processes. The model integrates basic findings from biometeorology, plant biology, soil biology, soil physics and soil chemistry into the study of complex ecosystem behaviour under changing weather and disturbance.

This model has been used to anticipate ecosystem response to hypothesised changes in environmental conditions. Projections by *ecosys* of climate change impacts on an arctic landscape (Grant et al., 2015a,b), indicated that increasing heat advection from increasing precipitation and overland flow would accelerate permafrost degradation, active layer deepening and methane emission. Consequently climate change impacts in permafrost-affected regions



would be greater than those projected in most current studies in which heat advection is not considered.

Model use in climate change studies requires well-constrained testing of model response functions to changes in temperature and atmospheric CO₂ concentration (C_a) under diverse site conditions. Such testing has been conducted as part of several interdisciplinary research projects, including the Fluxnet-Canada Research Network (FCRN), Canada Carbon Project (CCP), the North America Carbon Project (NACP), the Climate Impacts on Canadian Arctic Tundra (CICAT), Arctic Development and Adaptation to Permafrost in Transition (ADAPT), NitroEurope and the Next Generation Ecosystem Experiments (NGEE), and documented in ~100 peer-reviewed publications in a wide range of scientific journals. A few examples follow:

The response of *ecosys* to elevated C_a was tested against measurements of NPP, wood growth, C and N stocks and

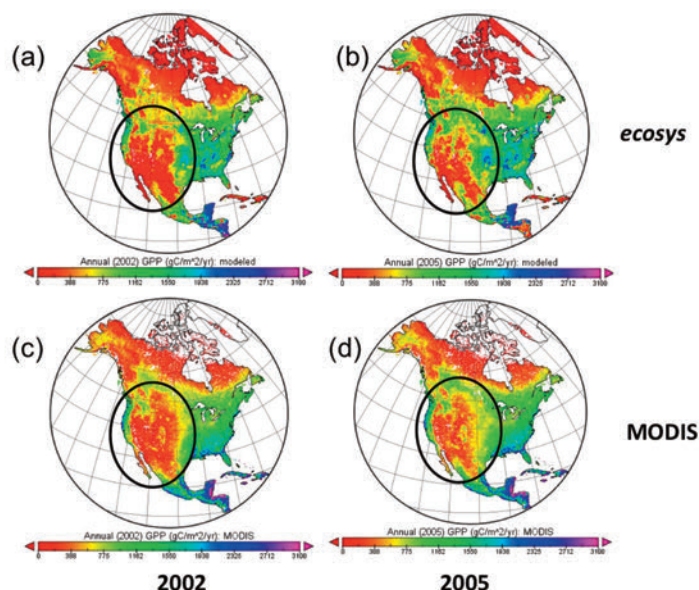
N cycling at three forest Free Air CO₂ Enrichment (FACE) sites with contrasting climates and plant functional types (Grant, 2013). This study demonstrated that the priming of soil N cycling is vital to the accurate modelling of ecosystem response to rising C_a, yet is currently overlooked in most ecosystem models.

The modelled responses of wheat growth, yield and yield components to increases in canopy temperature (T_c) was tested against measurements recorded under controlled heating over a range of temperatures (Grant et al., 2011). These responses clearly indicated gains in growth and yield with warming at lower T_c and losses at higher. Such testing is vital to confidence in model projections of climate warming effects on plant growth.

Modelled responses of C and N stocks of soil and trees to artificial soil warming were tested against measurements recorded in the Harvard Forest (Grant, 2014). The initial decline in ecosystem

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Fig. 2: Continental-scale model testing: model responses to 2002 drought, modeled vs. MODIS GPP



C stocks with heating was modelled as a disturbance response of soil C and N cycling to sudden heating. This response was not simulated with gradual climate warming which caused gains in tree C stocks consistent with observations in warmer vs. cooler climates. These different responses to warming indicated risks in inferring long term responses directly from short-term experiments.

The impacts of changing hydrology on wetlands have not been well represented in ecosystem models. To improve this representation, algorithms have been implemented and tested in *ecosys* to model constraints on C cycling imposed by O₂ transport (Grant et al., 2012). These algorithms were used to model hydrologic effects on net CO₂ exchange in drained vs. undrained tropical peatlands (Mezbahuddin et al., 2014; 2015), in an ombrotrophic bog (Dimitrov et al., 2010a,b,c; 2011), along a boreal forest – fen ecotone (Dimitrov et al., 2014a,b) and in an arctic landscape (Grant et al., 2015). These algorithms are vital to modeling climate change effects on C and nutrient cycling, GHG exchange and productivity of wetland ecosystems.

The ability of model processes to explain variation in net CO₂ exchange of diverse ecosystems has been tested at diurnal to decadal time scales across a wide variety of climates and disturbances. Model processes explained sharp transitions from C sink to source widely measured in coniferous forests (Grant et al., 2009a,b) and arctic tundra (Grant et al., 2015) caused by warming above 20 °C. Such non-linear transitions are likely to become more frequent as climate change progresses, and so need to be represented in ecosystem models.

In several international model inter-comparisons conducted in the NACP, *ecosys* was consistently ranked as one of the best performers among comprehensive, fully prognostic models for which results were submitted across a wide range of sites (Keenan et al., 2012; Richardson et al., 2012; Schaefer et al., 2012; Schwalm et al., 2010, Sulman et al., 2012).

Ecosys has been applied at continental scales through participation in the NACP Multi-Scale Terrestrial Model Intercomparison Project (MSTMIP) in which *ecosys* was run at 0.25°C resolu-

tion over North America (Mekonnen et al., 2016a,b). Outputs from this run were tested at a continental scale against remotely sensed products such as MODIS NDVI and GPP, and against NEP inferred from inversion and inventory products such as Carbon Tracker and SOCCR reports. These outputs have provided process based explanations for key impacts of changing climates on regional hydrology (e.g. impacts of arctic warming on ALD in Fig. 1 and of Midwestern droughts on ecosystem productivity in Fig. 2). Further large-scale applications of *ecosys* will be realised through coupling with the Community Earth System Model (CESM) currently underway at the Lawrence Berkeley National Laboratory of the USDoE.

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The Citizens' Debate on Space for Europe: Another space challenge

The European Space Agency's Nathalie Meusy reflects on the success of the Citizens' Debate on Space for Europe and ways to support sustainable development goals...

The European Space Agency (ESA) started to commit to Sustainable Development and Corporate Social Responsibility (CSR) over 10 years ago, with dialogue with stakeholders at the heart of the holistic approach supported by the Agency. The main aim is for ESA to be more coherent in terms of its DNA and missions (delivering applications and services for the benefit of society and for planetary security and health), in its decision-making process, and in its everyday operations, in accordance with CSR values.

In the space sector, we are very well acquainted with the challenge as, by definition, we undertake missions that are sometimes the first of their kind or that could be described as 'risky business' – which really is rocket science! We deliver access to space through the launching of space objects (such as rockets, space stations and satellites) to provide citizens and the planet with applications and services on a daily basis. We even recently landed on a comet with the Rosetta/Philae mission. So, professional challenges are in our DNA.

Another recent challenge was for ESA to organise the very first Citizens' Debate on Space for Europe. It was the first informed debate between a space agency and its main stakeholders, that is, taxpayers, citizens. This debate arose out of the determination of ESA's newly-elected Director General, Jan Woerner, to open up our agency and, more broadly, space to the general public.

The debate was designed and organised using as a model the 2015 citizens' debate on a planetary scale held in preparation for COP21 (the Paris Conference on Climate Change), which brought together 10,000 citizens in 76 countries on one day (6 June) to discuss and answer 30 questions on climate and energy. The results were conveyed to the negotiators.



*Nathalie Meusy
Head of the Coordination
Office on Sustainable
Development
Head of Citizens Debate on
Space for Europe*

ESA's debate was conceived to obtain information from citizens and inspiration for drawing up the future of Europe's space strategy. In terms of governance, this debate – although an illustration of participatory democracy – was not intended to interfere with ESA's institutional decision-making process, but to nurture and support it. The SME 'Missions Publiques' which co-organised the COP21 debate supported ESA throughout the process.

The debate was also a way to lend an ear to stakeholders as a matter of responsibility, accountability and respect towards them, and to collect their views, ideas, concerns and even dreams about space issues. More than 1,600 citizens dedicated a whole day (10 September 2016) to gather together and discuss space issues after having been given information through magazines and videos. These participants subsequently answered a questionnaire containing both closed and opened questions. They also experienced and appreciated a creative session, giving them the opportunity to help build up a space mission for 2036.



With this conversation, we realised in particular that citizens thought they had no access to space, thinking it was a matter for specialists, experts and policymakers. However, they actually did have access to space without even realising. For any citizen, there are a large number of benefits that make for a more sustainable society. Space programmes with their satellite applications and services also help and support UN Sustainable Development goals and address the more acute societal challenges of the 21st century. Space programmes and applications contribute to:

- Protecting the environment, through climate change research, they monitor and forecast global changes, preserve the Earth for the future, anticipate disasters and mitigate their impacts;
- Improving daily life, by providing broadband, internet, TV, weather forecasting, GPS, telemedicine and tele-education, they contribute to social progress;
- Living safely, by checking the health of the planet, helping in emergencies, making the world safer, enabling disaster management and reducing risks (epidemics, trafficking, etc.);
- Building our future, by observing and understanding the Earth, using space as a decision-making tool, preparing for tomorrow's changes, and encouraging collaboration between States;
- Boosting economic growth, by fostering the sector's

competitiveness, transferring space technologies and generating innovation, creating jobs, choosing the best synergies and boosting industrial activities;

- Stimulating our need for knowledge, by educating and motivating people, seeking out scientific excellence, transmitting knowledge and know-how, innovating, exploring new frontiers (space science and human spaceflight push back the frontiers of knowledge and satisfy our need to explore the natural environment, while space exploration sustains the dreams generated by the Universe).

During the citizens' debate, the inspirational dimension of space was tangible and the young participants were very enthusiastic and involved in the discussions. Space indeed represents opportunities in many sectors, as well as hope for the future, and this was demonstrated by the debate. With this citizens' debate, ESA opened up a new chapter of the space adventure. ■

See materials and results on: www.citizensdebate.space

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Nathalie Meusy
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Submillimetre-wave observations open a window on star formation

Dr Philippe André, ORISTARS Project Coordinator, discusses the implications of ongoing work on filamentary molecular clouds and their role in star formation

The process of star formation is closely linked to both the evolution of galaxies on large scales, and the formation of planets on small scales. Based at France's Alternative Energies and Atomic Energy Commission, the ORISTARS project is an ERC-backed initiative combining observational, theoretical and instrumental research to investigate the process by which stars are formed.

The general goal of the project is to understand the process of star formation, and also the formation of solar systems, together with their surrounding planets. This research builds on the results gained by the Herschel Space Observatory, which was launched in 2009 and continued to operate until April 2013.

The Herschel observatory investigated sub-millimetre wavelengths. The reason we want to observe sub-millimetre wavelengths is that stars form in cold molecular clouds and we need to observe sub-millimetre wavelengths to investigate the very cold objects involved in star formation.

This is a highly complex process, as a proto-star acquires mass from a molecular cloud and gradually evolves over time. A star can be broadly defined as an astronomical body that can generate its own energy; this characteristic develops over time, as a proto-star steadily gains mass, to a point where it is capable of nuclear fusion.

Initially, the mass of a proto-star is very small. The central object of the proto-star gains mass from the surrounding pre-stellar condensation, which itself lies in a filament. So a proto-star achieves its final mass when the central object has eventually accreted all of the mass of the pre-stellar condensation.

The pre-main sequence phase is another important stage in the development of a star. The star is no longer a proto-star at this point, but it's not yet a normal star either. In this phase, the object contracts progressively, and as it contracts it warms up, until the temperature at the centre reaches 10 million degrees and it is capable of nuclear fusion. At that point it becomes a normal star.

The development of the Herschel Space Observatory represented an important breakthrough in observational studies of these processes. Sub-millimetre wavelengths are difficult to observe from the ground, yet with Herschel, scientists were able to image molecular clouds, gaining unprecedented levels of detail.

Results revealed the widespread presence of filamentary structures in these clouds at high levels of detail. These filamentary structures appear to play a key role in the star formation process, and clear links have been established between these structures and pre-stellar cores, the progenitors of protostars in the clouds.

With Herschel we took a census of these pre-stellar cores. We realised from our observations that they were all associated with filaments, so a direct connection was established between star formation and the filaments – this was an important breakthrough from the Herschel observations.

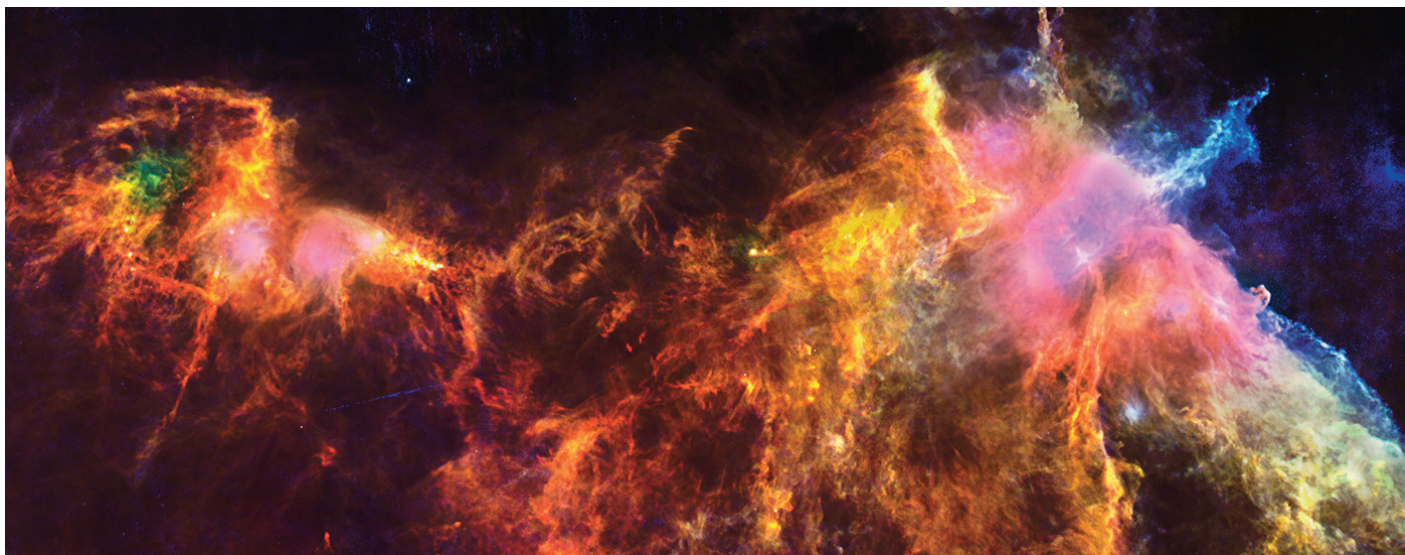
New paradigm

These observations form the starting point for the ORISTARS project, leading to a new paradigm for our understanding of star formation and inter-stellar filaments.

There are three main lines of research within the project. These are the investigation of filament formation, the fragmentation of these filaments into pre-stellar cores, and then, on smaller scales, the sub-fragmentation of these pre-stellar cores into binary stars and protoplanetary disks. There is a tight connection between these scales. There is also an instrumental component to the project, which is the development of a mm-wave polarimeter. This will enable us to learn about the magnetic field inside these filaments, and to better understand the role of magnetic fields in star formation at these scales.

Evidence on large scales suggests that the magnetic field tends to be parallel to the low-density filaments, including the faintest filaments that we can see with the Herschel Space observatory and perpendicular to the higher-den-

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Herschel's view of the Orion region including the Horsehead Nebula. Copyright ESA/Herschel/PACS, SPIRE/N. Schneider, Ph. André, V. Könyves (CEA Saclay, France) for the "Gould Belt survey" Key Programme

sity filaments in which stars form. We know this from results from Planck, another satellite launched at the same time as Herschel.

Magnetic fields are also thought to play a crucial role in the formation of protoplanetary disks. Observations show that the disks around proto-stars do not form as quickly as numerical hydrodynamic simulations of proto-stellar collapse would predict. It is becoming clear that magnetic fields play an important role in controlling the formation of these disks. There is likely to be a connection here with the filaments on larger scales.

Rotation in pre-stellar condensations is thought to be a primary cause of the initial formation of protoplanetary disks. The pre-stellar condensations have some degree of angular momentum, and as they collapse to form a proto-star, angular momentum is conserved leading to the formation of a flattened disk-like structure. We realise now that this momentum is probably linked to the formation process of the filaments on larger scales. The magnetic fields that play a role on a small scale inside these pre-stellar condensations are inherited

from the large-scale magnetic fields in the clouds.

We cannot currently resolve the magnetic field within the filaments from where stars form, but this is something we would like to investigate with future instruments, including the new polarimeter that we are helping to develop for a ground-based observatory, the IRAM 30m telescope, located near Granada, in Southern Spain.

Further data

We plan to use data from other telescopes and observatories to gain further insights. One major facility of interest is the ALMA (Atacama Large Millimeter/submillimetre Array) interferometer, a state-of-the-art array of telescopes located high in the Chilean Andes. We hope it will allow us to study the details of individual proto-stellar systems at high angular resolution. With Herschel, we already have a lot of details on the large scales – ALMA is a very powerful tool to study the smaller scales in particular.

These kinds of observations are also relevant in terms of the project's work on numerical simulations of molecular clouds. Numerical work is central to

building a deeper understanding of molecular clouds and star formation. While observational data can offer a snapshot of the clouds, simulations provide more of a dynamic insight. These numerical simulations are being refined on an ongoing basis and confronted with observations, as we seek to improve levels of accuracy and deepen our understanding of star formation.

DE LA RECHERCHE À L'INDUSTRIE



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Cryogenic technologies for precision tactical and space applications

Peter Iredale, Engineering Lead at Honeywell Hymatic

Honeywell Hymatic has been at the forefront of cooling technology for infrared and sensing applications for over 50 years. Operating in some of the most demanding environments, Honeywell technology increases reliability and efficiency, whilst enabling missiles, satellites, fighting vehicles, underwater weapons and submarines to more effectively and accurately complete their missions.

Through our expertise in Joule-Thomson cryogenic coolers, linear Stirling cycle cryocoolers and compressors and extensive knowledge of long life stored energy technologies, Honeywell offers customers an integrated solution for their cooling requirements. From our dedicated cryogenic facility, we provide a bespoke manufacturing service and a responsive aftercare infrastructure to support through the lifecycle of the product.

Joule-Thomson Cryogenic Coolers and Stored Energy Gas Systems

Joule-Thomson (J-T) coolers remain the simplest, lightest and easiest technology for cryogenic cooling across a wide range of IR sensor applications, employed in numerous global missile programmes such as, Javelin, StormShadow and ASRAAM. They provide rapid, accurate cooling, within tight space envelopes.

We offer a variety of J-T coolers that can optimise gas consumption, resulting



Joule-Thomson Cryogenic Coolers and Stored Energy Gas Systems

in more efficient operation. Complementary to this are our stored energy products that provide fuel for the J-T coolers and can utilise a variety of gas species, dependant on requirement, throughout their typically extensive 25 year life cycle. These gas systems can often include various gas management ancillaries that control flow rates under varying ambient pressures (altitudes), temperatures and other complex environmental requirements often akin to tactical/airborne applications.

What this ultimately provides is a complete solution for cooling, gas supply and management of gases for the intended application regardless of the environmental complexities customers are often faced with.

Linear Stirling cycle cryocoolers

Designed for use in high duty applications for continuous use as a replacement for legacy cooling systems, the Linear Cryocooler offers a significantly

extended life and enhanced levels of performance.

Honeywell's Linear Cryocoolers incorporate unique, patented technology from the development and industrialisation of an Oxford University design concept. This patented technology, born out of the need for extremely high reliability for space applications, offers superior durability to traditional tactical Linear Cryocoolers.

Designed to 'fit and forget' standards, the system uses a non-contact dynamic sealing of the internal working gas, coupled with a high reliability linear electric drive, which has been proven to deliver over 120,000 hours of constant, maintenance-free operation.

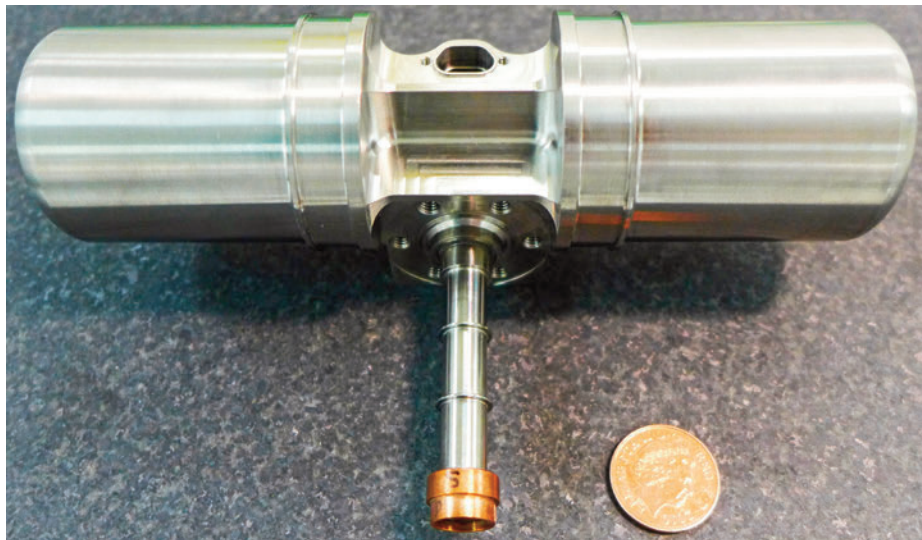
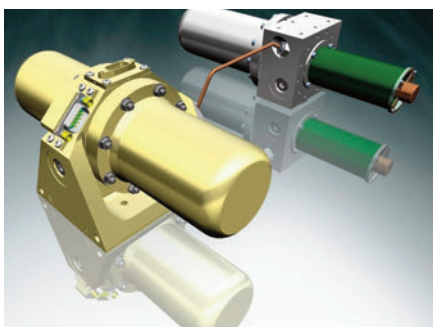
Due to their durability, reliability and military-grade performance, 85% of US long life flexure bearing Linear Cryocoolers in orbit on satellites today contain Honeywell Hymatic hardware. Other potential applications include:

PROFILE

- Extended operation cryogenic sensor cooling requirements;
- High efficiency compressors for space applications;
- High reliability/durability sensor cooling – radio isotope detection systems;
- Power generation for forward outposts.

Future developments and forging relationships

Under a General Support Technology Program (GSTP), funding from the European Space Agency (ESA), a consortium of Honeywell Hymatic, Rutherford Appleton Laboratory (RAL) and Thales Alenia Space UK are now working on the next generation of long life Linear Space Cryocoolers for Europe. Cryocoolers such as these are critical to future Earth observation missions where the need for high resolution IR sensing needs to be balanced carefully against the satellite payload size, weight and efficiency. ESA identified the need to push technology of Cryocoolers with respect to size, weight and efficiency after benchmarking US Space Cryocoolers as world leading, including those supplied by Honeywell. The program, currently at its mid-point of a 3 year schedule, promises to deliver engineering qualified units to ESA that will be market leading within Europe, with respect to low mass/size and high efficiency, whilst maintaining the long life heritage required for said applications.



Our relationship with RAL is yielding further development of products for tactical/commercial applications. The Cryogenics team at RAL has a long established heritage in the field of long life Space Cryocoolers, working with ESA and the UK Space Agency. Recently RAL have been developing a Small Scale Cryocooler for use in miniature space satellites, pushing the space envelope ever smaller. Honeywell Hymatic, seeing an opportunity with this design, has taken the technology and is applying our manufacturing techniques to ensure a version can be produced for tactical and commercial IR applications without the high costs traditionally associated with space applications. However this does present an opportunity for space applications in the respect that a Cryocooler may be taken from a standard production run, and with a minimal increase in testing and quality control, supplied to a space customer for a much reduced cost over traditional Space Cryocoolers. The key with this philosophy is sustainability of source product and their manufacturers. The space market represents very low quantities of product per annum, whereas the volumes for tactical/commercial coolers are far greater and often the technology cannot read from one

to the other. This is a dichotomy that Honeywell Hymatic is working to break with the Small Scale Cooler.

Honeywell Hymatic employs a dedicated team of specialised engineers and technicians with a combined experience of more than 300 years in cryogenic products. We continue to invest in developing leading-edge technology, working in partnership with our customers, to offer effective solutions based on our mission proven expertise.

For more information on our full product range, please visit our website: <https://Aerospace.honeywell.com/cryogenic-cooling>

To speak to one of our sales or engineering team, please feel free to contact us on the details below.

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Supporting young research talent in Norway

Anne Kjersti Fahlvik, Executive Director of Innovation at the Research Council of Norway talks to Editor Laura Evans about the importance of supporting young researchers in Norway and collaborations between universities and industry...

High quality research in Norway is viewed as an integral way to meet global challenges and transform the business sector. With a strong research tradition in areas such as the marine and maritime sectors, petroleum and energy research in general, the government has given Norwegian Research Policy high priority.

The Research Council of Norway (RCN) is a government agency responsible for awarding grants for research, as well as promoting research and science. They work towards adding value to the research and innovation system and through funding programmes and projects, the Council seeks to promote high calibre research and innovation potential.

In order to conduct world-class research you need to attract and recruit the best talent. Through a new policy, the RCN are doing just that. They also aim to increase the interaction between academia and working life in order to help strengthen career paths throughout the country. Here, Editor Laura Evans speaks to Executive Director of Innovation, Anne Kjersti Fahlvik from the Research Council of Norway to find out more about how the organisation is supporting young researchers and helping to develop their talent.

The StudENT 2016 programme being run by the Council aims to encourage young student entrepreneurs and support collaborations between universities and industry. Fahlvik starts by explaining the challenges for young researchers in Norway starting their research careers.

“Encouraging the next generation of scientists and researchers in Norway is very important, but there are different challenges when you are talking about the



Anne Kjersti Fahlvik

business sector and universities, or the higher education sector,” she says.

“The challenge we have seen for young talent is gaining permanent positions within universities. The young research talent scheme we have aims to boost talent earlier in their career so they can start building up their own research group and get faster career development. This then enables them to hire other young talent and build a strong team.”

The RCN support young researchers in a number of different ways through their funding projects and programmes. A research career is one of many potential career paths for talented students in Norway and in order for promising students to launch their research education early, the Council works to support measures that connect students with research activities and institutions.

“Over the last period, we have focused on a few projects that also look at the talent heading up the project, rather than the project itself,” Fahlvik explains.

“We have special schemes now for young research talent, for industrial PhD’s and for student entrepreneurs, specifically aimed at promoting young researchers’ careers, also in the business sector.

“What we aim to do now in these calls is look for talented young researchers and entrepreneurs. Traditionally, you apply for a project, we evaluate the science quality, the impact value, the innovation potential and not so much look at the young participants in the project. But, in these new schemes we are funding, that is what we are doing, putting the young researchers at the front.”

Two of the schemes in particular are looking at closing the gap between academia and industry. The industrial PhD scheme aims to invite companies that do not already collaborate with universities, while StudENT asks that the universities which the students graduated from support them during their first year in business with test facilities and mentoring.

“If you look at the numbers in the innovation score index and look at the numbers regarding the Norwegian research and innovation landscape, you can see that we have very good collaboration and effective knowledge transfer. This is within sectors such as geosciences and the oil and gas industry, everything related to marine disciplines and fish farming,” says Fahlvik. “However, we don’t have the same type of collaboration for public sector topics.”

Fahlvik goes on to explain: “The industrial PhD scheme has been very successful – so much so, we have had to increase the budget, due to the interest rising. What has changed during the last year or so is that it is seen as a good tool for companies to develop their own employees and develop connections with universities.”

In order to ensure the success of projects such as StudENT and the Industrial PhD project, funding is integral. Investment is a key part of research and innovation, as Fahlvik agrees.

“Investment is very important. What we do from at the RCN is to fund a third of the cost of the project and the companies or early stage investors carry the remaining cost.

“With the student entrepreneurship scheme, we think that by putting quite a significant amount of money in the hands of the project, recently graduated Master students can use that to test production or to start up with the first customers or refine their ideas together with a research institute.

“We look for entrepreneurs who try to think totally outside the box. They may not have all the experience and competence, but we see that as a good thing. We let them play around and take risks but we see that they grow enormously and I think it’s the young spirit combined with the out of the box thinking and the talent they carry,” she says.

“In order to conduct world-class research you need to attract and recruit the best talent. Through a new policy, the RCN are doing just that.”

The key aims of the StudENT project is to help students create their own business and to encourage a culture of entrepreneurship in academia.

“This is why we are requiring that universities or university colleges apply on behalf of their students, and we have asked that they aid the students with a mentor, test facilities and counselling,” says Fahlvik. “When they commit to this kind of support, our hope is that it will affect their organisations and encourage more entrepreneurship.

“This is an advantage both to academia and the young entrepreneurs. With a research based idea, you need to keep developing your product in parallel with customer testing: to do R&D at the same time as you check what the market wants. Good relations are vital in order to make this cycle work.” ■

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Anne Kjersti Fahlvik
Executive Director of Innovation
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Moedas welcomes open science with open arms

Open science has long been a key driver of EU Commissioner for Research, Science and Innovation Carlos Moedas' mandate, as M F Warrender writes for Adjacent Government...

"Open Innovation, Open Science and Open to the World". These are the defining drivers of the Mandate chosen by EU Commissioner for Research, Science and Innovation, Carlos Moedas. Previously Secretary of State to the Prime Minister of his native Portugal, Moedas firmly believes that "openness" is the key to an effective, successful and competitive European Research Area (ERA), and he emphasised this in a speech titled "[Embracing an ERA of Change](#)" at the German National ERA Conference, 10 October 2015.

"Science is no longer a matter of national prestige, but a collective responsibility," Moedas went on to state. Europe is more interconnected than ever before thanks to technology and curiosity-driven research, meaning openness is vital to maintaining a thriving innovation ecosystem, which commits to European challenges as well as specific national situations.

Sustained funding key to breakthroughs

In the last 20 years there have been incredible technological advances expanding our horizons, raising life expectancies and digitalising our economy. Funding and research are fundamentals in sustaining this level of development and continuing to make breakthroughs within the EU. Networks of research infrastructures for the physical sciences are heavily supported by the European Union, as projects are rapidly growing and now more than ever require larger structures to carry out research. Some examples of this are:

- EuCARD-2 (Enhanced European Coordination for Accelerator Research and Development) of which the EU's financial contribution is €8 million. This funding opens up many opportunities, including allowing the project to operate a transnational access programme in addition to its networking and joint research activities, and enabling successful applicants to conduct research at three unique facilities around Europe.

- HadronPhysics3 – The Study of Strongly Interacting Matter. Research along these lines requires particle accelerators and extremely powerful supercomputers. It is conducted at cutting-edge research facilities around Europe, thanks to the €9 million contributed by the EU.

"Considering European research still suffers from a considerable imbalance of gender and inefficient use of highly skilled women, more needs to be done to combat this injustice. Moedas has invited all member states to engage in partnerships with funding agencies, research organisations and universities to foster cultural and institutional change on gender."

The Commission is currently boosting research and innovation throughout Europe, with a [proposal to increase the budget of Horizon 2020](#) with an additional €400 million. This will provide a wide range of funding opportunities including direct funding to researchers of €6 billion through the Marie Skłodowska-Curie actions (MSCA) and €13 billion through the European Research Council (ERC).

However, there has been much debate over the implications of the UK referendum on research and innovation programmes, not just regarding funding (of which the UK is a major beneficiary), but also in terms of networks of information and experience exchange, and focus on this crucial "openness". While it is still far too early to speculate on the long-term implications of Brexit, Moedas has reassured UK researchers that their funding eligibility under the world's biggest current research and innovation funding programme Horizon 2020 (2014-2020), will not be affected.

Current European policies are geared towards removing



barriers, promoting open access and the sharing of research results, allowing scientific knowledge, technology and researchers themselves to circulate freely around Europe. For example, there are over 250 EURAXESS service centres across Europe, providing researchers with personalised assistance when moving abroad.

Embedding gender equality

“Openness is what binds everything together. It is the common denominator,” Moedas said in Berlin.

This openness is embedded in the ERA alongside the encouragement of gender equality in research and innovation. Equality is another core value of Moedas himself, as he stressed during the inaugural ceremony of the European Women Rectors Association (EWORA), in Brussels on 20 June 2016: “Equality isn’t just a women’s issue, it’s a human one”.

He brings to light the notion that feminism is not just for women, and that “more men need to stand up and talk about it”. He highlights how the European Commission is currently working to aid universities and research organisations in implementing Gender Equality Plans, for example, and the development of a new online tool becoming available this autumn. Developed together with the European Institute for Gender Equality, this tool will offer universities and research organisations practical help to:

- Audit their institutions and identify the gaps to be addressed in equal representation.

- Implement appropriate strategies to correct any bias that exists.
- Set up targets and monitor their progress.

The Commission is also already committed to guarantee a position for the under-represented sex on at least 40 per cent of all its expert groups, panels and committees, particularly in relation to Horizon 2020. Considering European research still suffers from a considerable imbalance of gender and inefficient use of highly skilled women, more needs to be done to combat this injustice. Moedas has invited all member states to engage in partnerships with funding agencies, research organisations and universities to foster cultural and institutional change on gender. Through these means the European Commission hopes to strengthen gender diversity in research programmes across Europe, reinforcing the positive correlation between openness and effectiveness.

“While it is still far too early to speculate on the long-term implications of Brexit, Moedas has reassured UK researchers that their funding eligibility under the world’s biggest current research and innovation funding programme Horizon 2020 (2014-2020), will not be affected.”

As European Union-led research continues to help reach solutions to Global Challenges, it is important to remember that it is the many collaborations and global partners that enable continual scientific breakthroughs.

“No single country or region can face global challenges alone. That’s why our research and innovation needs to be Open to the World.” – Carlos Moedas. ■

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Hybrid electrons and photons for quantum technology

Quantum technology is a rapidly developing field with great potential for nanoelectronic applications, as Dr Takis Kontos relates

Many machines made by mankind can be considered as hybrid systems to a large extent. An old windmill, for example, combines the softness of the sails with the stiffness of the wood in order to exploit in the best way the strength of the wind. Our modern technology is based on similar ideas, especially if one considers electronics. Two celebrated examples can be cited. First, the transistor, which combines in a very controlled way semiconducting materials with different electronic properties. Second, the read heads of hard drives, which are made from layers of magnetic and non-magnetic materials, providing very compact and sensitive read-out.

The emerging field of quantum technology is likely to follow a similar path. A quantum machine is one whose activity is based on the laws of quantum mechanics. In order to build such a machine, one is naturally led to mimic atoms. Indeed, quantum mechanics was invented at the beginning of the 20th century in order to understand their counterintuitive world. In electronic devices, manmade atoms can be designed in several ways, but all use nanoscale conductors, operating at a temperature close to absolute zero. One such way is electron boxes, i.e. electrical devices that can trap in a very controlled way

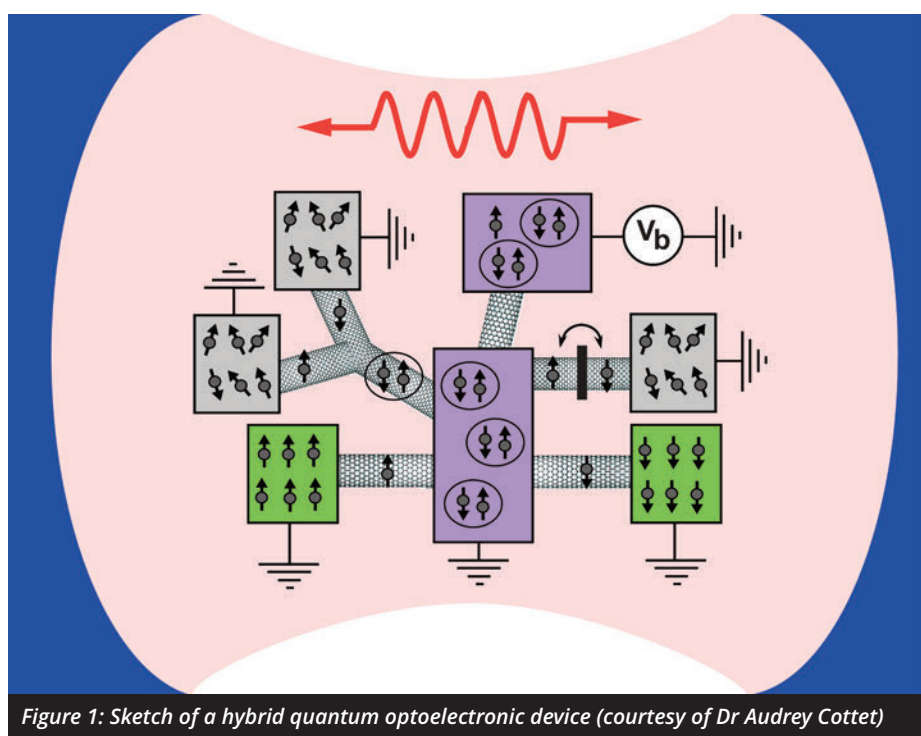


Figure 1: Sketch of a hybrid quantum optoelectronic device (courtesy of Dr Audrey Cottet)

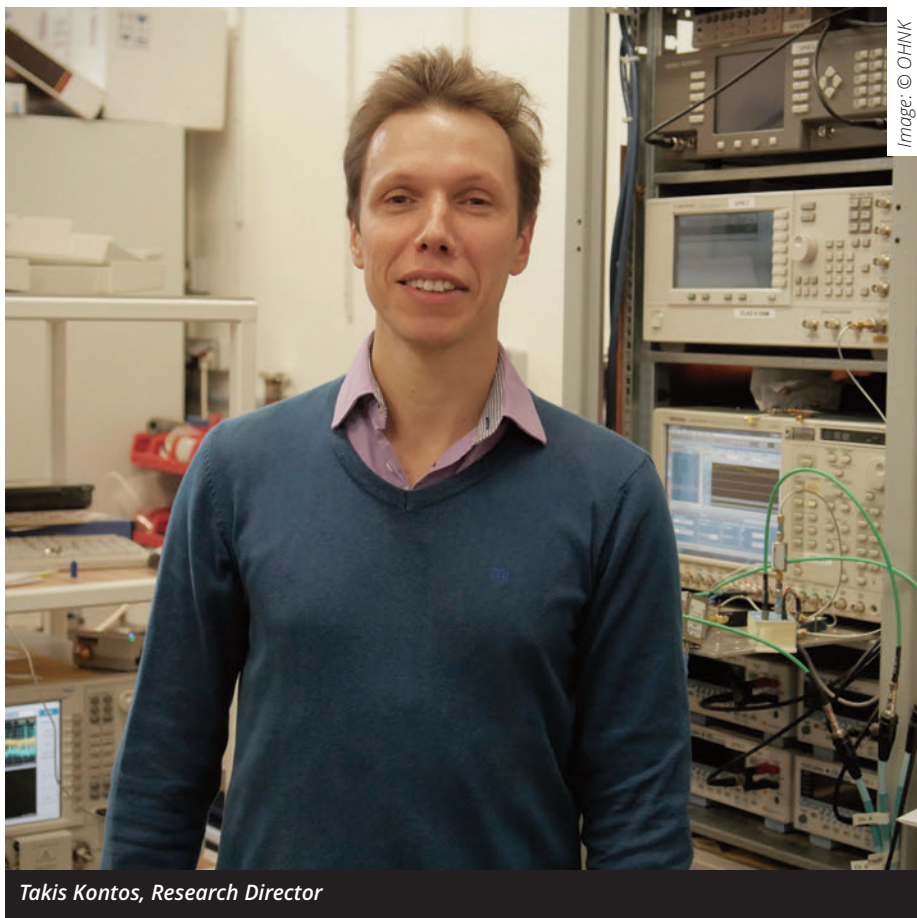
as little as one electron, also called quantum dots.

The interest in quantum dots stems from ideas put forward by Loss and DiVincenzo in 1998, which suggest using the spin of the electron to encode quantum information. This purely quantum mechanical degree of freedom can take two values for an electron – up or down. It is therefore natural to use it to encode the ‘0’ and the ‘1’ of a computer, which would exploit the laws of quantum mechanics – a quantum computer. Making such a computer is a priori a formidable task, but tremendous progress in

the field in the last decade calls for optimism. If one is to use the electron spin for that purpose, one needs to find efficient means to manipulate it, read it out and couple it to other spins. Completing all these tasks in a scalable way remains a challenge.

In this context, hybrid setups could come to the rescue. The CirQys project explores such a direction. Like the motion of a tilted top on a table, a spin precesses in a magnetic field. This is the natural way to manipulate it. However, a laboratory magnetic field is not of practical use especially if one wants to control several spins

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Takis Kontos, Research Director

individually. The use of micron size magnets has appeared recently as a very fruitful option. A quantum dot coupled to such magnets can keep its atom-like behaviour and at the same time “borrow” some of the internal magnetic field of the magnets, just because the electrons of the dot hybridise with those of the magnet.

We have recently added a new twist in the quantum tool box for single spin manipulation, in the form of a recent theoretical proposal by Dr A Cottet and myself¹. The very local magnetic field produced by a micromagnet can be made to turn on a very small length scale, simply by designing non-collinear micromagnets. Doing so has allowed us to engineer, in an artificial molecule (two artificial atoms

coupled), a controlled coupling between the position of an electron and its spin direction – an artificial spin-orbit interaction. Since the position is easily coupled to light via the electric charge of the electron, this has allowed us to engineer a spin-photon interface with a very large strength. The photons used for probing this interaction were trapped in a photon box, in a cavity quantum electrodynamics setup. The architecture demonstrated is therefore suitable for manipulating, reading out single spins and coupling spins over macroscopic distances². Experiments are now ongoing to explore these possibilities.

The demonstrated artificial spin-orbit interaction could be used in more complex setups, such as those envi-

sioned for engineering Majorana fermions in condensed matter. These elusive particles have the intriguing ability to be their own anti-particle. It has been shown recently that they could be engineered in hybrid nanoscale wires with strong spin-orbit interaction contacted to superconductors, in a magnetic field. We pursue in the CirQys project a new direction that is to replace the spin-orbit interaction and the magnetic field by our newly developed artificial spin orbit interaction which is expected to have the same properties. The photonic cavities may prove to be crucial for probing the particle/anti-particle duality of the Majorana modes. Such hybrid “squared” systems may turn out to be a major setup for quantum nanoelectronics.

¹ A. Cottet and T. Kontos, Phys. Rev. Lett. 105, 160502 (2010).

² J.J. Viennot, M.C. Dartailh, A. Cottet and T. Kontos, Science 349, 408 (2015).



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Pottery and people on Sai Island

On Sai Island, pottery tells us a lot about life in the New Kingdom in Nubia, writes Professor Julia Budka

A primary goal of the ERC AcrossBorders project is reconstructing life during the New Kingdom (c. 1539–1077 BC) on Sai Island in Nubia according to the material evidence. For this task, the most numerous finds to be considered on settlement sites like Sai are thousands of potsherds and ceramic vessels attesting to the use, function and occupants of the ancient cities.

The ceramic data from the New Kingdom town is currently being analysed and compared to pottery corpora from the Egyptian towns of Elephantine and South Abydos. In this pottery analysis, a particular focus is laid on similarities and differences between local products and imported pieces, including the significant appearance of hybrid types, e.g. Egyptian types made of Nubian fabrics or with Nubian surface treatment. Our archaeological interpretation and the ceramic typology is supported and extended by petrographic analyses, while neutron activation analysis is used for provenience studies.

These analyses will help to further distinguish within the Nile clays between real imports from Egypt and locally produced, wheel-made vessels. In general, New Kingdom pottery in Nubia is very similar to contemporary material in Egypt. However, the comparative study of material from Sai, Elephantine and South Abydos allows

a detailed assessment of both similarities and certain differences.

Sai Island is one of the major find spots for 18th Dynasty pottery in Upper Nubia – material was excavated both in settlement contexts (the New Kingdom town) and tomb contexts (especially pyramid cemetery SAC5). In addition to ready parallels from other Egyptian foundations in Nubia (e.g. Buhen, Askut and Sesebi) and New Kingdom sites in Egypt (e.g. Elephantine and Abydos), there is also a local component and site-specific features of the ceramics from Sai.

The locally produced Egyptian-style Nile clays are almost always wheel-thrown, whereas the indigenous Nubian tradition is hand-made. Especially within the class of cooking pots, the general co-existence of Egyptian (wheel-made) and Nubian (hand-made) pottery traditions is evident. Residue analysis conducted on Nubian and Egyptian cooking pots from Askut has shown that a distinction was made regarding the specific food to be prepared in each pot (see Smith 2003, 113–124). It is also likely that the choice of an Egyptian or Nubian cooking pot was dependent on the identity of the pot's user, although proof is almost impossible to achieve. At Sai, it is intriguing that both authentic (imported) Egyptian wheel-made cooking pots and examples thrown on the wheel locally are

used side by side with hand-made Nubian cooking pots. The imported cooking pots allowed the occupants of Sai to cook in Egyptian-style at their "home-away-from-home". To cover further demand, these authentic Egyptian vessels were also locally produced on the wheel.

Little is known about the ceramic industry on Sai, though the finished products and their technological features testify that Egyptian potters skilled in wheel production were certainly present at the town. To date, no New Kingdom kilns or pottery workshops have been identified with certainty. Furthermore, hybrid types attest to a regional style, despite a general similarity with contemporary pottery in Egypt. Sometimes, locally produced Nile clay pottery vessels have been modelled on Egyptian types, but with 'Nubian' influences concerning the surface treatment, production technique or decoration. The appearance of such hybrid types is very significant, but not straightforward to explain. Such pots might be products of a local fashion and local potters, but could also refer to the cultural identity of their users or be the results of more complicated processes. All in all, they seem to attest to a complex mixture of lifestyles in New Kingdom Sai.

Similar trends are also seen at other Egyptian sites in Nubia, where seem-

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ingly Nubian traditions – mostly expressed by surface treatment and decoration – are also traceable. Egyptian Marl clay vessels with incised decoration and a new type of Egyptian cooking pots illustrate that Nubian decoration patterns and shapes directly influenced the Egyptian pottery tradition of the 2nd millennium BC. The transfer of technology and knowledge between Egyptian and Nubian ceramic industries was clearly not unilateral;

both traditions adapted specific aspects, illustrating the complex entanglement of Egyptian and Nubian cultures.

In conclusion, the present analysis of pottery from New Kingdom Sai in conjunction with processing of material from Elephantine and Abydos proposes some tentative new thoughts about the occupants of Sai. From the earliest strata onwards, Nubian ceramics appear side by side with

imported Egyptian wares and locally wheel-made products. Since the Nubian pots are the minority, it seems safe to assume that the Egyptian style town was initially occupied by Egyptians. However, the production of hybrid pottery types illustrates that Egyptians and Nubians lived and worked side by side, combining aspects of both cultures. Although it comes as no surprise that Egyptian representation is dominant within a colonial site like Sai, a local substratum is traceable as well. The pottery attests to individuals who identified themselves primarily as Egyptian officials and occupants of an Egyptian site, but may nevertheless have had family ties in Nubia and derive from a local group whose specific cultural identity was never completely abandoned.

Reference

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A collaborative journey to greener chemicals

Kylie Vincent, Holly Reeve and colleagues at Oxford University are working on ways to make greener chemicals. With government funding, the technology could soon be used in industry...

We are working on greener ways to make chemicals that are used in medicines, food and cosmetics by using enzymes that are found in nature – an area of research known as industrial biotechnology. Our group came to work in industrial biocatalysis in a round-about way. We were studying types of bacteria that use the very small amounts of hydrogen gas found in the environment as ‘food’ or energy. To do so, these bacteria contain enzymes – hydrogenases – in their cells which use metal ions to split apart the hydrogen molecule. We were interested in how nature uses metal ions to enable, or catalyse, the split of the hydrogen molecule to better understand how we could make use of this reaction in the lab.

In the course of this work, we carried out collaborative experiments with Dr Oliver Lenz’s group at the Technical University of Berlin into a special hydrogenase that uses hydrogen as a fuel to drive the production of a biological molecule called nicotinamide adenine dinucleotide hydride (NADH)¹. NADH is an important energy currency inside cells, and is required for the function of many types of enzymes. In particular, NADH is essential to the types of enzymes that are gaining attention for their ability to make complicated chemicals such as pharmaceuticals, or flavour or fragrance chemicals in greener ways than in the past.

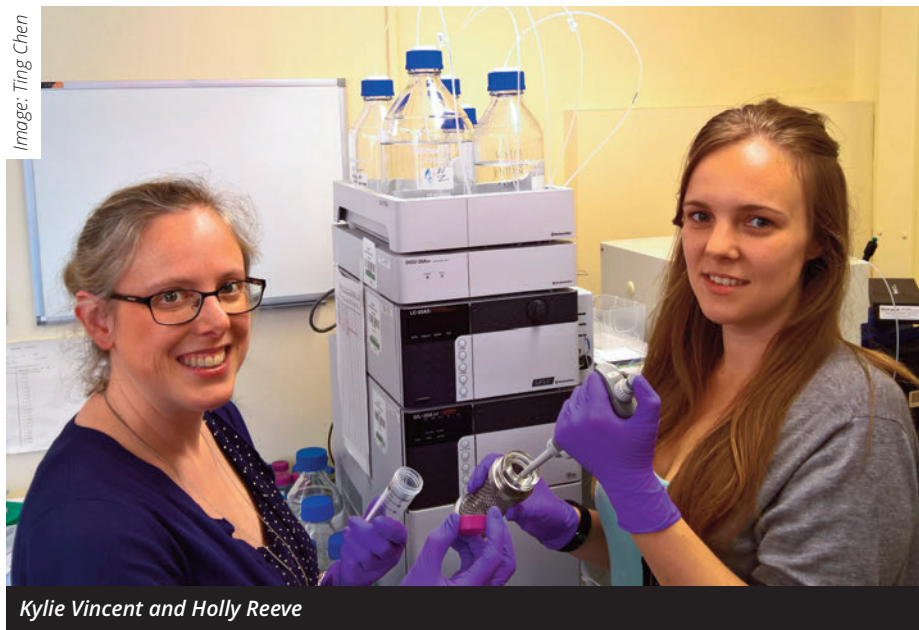


Image: Ting Chen

Kylie Vincent and Holly Reeve

Although the use of enzymes as biocatalysts in chemical synthesis is really taking off, a key challenge is developing an efficient supply of NADH. We quickly realised that we could make use of components from bacterial cells to assemble a system for recycling NADH that could be used outside of the bacterial cell by incorporating some of the cell components onto cheap carbon beads. The use of hydrogen gas as the energy source to drive the chemistry gives a much cleaner way of supplying the NADH for enzyme-catalysed chemical synthesis².

We developed this into a technology that we call HydRegen (short for hydrogen-driven regeneration). We were able to show quite quickly that our HydRegen beads work with a wide range of NADH-dependent enzyme reactions. This was a key finding, as it

increases the potential applications of the technology. We filed a patent application with support from Oxford University’s Technology Transfer company, Oxford University Innovation, and began talking to some of the companies that are interested in using NADH-dependent enzymes to make complex chemicals.

One of the questions we were frequently asked was whether we could extend to the related biological cofactor NADPH (nicotinamide adenine dinucleotide phosphate), as this is essential to many other industrially relevant enzymes. However, NADPH presents even more of a headache in industrial applications of enzymes as it is more expensive and less stable than NADH. After winning the prestigious Royal Society of Chemistry’s Emerging Technologies Competition

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in 2013, we were mentored by Dr Ian Churcher from the pharmaceutical company GlaxoSmithKline, who helped to advise us on development of the technology.

GlaxoSmithKline were natural partners as we started to explore the scope for extending our HydRegen beads to NADPH in an industrial setting. Together, we secured short-term funding in the form of a Business Interaction Voucher from the Metals in Biology BBSRC NIBB, to test whether we could produce enough NADPH to drive some NADPH-dependent enzymes that GlaxoSmithKline are interested in. The project was successful, and provided real proof of the versatility of the HydRegen technology.

However, major research challenges remain. The two enzymes we use are excellent biocatalysts – the hydrogenase enzyme splits the hydrogen molecule, causing electron transfer through the electronically conductive carbon beads to support the recycling of NADH (or NADPH) at the other enzyme. But they are complex metalloenzymes that can only be produced in bacterial cells.

Although making these enzymes for use in the lab is now relatively straightforward, making them on an industrial scale remains uncharted territory. We still need to find the best ways to make the bacteria produce these enzymes in high quantities, the minimal steps needed to isolate the enzymes, and the best ways to handle them once they are separated from the cells. To address these research challenges, we applied to a government funding scheme called the Industrial Biotechnology Catalyst scheme (run through the BBSRC/EPSRC/Innovate

UK), and in January 2016 we were awarded £2.9 million of funding for a major research programme to explore and de-risk the scalability of the HydRegen technology.

We have assembled an industrial advisory board, taking advantage of industry contacts we have made along the way at Oxford University-led meetings, at Metals in Biology BBSRC NIBB meetings, and with help from Oxford's technology transfer team. The advisory board is helping to keep the project focussed on addressing real industry challenges in biotechnology.

“A Business Interaction Voucher from the Metals in Biology BBSRC NIBB, to test whether we could produce enough NADPH to drive some NADPH-dependent enzymes that GlaxoSmithKline are interested in provided real proof of the versatility of the HydRegen technology.”

The Industrial Biotechnology Catalyst-funded project is now up and running successfully, and one of the most exciting parts of the first six months has been seeing the project generate new fundamental insight into the enzyme systems and new patentable discoveries, as well as advances in the core HydRegen technology itself. We have also continued to make industrial contacts and develop our commercialisation strategy in conjunction with Oxford University Innovation.

We have always enjoyed the interplay between detailed studies of enzyme function and development of applications of enzyme biocatalysis. In parallel to the Industrial Biotechnology Catalyst project, we continue to work on fundamental studies into hydrogenase enzymes, and to develop new tools for studying metalloenzymes, supported

by BBSRC responsive mode grants on which we are co-investigators³. Our strengthened understanding of how hydrogenase enzymes work, and the accumulation of related know-how in the group continues to feed very productively into our development of the HydRegen technology.

Indeed, the Industrial Biotechnology Catalyst funding should help this technology to cross the so-called 'valley of death' that often impedes early-stage technologies. With this funding, and our additional grants, we hope to bring the HydRegen system to market in the next 3-4 years.

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Metals IN BIOLOGY

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The importance of Open Science for Europe's university sector

The European University Association (EUA) and its Expert Group on 'Science 2.0/Open Science' are supporting universities in Europe in the transition to Open Science. Here, Dr Lidia Borrell-Damián, Director of Research and Innovation explains to Adjacent Government how...

Open Science is critically changing the way scientific research is being conducted, accessed and utilised both by scientists and society at large. The rapid development of Open Science facilitated through IT development is generating new and alternative ways for scientists to perform, publish and disseminate their research. It also has an impact on researcher career assessment, publication quality review and scientific reputation systems. Moreover, Open Science looks set to change the whole research landscape, and its implications are becoming more tangible for researchers, university leaders and administration, research funders, learned societies, scientific publishers and policymakers at national, European and global levels.

For its part, the European University Association (EUA) has been following up the developments in the area of Open Science from an institutional perspective, since 2007. In early 2015, with a view to supporting more and better institutions across the wide range of issues related to the [EU Digital Agenda](#), the EUA Council set up the [Expert Group on 'Science 2.0/Open Science'](#) in order to develop actions in the framework of the [2015 EUA's Antwerp Declaration](#). This underlined the importance for universities of pursuing the opportunities offered by rapid technological change in both research and teaching, based on the principles of scholarly sharing and academic collaboration.

The work of the Expert Group is grounded in EUA's previous activities, namely the [recommendations on Open Access](#) (2008), and the Task Force on Open Access (2012-2015) which worked towards the [briefing paper on Open Access to research publications](#) (2014), [EUA's Open Access checklist for universities](#) (2015) and the annual Institutional Open Access survey (since 2014). The Expert Group works in close collaboration with

EUA's National Rectors' Conferences and university members. It focuses on a broad range of issues related to Open Science, such as Open Access to research publications and data, research infrastructures, researcher assessment and career development, quality of publications, text and data mining (TDM), copyright, data protection and peer-review systems.

“Being an active and by far the largest stakeholder for universities and NRCs in Europe for more than a decade, EUA considers Open Science to be of utmost importance for further enhancing the competitiveness and attractiveness of the European university sector.”

The activities of EUA and its Expert Group revolve around issuing recommendations and guidelines, supporting institutions in negotiation processes with scientific publishers and making efforts to accelerate the transition towards a more open scientific system. In doing so, the progress of the transition will be closely monitored in order to ensure that its benefits extend to all institutions and researchers across Europe. The first of these initiatives was the publication of the [EUA Open Access Roadmap for Research Publications](#) in February 2016, which was intended as a contribution to facilitate universities' transition towards an innovative, fair and sustainable publishing system.

In line with its Open Access Roadmap, EUA is convinced that universities and scientists should have adequate and cost-effective platforms for collaborating, disseminating and using scientific publications openly, especially in the framework of publicly funded research. With the developments in Open Science and particularly in Open Access, new ways of producing, accessing, collecting, disseminating, and using research outcomes



are constantly emerging. These trends call for changes in traditional publishing systems which can lead to improved scholarly communication systems.

Regarding research publications, EUA aims to contribute to move towards a publishing system that is simultaneously fair and transparent for all stakeholders, including universities, research institutions, libraries, researchers, research funders, learned societies and commercial publishers. EUA is committed to working towards a system that seeks to achieve a balance of realistic costs and benefits shared between all stakeholders, considering that scientists have simultaneously the critical roles of content providers and peer-reviewers of research publications. The support of governments and funding agencies is crucial in this context. As the movement of Open Science is gaining momentum globally at political, institutional and scientific levels, it is now the time to progress towards a more open and sustainable scientific eco-system. With its unique views on the university community, EUA supports a number of important initiatives relative to Open Science and Open Access, namely the Max Plank

Digital Library [Expression of Interest](#) on “Large-scale implementation of Open Access to Scholarly Journals”, the San Francisco Declaration on Research Assessment (DORA) and the [Amsterdam Call for Action](#) on Open Science promoted by the EU Dutch Presidency.

Being an active and by far the largest stakeholder for universities and NRCs in Europe for more than a decade, EUA considers Open Science to be of utmost importance for further enhancing the competitiveness and attractiveness of the European university sector. EUA and its Expert Group look forward to supporting its membership in the transition towards Open Science and to continuing the dialogue with all relevant stakeholders, policymakers and politicians. ■

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How innovative is the UK?

Natasha Levanti, Group Communications Executive at the Association for Consultancy and Engineering examines the status of innovation in the UK...

The European Innovation Scoreboard 2016 was released this July, something which only caught the attention of a few, while it is a significant comparative indicator to move the UK forward as a global competitor.

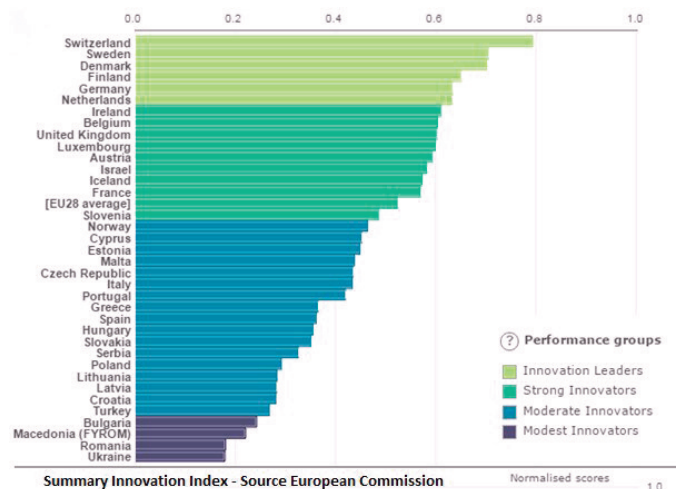
All forms of building, construction or infrastructure are dependent on innovation to reach the next level of future demands, such regional comparisons are vital, particularly as Brexit has emphasised the need for UK innovation to continue in order to remain globally competitive.

“As companies are in the midst of preparing for uncertainty throughout the withdrawal negotiation process, efficiency and innovative approaches to a business’s position in markets is key. While it is apparent in the European Innovation Scoreboard 2016 that the UK efficiently utilises what funding is available, it is vital that going forward innovation is cultivated, not just in monetary funding but also in business mentality.”

In this year’s ranking, amongst EU members Sweden is the innovation leader, followed by Denmark, Finland, Germany and the Netherlands.

The United Kingdom, was ranked as a strong innovator, in the position of 8 (amongst EU countries), remaining above the average level of innovation within the 28 member states of the European Union.

Within the European Innovation Scoreboard, it is intriguing to note, with the alternatives the EU membership considered, the comparative performance of Norway, Switzerland, Luxembourg and other non EU countries. When included in the rankings Switzerland has the

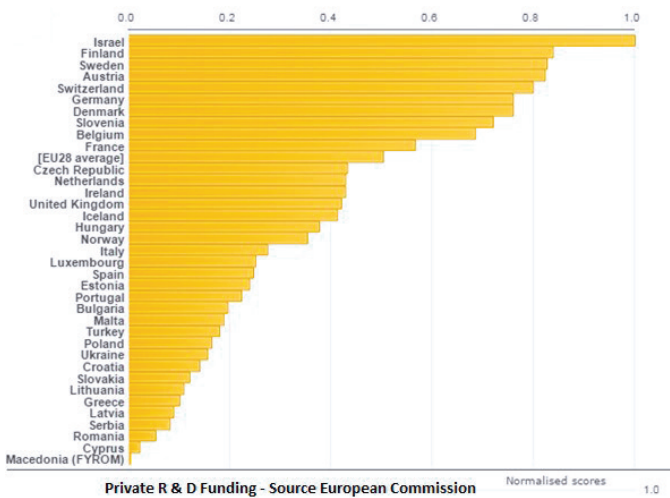
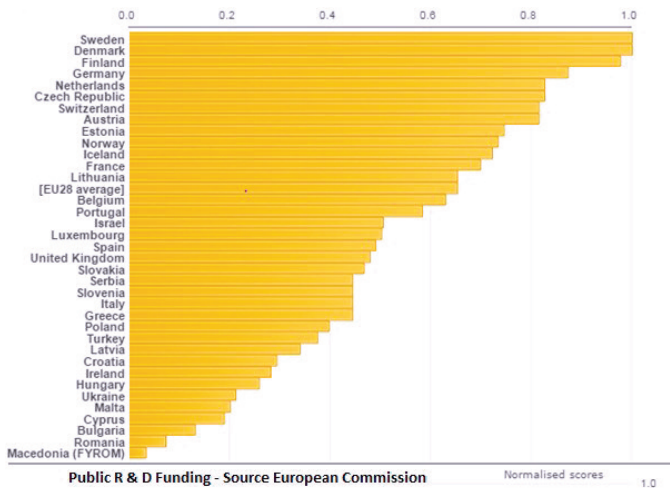


highest ranking of all countries measure for innovation, while Luxembourg is ranked as a strong innovator and Norway is considered a moderate innovator.

However, when looking comparatively at countries’ levels of innovation, an unavoidable topic is public, as well as private forms of support for research and development. When this is examined comparatively the UK shines. With the 2016 amount of public or private investment in research and development in the UK, it is clear that the country is able to maximise potential forms of innovation. Ranking 12th out of the EU 28 for business R&D funding, and 15th for public R&D funding, to place 8th for innovation amongst the EU 28, means the UK is able to efficiently use funds and as a society is more likely to embrace innovative thinking.

Going forward, harnessing this innovation potential fully will be a key way to stay and increase competitiveness as the UK faces uncertain business conditions going forward.

As companies are in the midst of preparing for uncertainty throughout the withdrawal negotiation process,



potential of innovation in infrastructure will set businesses apart, with some businesses being able in this time of uncertainty to deliver quality products that have long term cost benefits to clients.

Until a suitable trade agreement is reached with the EU as well as trade agreements settled with other countries that currently fall under EU trade agreements, the UK must not lapse into what has always been done, but push past what is perceived to be impossible.

“All forms of building, construction or infrastructure are dependent on innovation to reach the next level of future demands, such regional comparisons are vital, particularly as Brexit has emphasised the need for UK innovation to continue in order to remain globally competitive.”

In his remarks following the EU referendum results, David Cameron concentrated on the strength of the UK in going forward. He identified the UK as, “a great trading nation, with our science and arts, our engineering and our creativity respected the world over.”

Particularly in the uncertainty that has developed in the post referendum period, innovation is a key way in which Britain can retain and grow its global competitiveness. ■

efficiency and innovative approaches to a business’s position in markets is key. While it is apparent in the European Innovation Scoreboard 2016 that the UK efficiently utilises what funding is available, it is vital that going forward innovation is cultivated, not just in monetary funding but also in business mentality.

Infrastructure must embrace innovation, maximising what is available to exceed client expectations. While rumours abound regarding the impact that Brexit uncertainty will have on project funding, it is not business as usual. Though innovation does require a degree of resource investment, embracing the high

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Accreditation comes of age

UKAS highlights why accreditation is a valuable tool in a number of policy areas...

History has shown that whilst regulation can be a useful tool for effecting change, it can also be burdensome on business, expensive to enforce and doesn't always deliver the intended result. In conjunction with standards, accreditation provides policy makers with a cost effective alternative to regulation that delivers increased adoption of best practice and the highest degree of confidence in compliance.

The disciplines associated with accreditation can be applied to almost any area where there is a need for measurement or assessment, especially in support of better regulation and the delivery of government policy. As a result, accreditation is increasingly being recognised as a valuable tool across a wide range of policy areas, including deregulation, good governance, fair markets and international trade.

2016 sees the United Kingdom Accreditation Service (UKAS) celebrating the 21st anniversary of its establishment to be the UK's National Accreditation Body. However, accreditation and standards have been helping government departments deliver certainty in an uncertain economic and political climate for over 50 years. From its relatively narrow roots in manufacturing and engineering, UKAS accreditation now encompasses such diverse activities as food safety and quality, forensic

science, health and social care, energy supply, environmental change, personal safety and fair banking.

Although UKAS' primary relationship with government is through its Memorandum of Understanding with the Department for Business, Energy & Industrial Strategy (BEIS), UKAS operates on behalf of a wide range of departments and agencies. Looking to the future, UKAS is currently working with government to see how accreditation can support policy in areas as diverse as pet shop licencing, cyber security, mobile phone cell site analysis, financial advice, anti-money laundering and Building Information Modelling (BIM).

Accreditation is a global activity and from the outset UKAS has taken a leading role in the development of accreditation worldwide. It has been instrumental in the adoption of mutual recognition agreements that provide for the international acceptance of certificates issued by UKAS and UKAS accredited organisations thus making a major contribution to UK trade.

Despite the result of the recent EU referendum and reorganisation of government departments that followed, UKAS does not expect its relationship with government, its international status and status of certificates issued by UKAS accredited organisations to change in the foreseeable future.

Whilst the situation following the exit from the EU will depend on the terms of the package negotiated, UKAS expects the international recognition of its certificates will continue through its membership of the European co-operation of Accreditation, the International Laboratory Accreditation Co-operation and the International Accreditation Forum. Similarly, the transfer of sponsorship of UKAS to the newly formed BEIS is unlikely to result in any change in government policy on the increased use of accreditation in support of public confidence and international trade.

With a growing reputation at home and abroad, UKAS is well placed to deliver confidence for the next 21 years and beyond.



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GOVERNMENT

Size does matter

Additive layer manufacturing (ALM) is a rapidly growing technology receiving widespread attention from a multitude of industrial sectors for component repair and manufacture. The layer-by-layer process has evolved significantly over the past couple of decades and is now capable of fabricating near net shape, fully dense structural parts via two distinct routes: blown-powder (BP) or powder-bed (PB) manufacturing. BP has found use in repair scenarios for advanced, aero-gas turbine bladed disk components, otherwise referred to as 'blisks', where a complete overhaul of the part could be costly and timely, whereas additive repair could be performed in-situ. PB technologies, however, are more prominent in the manufacture of whole components. In 2015, a flying test bed A380 aircraft from Airbus provided a significant milestone in the world of ALM, demonstrating a Rolls-Royce Trent XWB-97 engine that was equipped with 48 aerofoil shaped vane components, each of which were produced by ALM.

The emergence of ALM is linked to the significant benefits that the process can offer, compared to more conventional manufacturing processes, such as forging or casting. These include considerable cost savings due to less

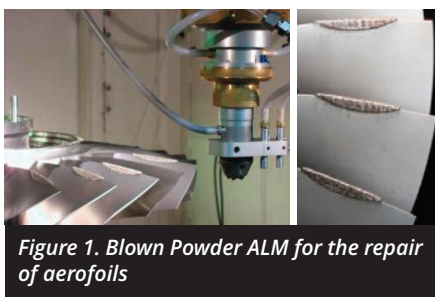


Figure 1. Blown Powder ALM for the repair of aerofoils

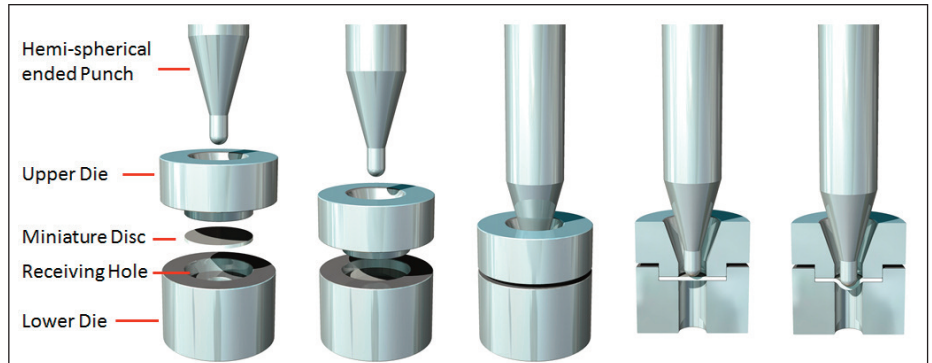


Figure 2. Small punch test set up

material wastage, short lead times and improved buy-to-fly ratios, whilst also being capable of forming highly intricate components that would not be possible with more traditional methods.

Understanding the transient microstructures which are typically produced in ALM build material, which can lead to a significant variance in the mechanical properties across the component, is a fundamental research requirement. Furthermore, considering the multiple interactions of the intra and inter build process variables on the integrity and consistency of the final structure, traditional laboratory scale test approaches are deemed unsuitable for mechanical characterisation as it is difficult to extract representative test specimens which comply to the relevant International test standards.

In recognition of this issue, academics and researchers from the Rolls-Royce University Technology Centre (RRUTC) in Materials at Swansea University, have devoted significant effort in defining methodologies that can accurately define the mechanical characteristics of such complex mate-

rials. The RRUTC is based within the Institute of Structural Materials (ISM) at Swansea University's new Bay Campus, and currently consists of a team of 6 academics supported by 15 research officers and a rolling cohort of over 30 postgraduate PhD or EngD students. The ISM is supported by Swansea Materials Research & Testing Ltd. (SMaRT), an ISO 17025 accredited commercial test facility that supplies design quality mechanical data to a range of companies within the structural material sector. From this group, a team of 6 scientists have formed under the supervision of Dr. Robert Lancaster working in unison with senior technologists and engineers from Rolls-Royce plc.

One approach adopted by the team to characterise these 3D build geometries is small scale testing, which can provide a discrete means of attaining mechanical property information from materials of limited dimensions. One such technique is the small punch (SP) test where miniature disc specimens can be extracted in a variety of orientations from the build to evaluate the anisotropic nature of the part, thus providing important, localised data.

PROFILE

The SP test is a miniaturised mechanical test method that has previously been employed to evaluate neutron irradiation damage in nuclear reactor materials and for remnant life assessment of power plant components extracted from operation. The primary advantage of this approach relates to the small volume of test material required, such that the test technique has been employed across laboratories worldwide to obtain creep rupture lives and tensile fracture data on a wide variety of different material systems. SP also offers the ability to correlate test data generated through such methods to those produced from more conventional approaches, making the test methodology a practical and attractive solution for many geometry related issues where material characterisation is required. Much research has now been published by the Swansea led collaborative team on materials ranging from single crystal superalloys for high pressure turbine blade applications, titanium alloys for fan blades and intermetallic titanium aluminides for low pressure turbine blade components. With this knowledge, the SP test is now being employed to assess the properties of additive layer structures.

The test typically comprises of a round miniature disc specimen, 9.5mm in diameter and 0.5mm in thickness, which is clamped between a die set, from which a load is exerted onto the

top surface through a hemi-spherical ended punch. From here, depending on whether the load is applied under constant displacement or constant load, a representative tensile or creep curve is produced.

The results are comparable to more conventional test approaches, particularly the SP creep test which typically exhibits the classical 3 stages of deformation, which are widely recognised from uniaxial experiments. A European Code of Practise for Small Punch testing was formulated in 2009 to ensure consistency across multiple international test houses and institutions, from which a creep correlation factor, or the k_{SP} factor, was proposed, where the SP load may be correlated to a uniaxial creep stress in order to compare SP and conventional creep data. This method has found widespread success in a number of material systems and is now widely accepted.

Given the transient and anisotropic nature of the microstructure in ALM structures, SP specimens can sample isolated regions of interest and reveal any variance in the properties across the build. Naturally, this is of high importance in the design of ALM components, helping to identify regions susceptible to a variation in properties, information that is impossible to gain from more conventional, larger scale mechanical test approaches.

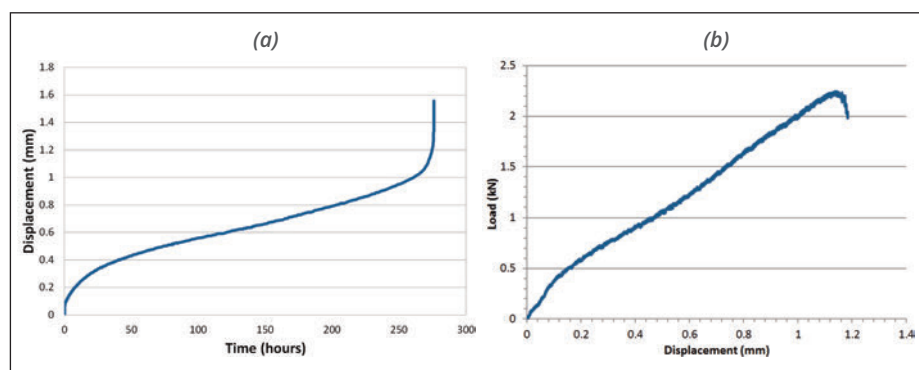


Figure 3. SP curves for a nominal PB nickel alloy showing (a) creep behaviour and, (b) tensile response

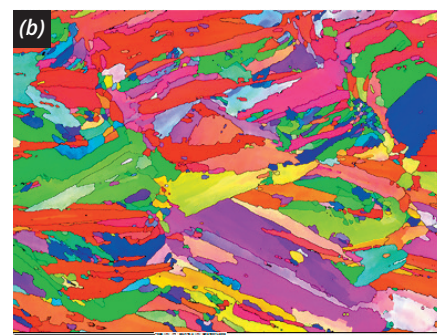
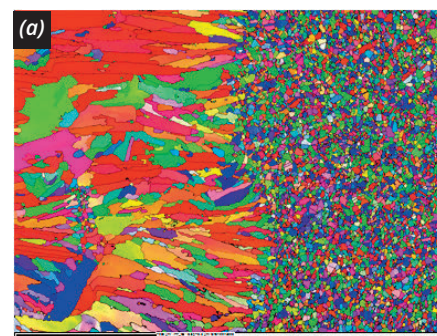


Figure 4. EBSD maps of (a) the bondline between wrought and BP variants of a nickel based alloy and (b) 1mm into the ALM build, highlighting the variation in microstructure and micro-texture

1 R.C. Hurst, R.J. Lancaster, S.P. Jeffs, M.R. Bache "The contribution of small punch testing towards the development of materials for aero-engine applications". *Theoretical and Applied Fracture Mechanics* (2016) 10.1016/j.tafmec.2016.07.013

2 R.J. Lancaster, G.R. Davies, H.W. Illsley, S.P. Jeffs, G.J. Baxter "Structural Integrity of an Electron Beam Melted Titanium Alloy". *Materials* 9(6) (2016) 10.3390/ma9060470

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Getting inspired to study physics

Antigone Marino, a Member of the European Physical Society, and Researcher at the Italian Research Council's Institute of Applied Sciences and Intelligent Systems, outlines the challenge of getting young people interested in physics...

Assume that everyone has seen at least one TV show in which a young lawyer succeeds in exposing a corrupt politician, or saves the world from the shady interests of a multinational company. Likewise in our imagination and in Hollywood movies, there are plenty of beautiful and talented doctors working every day at the forefront to save lives. However, we all know that the daily task of most of the lawyers and doctors are routine, simply because it is statistically highly probable that you know one. Though fascinating on the big screen, we know that a lawyer will handle simple divorces, or cases for car accidents, and a doctor will deal every winter with simple colds. But now let us ask ourselves, what does a teenager know about the physics profession?

Unfortunately, physicists have to compete with an image at the highest level, because the first word that a teenager connects to physics is "Einstein". And TV is not helping us (yes, I am a physicist), even though we finally got our own series. Take the case of *The Big Bang Theory*, a group of 4 roommates whose intelligence, creativity and passion for physics, leads them to have a life everything but boring. All this is obvious, no one would produce a TV show about how boring life can be. And to be honest, I believe that, on average, a physicist's life is everything but humdrum. But the point we are discussing here is the difficulty for a teenager to have a real picture of the job of a physicist. Because it's probably true that he or she has never met a physicist.

In a time of high unemployment, society has a responsibility to inform young people about the career opportunities that come from studying physics, which has different outlets, such as academia, research, industry, education, banking, insurance and scientific communication in general. The channels that society has to

inform are varied. The first is definitely in high school, which has the task of placing physics in the spectrum of studies and careers that a young person can take. However it is not easy for the school to describe well and suitably present such specific professions as the one of a physicist. Just as it would not be easy to explain the work of a geneticist, or an astronaut.

"In 2010, the EPS launched the Young Minds project, which has the goal to promote the study of physics to the next generation of scientists."

Inspiring young people to get closer to the study of physics is one of the priorities of the European Physical Society (EPS). Born in an era without the Internet and pdfs, during the social upheavals in 1968, EPS is a non-profit association whose members include 42 national physical societies in Europe, individuals from all fields of physics, and European research institutions. As a learned society, the EPS engages in activities that strengthen ties among physicists in Europe. Being a federation of national physical societies, the EPS studies issues of concern to all European countries relating to physics research, science policy and education.

EPS has always recognised outreach as the most effective tool for the community involvement. On the one hand, outreach allows EPS to attract young people to the study of physics, on the other it works to replenish its member's pool guaranteeing the generational change.

Linking up to what we were saying before, we must ensure that a young person with a predisposition to physics can come into contact with this community to understand what it is. So, without delegating to television fantasies, EPS promotes various outreach activities for schools and the general public to provide this

Image: © Antigone Marino



contact, and show how useful physics research is to our daily lives. Just think of how the LASER has changed the way we communicate, or how optical fibers have allowed for laparoscopic operations, or as the need to analyse and share large data amounts has given rise to what we now call the World-Wide Web.

In 2010, the EPS launched the Young Minds project, which has the goal to promote the study of physics to the next generation of scientists. Young Minds uses the energy and talents of young physics students to carry the message of the wonder and impact of physics to members of their local community: other university students, the general public, elementary schools etc., In fact, young physicists become ambassadors of this message, which explain how the study of physics is fundamental to our society.

We cannot quantify yet if and how this project might have influenced young people on the choice of physics as a profession, and perhaps we could never measure or calculate it. But it is certain that Young Minds allows the contact we are speaking of, it allows people to meet a physicist and understand that you do not have to be Einstein to start this profession.

It is not easy to inspire people, it is not easy to find the proper tool, or audience.

I remember the day I read Galileo Galilei: "Philosophy is written in this grand book, the universe, which stands continually open to our gaze. But the book cannot be understood unless one first learns to comprehend the language and read the letters in which it is composed".

And I got inspired. ■

Antigone Marino **Member**

European Physical Society
www.eps.org

Researcher

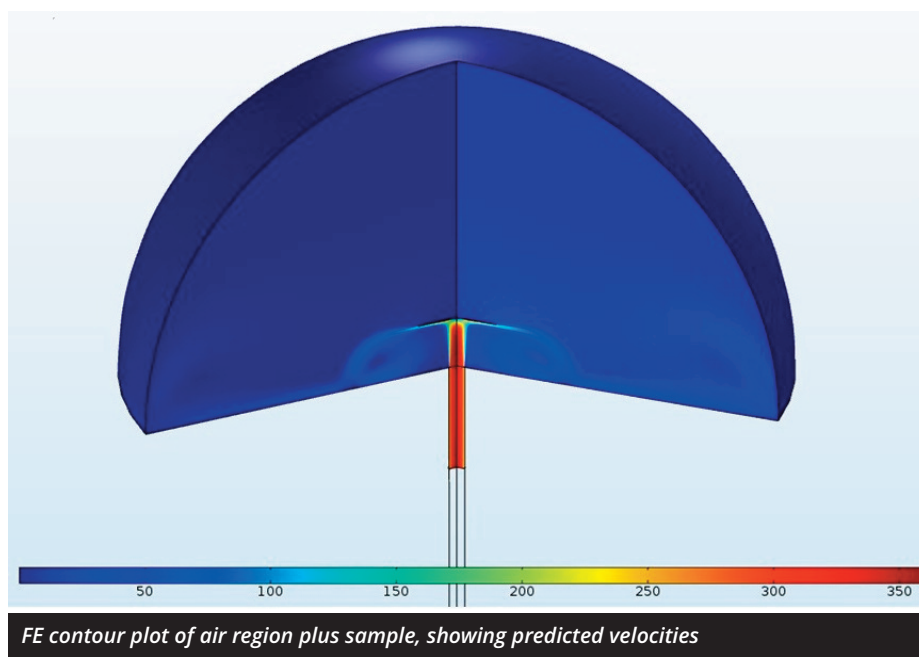
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Modelling particulate erosion, improving material performance

By modelling particulate erosion, Dr Louise Crocker of the National Physical Laboratory hopes to improve design and understanding of materials...

The efficiency of high temperature energy generation plant and aero-engines is critically impacted by solid particle erosion, particularly at elevated temperatures. The cause and type of solid particle erosion varies across different industries and locations in plant. In all cases the performance of materials can be improved through better surface engineering and coatings, but this is restricted due to lack of generic models, well-controlled and instrumented tests, and international standards. For industry the long-term aim is to develop a system where the components are manufactured from appropriate materials, the materials degradation modes are identified, and that models exist to predict material performance.

A review in 2010 identified the limited number of high temperature solid particulate erosion (HTSPE) testing facilities worldwide for the measurement of high temperature particulate erosion. Those that exist are limited in terms of the particle velocity and temperature. A European initiative – MET-ROSION – had a primary objective to develop a metrological framework necessary to fully instrument and monitor HTSPE testing. As part of this initiative, the National Physical Laboratory (NPL), the UK's National Measurement Institute, designed and built a new HTSPE facility to extend the capability of high temperature erosion tests, carrying out experiments at



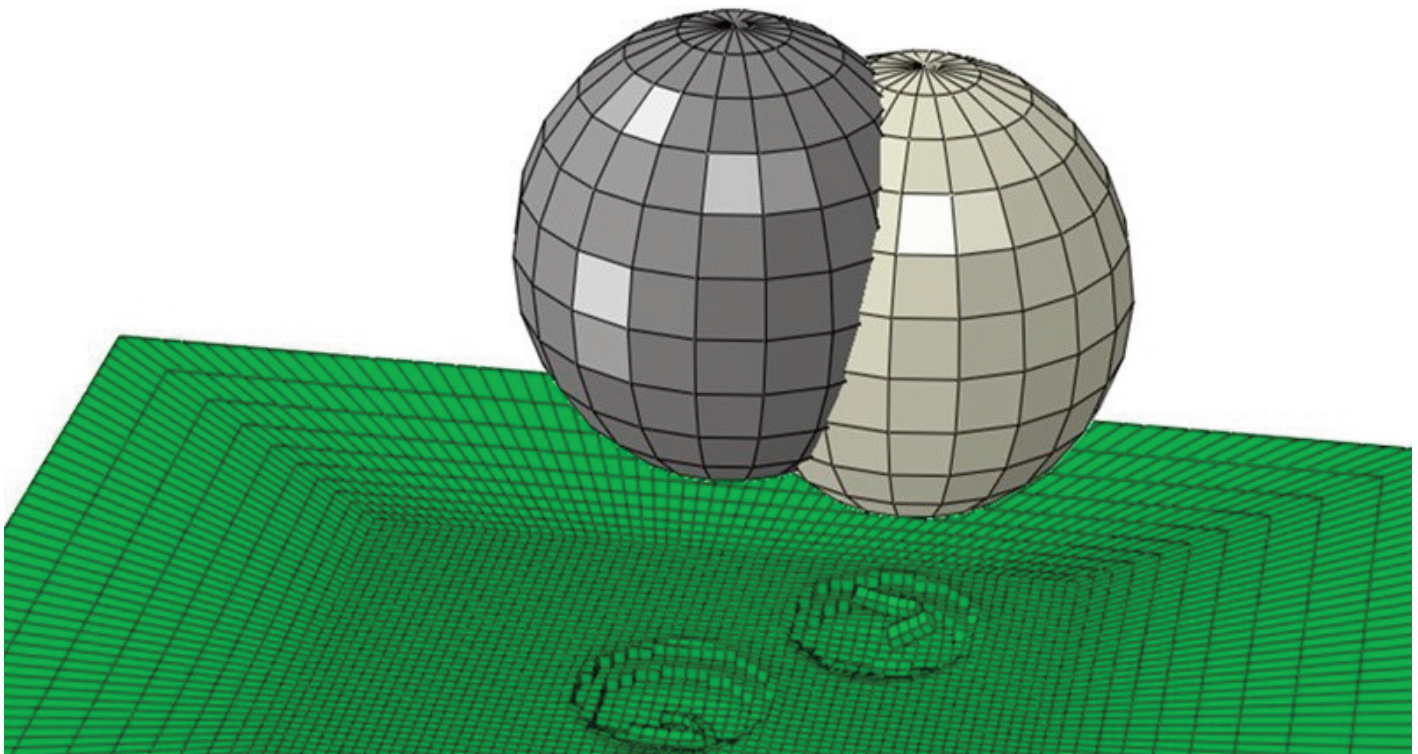
temperatures up to 900°C and particle velocities up to 300 ms⁻¹. The novel design approach for the new NPL rig involves the use of a compact air heater. This connects directly to the particulate delivery nozzle providing a simple method for heating gas to any required temperature.

To achieve the necessary performance envelope of the nozzle, an extensive period of design using Finite Element (FE) modelling was conducted by modelling experts within the Materials Division at NPL. To ensure the nozzle would meet the requirements before machining the component, a parametric study was carried out to select the dimensions of the nozzle, balancing the gas flow, gas pressure and nozzle geometry to achieve the design goals. Simulations were conducted for the

chosen optimum dimensions, changing the inlet pressures and flow rates within the permissible ranges, to make sure that the target outlet speed of 300 ms⁻¹ was achieved at a temperature of 900°C. Validation analyses were carried out using the same modelling principles to represent an existing nozzle used on a partners HTSPE apparatus; the predictions agreed well with experimental data.

The use of FE modelling has been fundamental in defining the experimental set-up of the new HTSPE rig. By extending the nozzle model to include the sample and air, enabling prediction of the gas plume as it leaves the nozzle and reaches the sample, the effect of parameters such as stand-off distance and impact angle on the gas flow exiting the nozzle and impacting

PROFILE



FE model of two particles impacting at different locations. Note: the particles appear to collide but in fact no interaction takes place between the particles

the sample were studied. This modelling showed the influence of impact angle on the vertical and horizontal velocity components, showing that a glancing angle impact, e.g. 30°, generates a large area of stable horizontal velocity.

We know that erosion is a complex process, strongly affected by factors such as shape, size, density and hardness of the erosive particles, properties of the substrate/coating, particle velocity and impact angle. Material degradation is often unavoidable but the ability to model the erosion process allows us to improve design through better material selection and the use of erosion reducing measures. Modelling of the erosion process is invaluable in interpreting existing experimental data, or extending experimental data to conditions that cannot be tested. At NPL we have developed an FE model to simulate material removal through

the use of advanced modelling tools such as element failure and deletion. The model simulates a small number of particles impacting a substrate and the subsequent loss of material allowing erosion rates to be calculated directly. In setting up the model, no experimentally determined erosion constants are required. Only the material properties needed for the material model are used, thereby using physics and physical properties to model the materials performance rather than empirically fitted data.

Within the model the impact velocity, angle and locations can be controlled to investigate the effect of subsequent impacts. The method also enables the direct prediction of other outputs such as residual stresses, crater depths, plastic strains and particle velocity and displacement. Our model shows clear trends in the prediction of erosion rate with varying impact angle, along

with changes in the particle behaviour – from bouncing off the surface to skimming along the surface – causing more erosion and possible particle embedding. An NPL Good Practice Guide is to be published shortly, giving guidance on the use of FE analysis for predictive erosion modelling.



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Cryogenic technologies for precision tactical and space applications

Honeywell Hymatic has been at the forefront of cooling technology for infrared and sensing applications for over 50 years. Operating in some of the most demanding environments, Honeywell technology increases reliability and efficiency, whilst enabling missiles, satellites, fighting vehicles, underwater weapons and submarines to more effectively and accurately complete their missions.

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Cryogenic technologies
for precision tactical and
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Boosting research in Italy

Stefania Giannini, Italian Minister of Education, Universities and Research, outlines to Adjacent Government how the Ministry are investing in research talent to boost science in Italy...

What makes a European Country competitive and attractive in the 21st century are not natural resources, or merely the cost of employment protection legislation. Conversely, its ability to innovate, to create and to disseminate knowledge will ensure a sustainable future to our citizens and encourage investors to bet on Italy.

Since the beginning of our term, the Italian government has invested on the quality of the human capital, considering it as a key factor for the necessary socioeconomic transformation and development. Knowledge and education really make the difference for the future of our globalised societies and economies.

“The NRP will invest €2,5bn in the next three years, an unprecedented budget that allows us to attract additional national resources. More than 40% of the budget will be devoted to the Human Capital Program: we expect to have more than 6000 researchers and PhD students at the end of the plan.”

With this belief, in last 3 years, Italy has completely overturned the paradigm for education and research policies.

Starting with universities, our policies are oriented firstly to renew the human capital of professors and researchers. We want to attract the best global and European talents, facilitating brain circulation towards Italy.

This twofold goal will be achieved through the recruitment of 500 new full and associate professors supported by the “Natta fund”. Moreover, an extraordinary plan has been launched in order to hire new full professors and



Stefania Giannini, Italian Minister of Education, Universities and Research

more than 1000 researchers in the universities and in the public research agencies.

Our wider, but feasible ambition is aimed at stimulating the creation of an ecosystem open to investments and partnerships from the private sector and from foreign countries.

Only such an ecosystem will allow us to fully emerge our strengths that we assume here as a point of departure for the next challenges. The quality of Italian publications, for example, is certified by the high number of citations, on average comparable to Germany and France performance, with some peaks in medicine and engineering.

Having said that, the National Research Program (hereinafter NRP) constitutes the master-plan of the research for the next 3 years, ensuring that Italian research policies are contextualised in a consistent, predictable and selective framework.

We conceive this plan as the innovative industrial policy for the scientific, economic and social growth of our country.

The NRP will invest €2,5bn in the next 3 years, an unprecedented budget that allows us to attract additional national resources. More than 40% of the budget will be devoted to the Human Capital Program: we expect to have more than 6000 researchers and PhD students at the end of the plan.

Other measures will be carried out in order to reinforce the Public-Private Partnership and Industrial Research Program.

“Starting from the universities, our policies are oriented firstly to renew the human capital of professors and researchers. We want to attract the best global and European talents, facilitating brain circulation towards Italy.”

The NRP paves the way for a better innovation ecosystem and selective funding of joint public-private initiatives. It provides the national research system with an intermediate infrastructure of soft-governance, the National Technological Clusters, which are in charge of proposing technology roadmaps on a national level in different fields.

In addition to this comprehensive master-plan, the Italian government has set a challenge towards 2040: to become a world lead in personalised medicine, oncology and neurodegenerative diseases through the development of an intensive, cross-disciplinary project.

Actually, a comprehensive approach to health and ageing (human technologies) does not yet exist, in part

because of the necessity to integrate cutting-edge technologies with high-profile basic and translational science in critical areas of medicine, data science, nanotechnologies and nutrition.

Italy wants to fill this gap through a large-scale, cross-disciplinary research infrastructure, named “Human Technopole”, which will encompass the synergistic development of fundamental and clinical genomics, nutrition, innovative algorithms for data analysis, multiscale methods in computational life sciences and advanced technologies for food and diagnostics.

The “Human Technopole” will be created in Milan, in the Expo area, by 2018 together with a strong international recruiting action to secure top talents from all over the world. It will host at steady state more than 1,500 researchers (1000 staff units + 500 PhD students), with a strong reverse brain drain effect.

The government will finance the project with €1.5 bn in 10 years.

We conceive it as an asset of a broad strategy that firmly believes in Italian potential to anticipate and create the future through the ideas and the research shared and tested with other scientific communities all over the world.

Italy's present and future competitiveness will depend largely on its ability to transform talent into development, by increasing the knowledge component of our economy and finding new answers to the challenges of society, markets and the environment. ■

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Stefania Giannini
Minister of Education,
Universities and Research

Italian Ministry of Education,
Universities and Research
www.istruzione.it

Leadless pacemakers by Micra System

Corrado Vassanelli, University of Verona School of Medicine details how leadless pacemakers offer an alternative treatment option for bradyarrhythmias patients

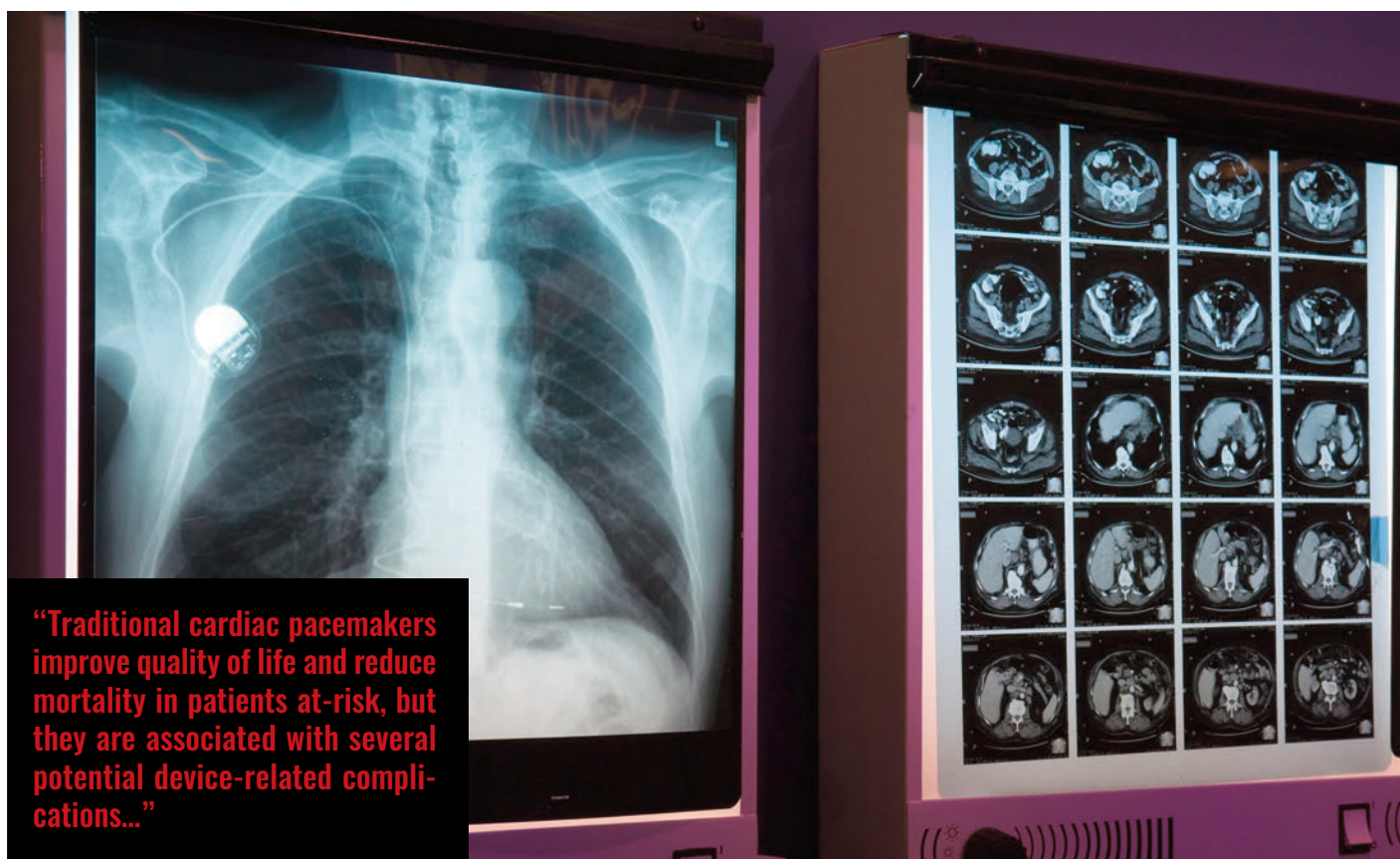
Every year more than 700,000 cardiac pacemakers are implanted worldwide. Traditional cardiac pacemakers improve quality of life and reduce mortality in patients at-risk, but they are associated with several potential device-related complications especially of transvenous leads (e.g. venous obstruction, insulation breaks, conductor fractures, infections). Leadless pacing systems offer an alternative by eliminating the need for permanent transvenous leads while providing therapy for patients with bradyarrhythmias.

The clinical safety and efficacy of the first self-contained leadless pacing device implantation in humans has been reported in the LEADLESS trials.

The second generation Medtronic Micra Transcatheter Pacing System is a 26 mm long and 6.7 mm in diameter device. It is delivered to the right ventricular apex through a 23 French femoral vein sheath. The anode is a circumferential ring located in the proximal portion of the device, and the cathode is at the tip of the device. Four nitinol fixation tines at the distal

end of the device are used to secure the device to the endocardium. Once the tip is at the desired location, the sheath is retracted and the nitinol tines engage the myocardium, fixing the device in place. The sheath is then disconnected from the device and removed from the body.

Reynolds et al recently reported (N Engl J Med. 2016;374:533–541) the results to a prospective, nonrandomised, single-study-group, multi-centre study aimed to evaluate the safety and efficacy of the Micra Pace-



PROFILE



maker System. The analysis of the primary end points began when 300 patients reached 6 months follow-up. The primary safety end point was freedom from system-related or procedure related major complications. The primary efficacy end point was the percentage of patients with low and stable pacing capture thresholds at 6 months. The device was successfully implanted in 719 of 725 patients (99.2%). The Kaplan–Meier estimate of the rate of the primary safety end point was 96.0% (95% confidence interval [CI], 93.9 to 97.3; $P < 0.001$ for the comparison with the safety performance goal of 83%); 28 major complications occurred in 25 of 725 patients. Patients with leadless pacemakers had significantly fewer major complications than did the control patients (hazard ratio, 0.49; 95% CI, 0.33 to 0.75; $p = 0.001$). No device dislodgement was observed. The rate of the primary efficacy end point was 98.3% (95% CI, 96.1 to 99.5; $p < 0.001$ for the comparison with the efficacy performance goal of 80%), among 292

of 297 patients with paired 6-month data. In a post hoc analysis, the leadless pacemaker met the pre-specified safety and efficacy goals with a safety profile similar to that of a transvenous systems while providing low and stable pacing thresholds.

Link compared in *N Engl J Med* (2016 Feb 11;374(6):585–586) two nonrandomised, industry-sponsored studies of leadless pacemakers (the Nanostim device from St. Jude Medical and Micra device from Medtronic).

The implantation was successful in more than 95% of cases (95.8% with Nanostim and 99.2% with Micra). However, Micra had lower major complication rate (4% vs 6.5%), lower dislodgement (0% vs 1.1%) and higher adequate pacing parameters at 6 months (98.3% vs 90%).

These studies demonstrate that leadless pacing is feasible and relatively safe, at least in the short term. Leadless cardiac pacing systems represent

the greatest advancement in bradycardia therapy since the first transvenous pacemaker implantation more than 50 years ago. Long-term results are needed to see whether these devices remain safe and effective over time and are as durable as transvenous pacemakers. Presently leadless systems are restricted to single-chamber ventricular pacing. However, they offer an option for patients with difficult venous anatomy. In the near future dual-chamber and multi-chamber leadless pacing for the treatment of patients with heart failure will likely be developed and a fully leadless technology by subcutaneous ICD and Micra system will provide both bradycardia and tachycardia therapy.



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A smart mirror for cardio-metabolic risk prevention

The SEMEOTICONS project presents the Wise Mirror, a multisensory platform that analyses your face for signs of cardio-metabolic risk and guides behavioural change...

Cardiovascular diseases (CVD) are the leading causes of mortality worldwide. It is estimated that 17.5 million people died from CVD in 2012, representing 31% of all global deaths. The increase of CVD on a global scale is putting a strain on social resources and health systems. Studies published in 2014 demonstrated that the total cost of CVDs in 6 European countries (France, Germany, Italy, Spain, Sweden and the UK) was around €102.1bn – roughly the size of the gross domestic product of a mid-sized Euro-

pean economy such as Hungary. Costs from CVDs in the 6 study countries are expected to increase to €122.6bn by the end of the decade, i.e. €20.5bn over 6 years. Prevention is the way forward, cardio-metabolic risk factors (hypertension, dyslipidemia, insulin resistance, type 2 diabetes mellitus, and obesity) are mainly related to individual lifestyle, including diet, physical activity, tobacco and alcohol consumption, stress and psychological status. Awareness and empowerment of individuals to self-monitor their health status and take

action upon their lifestyle is the winning strategy to preserve health and reduce the incidence and burden of disease.

SEMEOTICONS' Wise Mirror may help people to shift from passive recipients of care towards management of their own health. While you sit in front of the mirror – either as a part of your daily morning routine at home, or at the gym or the pharmacy – the mirror detects signs of cardio-metabolic risk on your face, and advises you on how to reduce the risk through behavioural

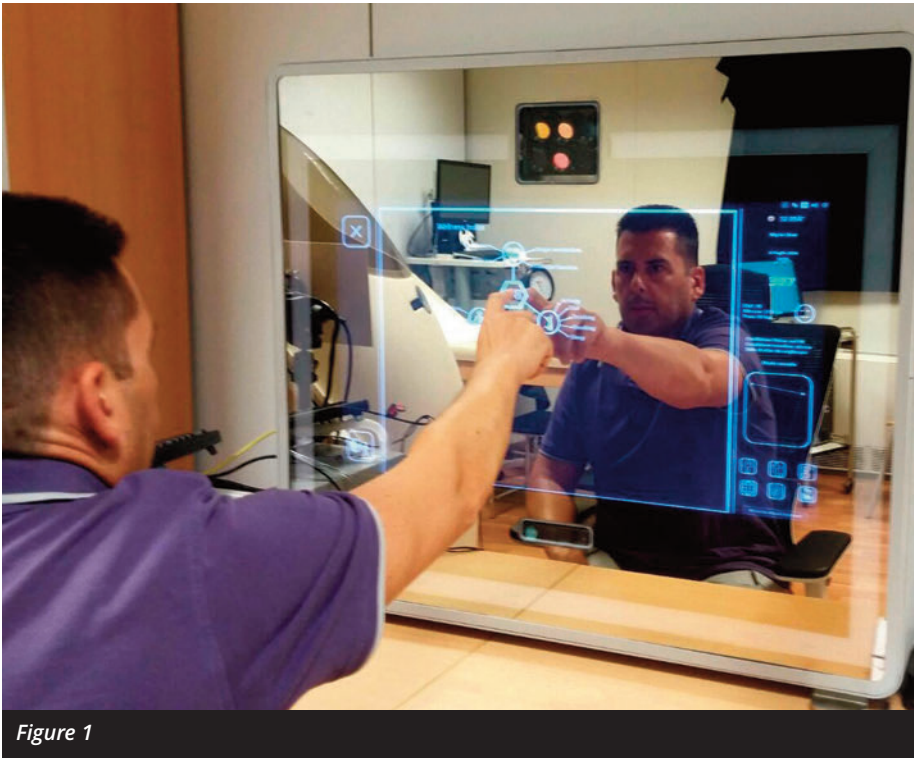


Figure 1

changes (Figure 1). It's not magic, it's science and technology.

Medical semeiotics goes digital

The rationale behind the mirror is medical semeiotics, which has been used by medical doctors since Aristotle's times to deduce one's health status via physical face signs and facial expressions. The Wize Mirror is a multisensory platform that does the same, thanks to a contactless sensing framework and an advanced processing module (Figure 2).

The sensing framework includes a multispectral imaging (MSI) system for skin tissue analysis, made up of 5 compact monochrome cameras with band pass filters at selected wavelengths, and 2 computer controlled LED light sources (white light and ultraviolet); low-cost

3D optical sensors for face reconstruction and bio-morphometric analysis; high-resolution visible cameras for emotional analysis; and a portable device for breath analysis. According to a semeiotic model of the face for cardio-metabolic risk, the MSI system analyses the face skin to quantify AGE (Advanced Glycation End-products) deposits, which are linked to inflammation and atherosclerosis; measure skin cholesterol concentration; and evaluate endothelial dysfunction – a mechanism which may lead to coronary artery disease – in facial skin microcirculation after thermal stimulation by a remote skin heater. The 3D optical sensors support face detection and recognition, 3D head pose tracking, face segmentation and labelling, and 3D reconstruction to detect and monitor over time morphological changes

due to weight gain, since overweight and obesity are major factors for cardio-metabolic risk. The visible cameras record video sequences, which support expression analysis (head, eye and mouth movements) and colorimetric analysis (skin pallor, redness, jaundice) to account for stress, anxiety and fatigue; other contactless estimates of physiological parameters include respiratory rate, heart rate and heart rate variability. Finally, the gas sensing device analyses the breath composition and gives quantitative feedback about noxious habits such as smoking and alcohol consumption.

“We believe that the Wize Mirror is a practical and innovative eHealth solution which offers a fresh perspective on educational programs and lifestyle intervention for the prevention of cardio-metabolic diseases, with potential impact on the society at large.”

The processing framework calculates a composite wellness index out of the acquired data. This index measures the health status of a person, related to his/her cardio-metabolic risk. Besides the objective measurements gathered from the sensors, the wellness index also takes into account the subjective evaluation of perceived health status. A sensible graphical representation shows the user an estimate of his/her global wellness, along with estimates on the physical, emotional and lifestyle components. The wellness index is traced over time and reported in a health diary for the user (or the practitioner) to consult.

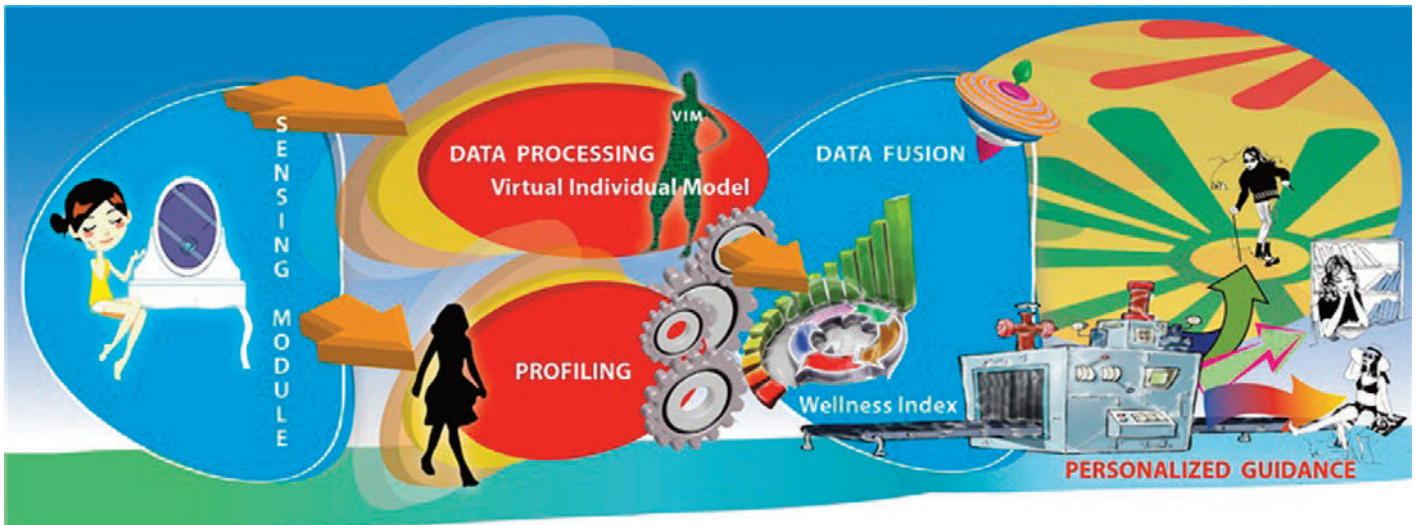


Figure 2

The Wize Mirror comes as the result of 3 years of research and development by 10 European partners (Figure 3), who met technological, scientific, and clinical challenges. From a technological standpoint, the challenge was to develop a non-intrusive platform, integrated into daily-life settings. To face this challenge touch-less data acquisition was mandatory together with synchronisation and real-time processing of multimodal data, end-user experience optimisation, and hardware and software integration. From the scientific perspective, the mirror was built on intelligent methods translating face signs into accurate and sensible computational measures, and their semantic integration towards the evaluation of holistic wellness. Clinical research was meant to develop a semeiotic face model of cardio-metabolic risk, and validate the clinical significance of the mirror against traditional, commercially available diagnostic techniques. Three mirror prototypes underwent validation in clinical sites in Italy and France between July and October 2016. A human study involved 66 volunteers followed for 3 months, on a bi-monthly basis. The study was designed to

assess reproducibility of measures and the potential influence of environmental conditions, on one side; to prospectively assess how the mirror output reflects changes in body composition and metabolism, on the other.

“In the future, more sophisticated mirror versions could be released as medical-device grade instruments, and become part of today’s medical toolbox. As a matter of fact, a device like the Wize Mirror could help physicians in improving counselling on cardio-metabolic risk factors in the general population, especially for primary prevention.”

Target: Improving lifestyle

Upon the assessment of cardio-metabolic risk, the Wize Mirror offers personalised user guidance, to lifestyle improvement for risk reduction. We believe that the key to successful lifestyle intervention is represented by sustained, long-term engagement. Indeed, the increasing adoption of supportive smart devices (e.g., in September 2013 one of 10 US consumers, over the age of 18 owned a modern activity tracker), is counterbalanced by

the fact that most of the consumers stop using the device within 6 months. To drive long-term engagement, the Wize Mirror guidance is based on the promotion of behavioural changes towards both physical and emotional wellness. Most of the people not only want to lose weight or look better, but wish to improve their quality of life and overall wellness. Therefore, the mirror offers recommendations on different target areas related to lifestyle (diet, training, tobacco, and alcohol) and on stress and anxiety management. Also, modulators based on the user profile (e.g., initial health condition, reported self-efficacy, emotional strength) are aimed towards tuning the intervention and to improving adherence to recommendations.

Stimulating initial adoption and periodic utilisation by providing a pleasant user experience, also play a key role in the long-term impact of the mirror. One of the volunteers enrolled in the study at the end of 3 full months of mirror interface stated: “I wish the study could last three more months: for the first time I was able to reduce my weekly alcohol consumption and

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Figure 3

improve my dietary habits having a lot of fun.”

“SEMEOTICONS’ Wize Mirror may help people to shift from passive recipients of care towards management of their own health.”

The road ahead: From academia to market

The Wize Mirror is an innovative technological product which integrates advanced software and hardware solutions. To make a true impact outside academia, it is mandatory for the Wize Mirror to enter the mass market. The first target is the well-being sector. The well-being industry has been advancing rapidly in recent years: collectively, the wellbeing industry was valued globally at \$3,4 trillion in 2013. Nevertheless, the smart mirrors market is still in its earliest stage, and most companies are focusing on automotive, defense and commercial/retail/entertainment, rather than on wellness. The Wize Mirror target market includes gyms, fitness centres, spas, and hotels, which will use the mirror to offer personalised coaching to their clients. High schools could also represent a potential target, after customisation to youngsters. The residential sector can

be initially addressed as a niche market, with the Wize Mirror as a high-end technology product, and become the main target sector when the mirror reaches the cost of a big television set.

In the future, more sophisticated mirror versions could be released as medical-device grade instruments, and become part of today’s medical toolbox. As a matter of fact, a device like the Wize Mirror could help physicians in improving counselling on cardio-metabolic risk factors in the general population, especially for primary prevention. The possibility of close follow-ups by means of an easily manageable technique which periodically provides information on maintaining a good lifestyle by improving diet or exercise, as well as reminding the user to modify dangerous habits such as alcohol consumption and smoking, is an additional time-saving support to busy health professionals.

We believe that the Wize Mirror is a practical and innovative eHealth solution which offers a fresh perspective on educational programs and lifestyle intervention for the prevention of cardio-metabolic diseases, with potential impact on the society at large.



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To assess, or not to assess endocrine disruptors, that is the question

Alberto Mantovani and Francesca Baldi from the Istituto Superiore di Sanità – Roma, Italy outline their thoughts on whether endocrine disruptors should be assessed with regards to health effects...

Endocrine disruptors, (ED from here) are a current challenge in the international arena of hazardous chemicals evaluation. The debate on ED often reaches high-pitched tunes especially in Europe, due to the great move for chemical safety represented by the REACH (Registration, Evaluation, Authorisation and restriction of Chemical Substances) programme. Somebody coming into this arena, who is unaware of ED, might ask whether a (Shakespearean) tragedy is going on.

“Overall ED affects the most complex regulatory network of the body, distributed in several, highly different tissues (pituitary, gonads, thyroid, adrenals, pancreas...). Thus, ED may hit a number of targets with a number of mechanisms.”

Indeed:

- The fatal flaw: all heroes in Shakespeare’s tragedies have a weakness in personality that eventually leads to their downfall (ED themselves, slowly drawn toward banning due to their hazards);
- Fall of the nobleman: many characters in Shakespeare’s tragedies have extreme wealth and power, making their downfall more tragic (let’s look to industry and the European Commission and their investments in economy, reputation, etc.);

- External pressure: Shakespeare’s tragic heroes often fall victim to external pressure from others (let’s look to public opinion, media and ONGs);
- And finally, the hero, who has the opportunity for redemption and victory, but never takes advantage of these in time, which leads to ruin (unfortunately, scientists seem to fit this role).

ED are substances that can cause adverse effects on health by altering the endocrine system function, according to the definition by the World Health Organization (WHO) in 2012. The safety of chemicals is evaluated by the risk assessment process, where (i) critical hazards are identified (e.g. liver toxicity), and (ii) safe levels of exposure are set based on the identified critical hazard(s), taking into account all the uncertainties; the safe levels are then compared with certain exposure conditions (e.g. intended usage levels of a pesticide in fruits) to determine if an appreciable risk does exist.

Together with the great mainstream of toxicology, we are convinced that the risk assessment framework should be adopted whenever possible, with updates from new scientific developments. Indeed, several toxicologists keep maintaining that ED assessment is “business as usual.” ED can cause reproductive disorders and/or

tumours in toxicological tests with laboratory animals, if that’s the case, then let’s set safe levels for such effects.

Unfortunately, what complicates ED risk assessment is the burden of uncertainties.

Overall ED affects the most complex regulatory network of the body, distributed in several, highly different tissues (pituitary, gonads, thyroid, adrenals, pancreas...). Thus, ED may hit a number of targets with a number of mechanisms. True, the current methods can reliably identify ED effects on reproduction and thyroid. However, a number of other targets, such as adrenals, growth hormone or parathyroids, are evaluated less reliably or might even escape evaluation. The first and main example is the endocrine component of the so-called “metabolic syndrome” (diabetes, obesity and hypertension), which is a main cause of disease worldwide. We have no validated tools to screen chemicals for their potential to cause, or increase the risk of, metabolic syndrome. This holds true also for several other endocrine-related diseases, associated to ED exposures by some epidemiological findings. Yet, no robust experimental framework can currently screen chemicals for mechanisms related to endometriosis, polycystic ovary syndrome or osteoporosis. Thus, we can identify part, but not all, of the spectrum of potential ED effects.

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Moreover, ED effects depend on lifestage. One great issue of ED assessments are “low dose” effects. The same term “low dose effect” is unclear: it may indicate an adverse effect observed at doses lower than the “mg/kg body weight” magnitude order usually investigated in standard toxicological assays, it might even hint to the uncertainty about a “lower threshold of effect” for ED that interact with hormone nuclear receptors. Whatever the interpretation, there is sound evidence that organisms during prenatal and, to a lesser extent, post-natal development are more susceptible and, therefore, ED effects may be elicited at significantly lower exposures than in adults. But, again, no validated tools are available to screen chemicals for some highly relevant ED effects on developmental programming. For instance, independent research showed that the developmental exposures to certain ED alter the differentiation of target tissues, making them more prone to develop cancer later in life. Bisphenol A (a diffused, and much debated, plasticizer with estrogen-like action) increases the proliferation of mammary tissue in developing rodents; this effect has been taken into account by the European Food Safety Authority (EFSA) when evaluating bisphenol A (2015), as well as reducing the previous tolerable daily intake by one magnitude order. Yet, toxicological testing must deal with the “universe of chemicals”, beyond the small bunch of highly investigated “usual suspects”: no standardised test is currently available to screen chemicals for their endocrine-related effects on the programming of cancer predisposition.

The uncertainty burden (which includes also other issues besides those discussed above) may imply either i) that ED risk assessment requires a particularly great amount of data (like the EFSA assessment of bisphenol A) or that ii) a precautionary approach is needed, as called by NGOs and part of the scientific world, such as the Endocrine Society. An international workshop organised this year by the Federal Institute for Risk Assessment (Germany) under the auspices of the European Commission pointed out that considerable uncertainties and debate exist on ED assessment; conversely, most ED can be identified here and now, based on WHO definition. The workshop delivered a set of general criteria to identify ED. In addition, to keep criteria as straight as possible, I deem that sub-categories such as “possible ED” should be avoided, unless temporary, i.e., indicating substances for which more studies are needed in order to identify whether they are ED or not. The process should pinpoint in a specific way chemicals of concern: if the system indicates that “almost every substance might be an ED”, the legitimate reaction by risk managers could be “then, if everything is an ED, nothing is an ED”. The approach pivoting on ED identification is currently undertaken by the European Commission, albeit with much debate, excitation and painful delay. ED should be identified in a consistent way across different regulatory contexts (REACH, biocides, pesticides) alike other “high-concern” hazardous substances (e.g. carcinogens). Then, the work of risk managers will start: regulations require that, whilst considering socio-economic

impacts, restriction measures are launched for ED, with substitution featuring prominently.

So, the answer is that identification, rather than assessment, is the priority action to date.

But, some ED, even after drastic restrictions, may persist in the environment and enter the food chains, like brominated flame retardants. Here risk assessment is required: you cannot ban foods.

ENDOCRINE DISRUPTERS

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Making science popular in Italy

Marco Ferrazzoli, Head of the Press Office of Italian National Research Council, and professor at University of Rome Tor Vergata, highlights their aim to make science popular for young people in the country...

'**Q**uo Vado?' of Checco Zalone, the film that has broken all Italian records at the box office, tells a story in which researchers are shown as the positive and healthy part of Italy, as opposed to the protagonist, a slacker looking for a permanent job. Some scenes of the movie were shot in Ny Alesund, in the Arctic base of the Italian National Research Council. A few months later, this was the very place that some students from the Lyceum Filzi of Rovereto visited, accompanied by two teachers and one researcher: a sort of baton passed from the stars of the show to the young people, which raises hopes for the future. Through the communication of scientific topics, we aim to attract more young people into strenuous but beautiful careers in research. This shows how even a simple message, such as that of a comic and commercial movie, can help to promote the activities of universities and research organisations in the country.

In the last few months, the National Research Council has been engaged in many events in order to close the gap between Italian people and the world of scientific research. For example, the 13th anniversary of the first Italian connection to the Internet, celebrated in the Research Area of Pisa; the States-General of health research; the presentation of the National Programme of research and of the new Human Technopole. And, also some events which are open to the public, such as: the night of researchers, which took place in dozens of locations throughout Italy, the first TEDxCnr in Rome, The Science Festival in Genoa, and Remote Future in Naples.

Thanks to these meetings, both in a political aspect and for citizens, in Italy we have begun to talk about research a lot more, with a wide participation of the various parties involved, including: institutions, enterprises, people, and the media. Science is a serious subject that needs not just advertising but a public

debate. Italians generally consider research not as they should; they think of science as an activity that is worthy and interesting, but without being fully aware of how it is actually linked to our future and to the quality of everyday life.

The state of research in our country is complex and there is no magic formula or miracle. We need to reflect on the reasons why Italy has lost its international leadership in information technology, and in scientific and industrial fields such as polymers and aerospace. We must discuss how to find financial and human resources, enough to make good scientific research in a quite critical economic phase. Adequate funding and human resources are needed to improve the state of research at a European and an international level.

The annual report on Science Technology and Society 2016 tells us that the Italians' interest in science and technology is relevant and stable. It suggests that 80% of people watch TV programmes on these topics at least once a month, more than half of the population follows them on the web, 44% in journals and about a third listen on the radio. A significant percentage of Italians visit museums and exhibitions, as well as following meetings and informative debates about science and technology. The level of correct scientific knowledge, measured by three standardised questions, is increasing.

The picture is, however, contradictory. For example, 40% of people do not know if the Sun is a star or a planet. Scientists are often involved and sometimes accused in intricate legal proceedings: we can remember, among many others, the case of the scientist Ilaria Capua and that of Xylella in Puglia, the frequent polemics against vaccines and the so-called Stamina protocol. We're living in a country that "hates science", wrote Paolo Mieli in the *Corriere della Sera*. Maybe, he exaggerates, but in a



book titled 'Word of Scientist', we observe how, in the global village and particularly in the social networks, anti-science criticism is widespread and everyone's opinion is considered equal, so that everybody presumes to be qualified to talk about any subject as an expert. However, knowledge is not considered a value, and the position of the scientist with his precise expertise tends to be confused with a simple opinion.

To conclude: there are positive signs but universities and research institutions must always work to increase awareness on these issues. In particular, science needs to be presented in an attractive way to young people and to the population with a lower education level. We have many tools to do it: television programmes as SuperQuark of Piero Angela; people who are followed by the public, like the astronaut Samantha Cristoforetti, successful books such as 'Seven short physics lessons'

by Carlo Rovelli; and newspapers such as Focus. But first of all we need the direct involvement of researchers, who must leave the laboratories to tell people about their work. In this activity, the engagement of the CNR is strong and constant. ■

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Paediatric ataxias: Complex disorders with many challenges

An Italian clinical and research network aims at improving the diagnosis, management and care of patients with paediatric ataxias...

Paediatric ataxias (PAs) are a large, heterogeneous group of non-progressive (malformative) or progressive (degenerative) conditions, often with a genetic basis. The clinical association of early onset ataxia with a wide spectrum of neurological and non-neurological signs makes these conditions highly disabling, with major consequences in terms of mortality and morbidity.

Clinical data and neuroimaging may remain unspecific, while genetic diagnosis is often impaired by scarce access to testing, high heterogeneity, and limited knowledge of the genetic basis of many PAs. As a result, diagnosis is delayed or remains merely descriptive in many patients, leading to uncertain prognosis and incorrect counselling. Also, the natural history of many forms of PAs is poorly understood and, even for patients with a genetic diagnosis, genotype-phenotype correlates are scarce, with a lack of prognostic indices that could be useful for patients' management. Reliable quantitative ataxia scales in children are missing, making it difficult to properly assess progression and treatment-related improvements. To date, therapies for most PAs (especially non-progressive) are lacking, and effective motor and cognitive rehabilitation remains a key strategy to improve patients' quality of life and favour their inclusion in the social context. Yet, at least in Italy, access to traditional rehabilitation is often



impaired by distance, families' economic issues, limited time availability and long waiting-lists of rehabilitation centres, greatly hampering its potential benefits.

The Italian Network for Paediatric Ataxias

To address these issues, several clinical and research centres specialized in different aspects of PAs have recently gathered to create an Italian Network for Paediatric Ataxias, with support from the Italian Ministry of Health (Network Project, Ricerca Finalizzata 2013) and the Pierfranco and Luisa Mariani Foundation, a private Foundation funding research on paediatric neurological disorders in Italy (PADAPORT project). Among participating centres are the IRCCSs Santa Lucia Foundation and Bambino Gesù Paediatric Hospital in Rome, Eugenio

Medea Institute in Bosisio Parini, Carlo Besta Scientific Institute in Milan, and many others.

The Network, coordinated by the Italian National Institute of Health, has many ambitious purposes, the first being to define a still lacking public health approach in the field of PAs. This objective is being pursued through the creation of a National Registry of Disease, in order to reliably describe the prevalence, incidence, distribution and received levels of care for PAs in Italy, and also to characterise the natural history of different forms. This database builds upon already existing local registries focused on specific PAs, such as Joubert syndrome, Friedreich's ataxia and so on. Such a centralised collection of data is expected to optimise diagnostic algorithms at least for the

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commonest forms of PAs, integrating clinical, genetic and neuroradiological data as well as data on disease progression and response to treatments.

In the long term, the Network aims at putting together an expert panel to define Clinical Guidelines for the management and rehabilitation of PA patients, integrating the use of common strategies and modern, cost-effective, home and lab-based neuropsychological and motor rehabilitation techniques. These guidelines are likely to reduce the social costs for the national health system, by exploiting novel methodologies, reorganising available resources and making diagnosis and rehabilitation widely accessible throughout the national territory. In parallel, a web portal is being created in close liaison with patients' associations to spread information to families, teachers, health and social care givers; a dedicated and reserved area of the portal will be dedicated to the connection of clinicians for faster exchange of information and support, expanding the existing network of professionals.

As a second objective, the Italian PA Network seeks to improve the rate of genetic diagnosis of PAs in Italy. To date, the evaluation of clinical and neuroimaging features results in a precise diagnostic suspect only in a subset of patients, in whom genetic confirmation still allows more precise genotype-phenotype correlates and the possibility of access to early prenatal diagnosis. In other patients with unspecific clinical and imaging features, genetic testing would be mandatory to reach a definite

diagnosis, yet this is impaired by the scarce offering of such diagnostic tests on the territory, and the fact that many genetic determinants are yet to be identified. This results in frequent under-, mis- or delayed-diagnosis, leading to uncertain prognostic assessment and counselling. The Italian Network plans to centralise genetic diagnosis in a limited number of centres, and to optimise next generation sequencing strategies in order to offer genetic diagnosis even to patients with rare PAs, and also to identify novel disease genes. This is expected to speed up the time to diagnosis, greatly increasing diagnostic efficacy on the territory.

From diagnosis to care: Promoting translational research on paediatric ataxias in Italy

Finally, the Network intends to promote and develop a new concept in the study and treatment of PAs that, through the use of pervasive technologies, moves the assessment and rehabilitation scenario from a clinical setting to the patient's home, with the double aim of obtaining a controlled, quantitative evaluation of motor and cognitive performances and of assessing the potential benefits of innovative videogame-based rehabilitation strategies.

This is based on recent studies which demonstrated the effectiveness of treatments based on virtual reality and videogame platforms to reduce ataxia and improve balance. Moreover, virtual reality and commercially available videogames are well fitted to develop rehabilitation programs aimed at improving problem-solving

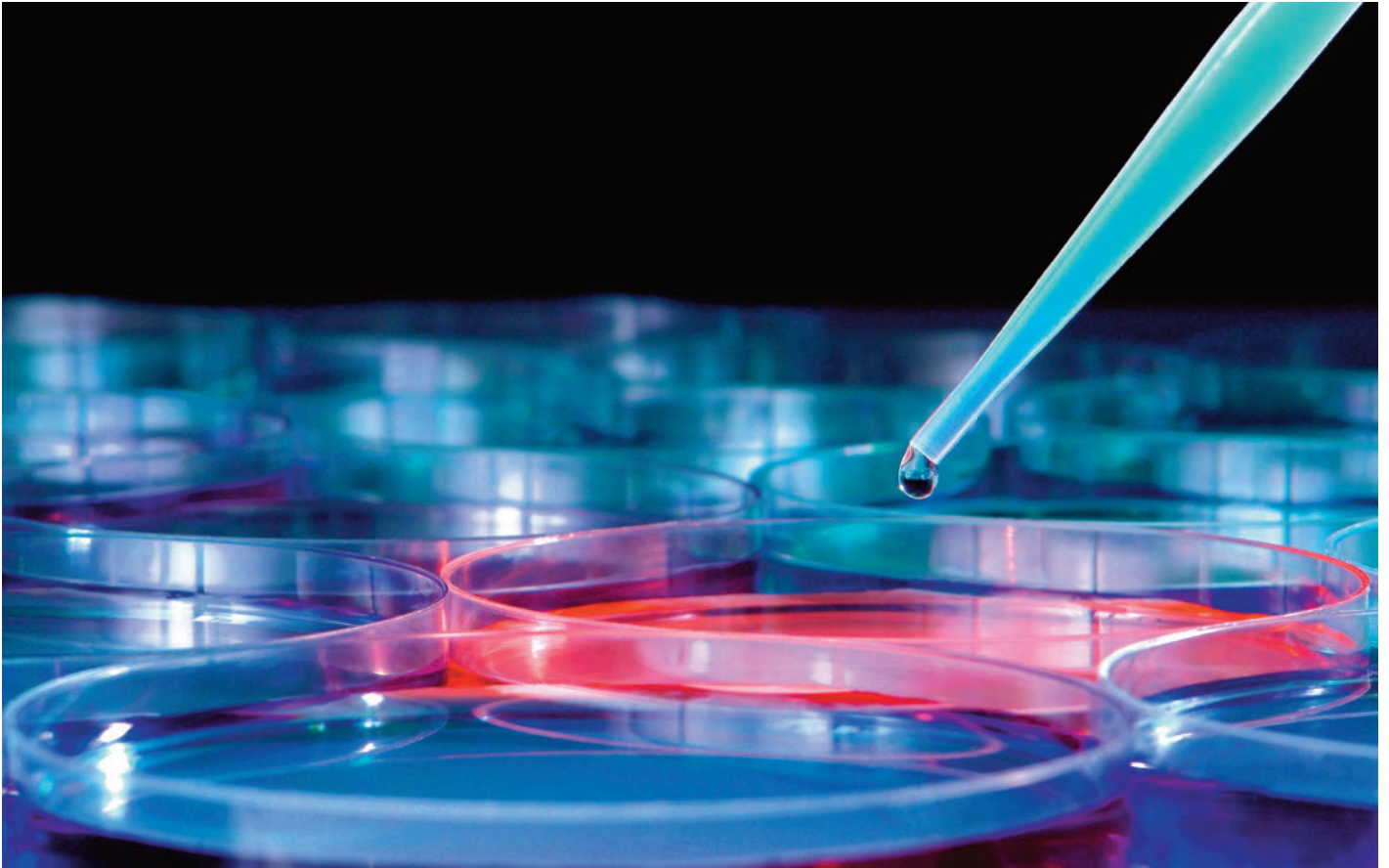
strategies, attention, working memory and visuospatial organisation – all abilities compromised in PAs.

In this light, innovative low-cost, widely accessible technologies are being developed for home-based assessment and for rehabilitation of motor and cognitive deficits. If successful, these techniques will be easily made accessible to most if not all families at their own home, with very considerable benefits for both patients and the National Health System. This pioneering approach is also expected to pave the way for the adoption of innovative diagnostic and rehabilitative strategies in other paediatric disorders also characterised by motor and/or cognitive deficits, becoming an example of effective translational research.



SANTA LUCIA
NEUROSCIENZE
E RIABILITAZIONE

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Progressing cancer research in Italy

Federico Caligaris-Cappio, Scientific Director at AIRC - the Italian Association for Cancer Research, highlights the work of the organisation in order to support and boost cancer research throughout Italy...

AIRC is a non-profit association founded in 1965 by a group of researchers at the Istituto Tumori in Milan, supported by eminent local business people with the aim of fostering cancer research in Italy. Over the years AIRC has gradually expanded to become a nation-wide association that now includes 17 Regional Committees, more than 1,500,000 donor members, more than 20,000 volunteers for voluntary services and financially supports about 5,000 researchers all over Italy. On this basis, AIRC is now the most important charity devoted to cancer in Italy and ranks among the most significant cancer charities in Europe, with a yearly budget dedicated to research in oncology, which in 2015 was slightly over €90m.

AIRC mission is threefold:

- 1) Funding research carried out at scientific institutions, universities and hospitals in Italy;
- 2) Completing the education of young researchers in Italy and abroad, and;
- 3) Informing the public and raising awareness of progress in cancer research. In a nutshell AIRC core mission is finding the cure of cancer through research.

The primary goals pursued by AIRC are to overcome the biological barriers that prevent clinical advances in

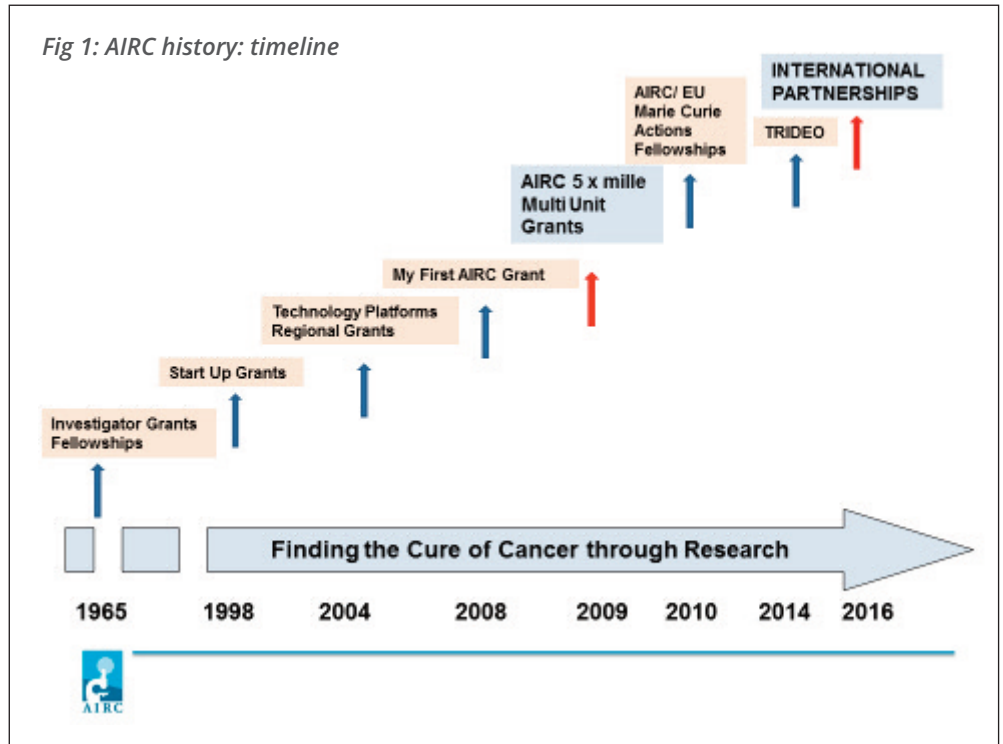
the treatment of cancer and to develop science-driven studies, which are offered to the scientific clinical community.

To pursue its goal, AIRC uses fundraising, which takes place in different forms, through national and local events designed for the general public and the business community it does this through letters requesting support, legacies and donations, including the revenues of the 5 x mille tax payment system. The funds raised are allocated to finance cancer research and to provide support to both junior and senior scientists in terms of grants and fellowships. Every year on a regular

basis calls are published that solicit application submissions. Graduates at the beginning of their career who wish to complete their education may apply for fellowships which can be spent either in Italy, or abroad in highly qualified centers and laboratories. Young, as well as senior investigators may apply to different granting schemes. For example, young scientists have different possibilities, such as My First AIRC Grant, start-up grants (for investigators who wish to return to Italy after an experience abroad), and more recently the experimental Trideo (TRansforming IDEas into Oncology). Senior scientists may apply to either individual investigator grants (IG) or to Multi-Unit grants.

All applications (both grants and fellowships) are evaluated and ranked according to the peer review system. To this end we have a number of more than 600 international reviewers from different countries, mostly from the US, UK and other Northern European countries, and a study section of Italian scientists with different expertise in different aspects of research in oncology who are nominated according to their competence and operate within a rotating system. To provide a snapshot of AIRC activity the numbers of the past 3 years (2013-2015) are the following: 21 calls have been published, in response to these calls, 1,852 new research projects and 995 fellowship requests have been received, triaged and sent out for review. The research projects received can be divided into 2 broad categories: non-clinical, including

Fig 1: AIRC history: timeline



both basic and translational research (85%) and clinical the remaining 15%. The percentage of projects awarded is around 28%.

As for the future, we plan to implement our activity adding some novel initiatives to our portfolio of grants and keeping in mind 2 critical issues. The first is the career of young scientists, which we need to further support in order to not waste talent. The second is based upon the notion that cancer knows no boundaries, hence we wish to break down national barriers through international partnerships. To leverage the strengths and complement the weaknesses of Italian research in oncology we aim at developing partnerships between AIRC and other major international charities and/or institutions. The take home message I wish to convey is our commitment to support science, as it is our firm belief that research is the cornerstone of any plan ultimately aiming at curing cancer. ■

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What are the key values and benefits of an MBA?

Andrew Main Wilson, chief executive of the Association of MBA's (AMBA) outlines why an MBA qualification is worthwhile and what they can offer any graduate...

While the nature of our global economy makes future gazing virtually impossible, our increasingly volatile world has a huge appetite for quality MBA graduates. These future leaders must be global in their approach, with a focus on sustainability, resilience and agility.

They need the knowledge and insight to know how to manage within complex corporate environments, but equally, they need the speed of thought, innovation and creativity to operate like start-ups. An MBA provides life skills required not just by large businesses, but by the public sector, charities, SMEs and start-ups, where there is an ongoing need for qualified managers in the marketplace.

The reasons for people taking an MBA are no longer predominantly financial. The Association of MBA's (AMBA) research shows that people are choosing to complete MBAs to do 'worthwhile' things and make a difference. More MBA graduates are moving from the private to public sector for that reason.

An MBA focuses on core areas like marketing, operations and finance and specialist topics including sustainability and innovation. But it can offer more than that: it is a transformative experience. Completing an MBA is a solid investment for hardworking, ambitious and motivated people who believe they are suited to senior management.

What can MBA graduates expect to gain?

While studying an MBA, participants develop leadership proficiency and study in-depth management strategy and analysis. They have the opportunity to work on team projects, developing skills in people management, as well as teamwork, negotiation and public speaking.

AMBA's 2016 career and salary study surveyed 3,355

MBA graduates of more than 120 nationalities and found that the average salary of a graduate from an AMBA-accredited school in the UK was £86,762.

In 2016, 58% of the MBA graduates are in senior management, board level or CEO roles, following the completion of their MBA. Research conducted by AMBA's strategic partner GMAC (Graduate Management Admission Council) found that 84% of employers planned to recruit MBAs in 2015 compared to 74% in 2014. In fact, the MBA was the most sought after post-graduate qualification in the opinion of the employers surveyed.

Several business schools have specialist entrepreneurship and 'intrepreneurship' groups, courses or modules for leaders who wish to pursue this route – and the MBA is a sensible route for those wishing to change sector or industry.

During the MBA, students build relationships with some of the best business minds in the world – be that with their cohort, business leaders they might meet or indeed their course tutors. Afterwards, their cohort peers will be likely to be successful in their field, so will be great contacts to have throughout your career.

What is an AMBA-accredited MBA?

Accreditation is at the heart of the AMBA's commitment to developing standards in global postgraduate management education.

- We accredit MBA, Doctor of Business Administration (DBD) and Master of Business Management (MBM) programmes at more than 230 business schools in over 80 countries;
- Our rigorous assessment criteria ensure that only the highest calibre programmes, demonstrating the best standards in teaching, curriculum, and student interaction, achieve accreditation;



- Our accreditation is international in scope and reach and we work with senior academics at top educational institutions around the world to continuously update our accreditation policies and maintain our unique, in-depth and detailed approach;
- We believe that accredited programmes should be of the highest standard and reflect changing trends and innovation in postgraduate management education;
- Our accreditation process reflects this commitment to fostering innovation and challenges business schools to continuously perform at the highest level.

For students, the decision to take an MBA represents a major commitment, both in terms of time and money. In a crowded and complex market, our accreditation provides a reliable list of meticulously tested programmes and ensures that students' investments are rewarded with the finest business education available, which will have a demonstrable impact on their careers.

Studying for an AMBA-accredited MBA gives students an exceptional platform for networking at the highest level. They will join a diverse and experienced group of professionals, studying with people who have been

carefully selected, while benefiting from top quality connections with the alumni of some of the world's best business schools.

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Chief Executive

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The future of government in a digitally connected world

Professor Alan W. Brown, Executive Director of the Centre for the Digital Economy (CoDE) at Surrey Business School discusses how government can be used as platform to better meet citizens' needs...

“The UK has a renewed focus on making digital part of the culture of the public sector at both central and local government. This will entail a revolution in the design and operation of public services that can capitalise upon developments in technology and the emergence of digital organisations to create services that better meet citizens' needs.”

Excerpt from 'Digitising Government: Understanding and implementing new digital business models', by Alan W. Brown, Jerry Fishenden, and Mark Thompson.

Digital transformation across local and central government has been in progress for at least the past decade. Consequently, today's thinking about government service delivery requires a shift in perspective to consider how it can become a platform for connecting citizens and residents to a wide range of possible service providers.

A number of important trends have been evident as digitisation of government takes hold. Local authorities and county councils, as well as national government organisations are now releasing more data to citizens, giving businesses and individuals greater opportunity to work with the government to understand citizen needs and deliver services in a more meaningful way. This is one of the ways in which the government environment is

opening up and forming the basis for 'government-as-a-platform'.

What are the key success factors for government in a digital economy?

Government needs to see itself as an infrastructure provider to external agencies offering the opportunity for citizens, residents, businesses and 3rd sector organisations to interact with government. This might be through open data access and via Application Programming Interfaces (APIs) to shared services.

Government should work closely with citizens, residents and businesses to decide on the services that should be offered. Direct input will help government agencies to assess how those services should work, what priorities to place on service provision, and how services can be offered in effective and efficient ways.

An open dialogue needs to be created to ask 'what is the future of government?' engaging a broader constituency of citizens to work with governments to allow services to be delivered in new ways.

Initiatives such as the Government Digital Service (GDS) are already making significant progress in these areas. They are championing an approach where digitisation of public services is built on the application of

open technical standards and sound platform-based architectural principles. However, much more work remains. Sustainable and meaningful reform and improvement will only be achieved when there is an equal relationship between internal organisational and digital services transformation – significantly improving our public services in the digital economy.

Alan W. Brown is Professor of Entrepreneurship and Innovation at Surrey Business School where he leads activities in the area of corporate entrepreneurship and open innovation models. Alan teaches on the Surrey MBA on Strategic Entrepreneurship and acts as module leader for the Innovation & Design Thinking module.

Get in touch at sbs@surrey.ac.uk and www.surrey.ac.uk/mba for more details.



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Agile Enablement and Governance



Agile Strategy and Portfolio



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Agile projects

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Agile Service Evolution



In 1994, the DSDM Consortium was formed by a group of blue chip companies who were all struggling to build computer systems that properly met the needs of their sponsoring businesses, in a time and cost effective way. With the Dynamic Systems Development Method, the UK's first Agile approach was born, focused around IT-enabled business change projects.

Why IT-enabled business change?

It is only by evolving business services hand-in-hand with the technology to support them, that the most effective business solution can be achieved. In a business context, software product development alone will often provide limited value.

Why the emphasis on projects?

If all you are building is software, or if the incremental business changes are very small, then the value of running a project is limited, unless dealing with technical or commercial complexities, or issues of scale. It is when significant business change is involved that projects really come into their own – synchronising the complexities of business processes and organisational change, with the technology optimised to support a new or revised business capability.

An evolving business change focus

Over the years, DSDM, and the DSDM Consortium have evolved to provide an ever-stronger business change focus. In 2010, in partnership with APMG International, the Consortium launched AgilePM® – DSDM from the project manager's perspective – providing guidance and certification for a role at the heart of Agile change projects. More recently, the DSDM/APMG portfolio has expanded further to embrace Agile Programme Management (AgilePgM®) for business change at scale and Agile Business Analysis (AgileBA®) offering strength and depth in the analytical and modelling disciplines, instrumental to understanding and designing effective business Agility solutions.

A bold expansion...

At the end of 2015, driven by the success of recent years both in the UK and internationally, the Consortium began planning a bold expansion aimed at bringing Agile values and philosophy to the world of business. Just last month, the Agile Business Consortium was launched along with the first iteration of the new Agile Business Change Framework.

The Agile Business Consortium

Our Mission:

**“To be the global leader in promoting, supporting and enabling Agile Business”
by providing guidance, accredited products and services to C-level executives and
their change management teams, through an international network of partners**

A successful Agile Business will value:

Innovation over the status quo
Inspiring leadership over conservative management
Collaboratively autonomous teams over those under hierarchical control
Customer focus over individual or organisational self-interest

Whilst recognising that a balance needs to be achieved between the position on the left of each value statement and the position on the right

The Agile Business Change Framework

Helping businesses be Agile in all business change initiatives – regardless of scale.

Embracing the current suite of DSDM business-change-centric products and signposting expansion into:

Agile Business Strategy – a dynamic new approach for ensuring that business strategy always remains aligned with business and market imperatives

Agile Portfolio Management – ensuring change initiatives are properly aligned with the overarching, whole-business strategy and remain so throughout their life

Agile Culture and Leadership – providing advice and guidance on leading Agile change from whatever your position in the organisation. From C-suite executives and senior business and IT management roles (sponsoring and owning their business change initiatives), through Programme and Project Management roles (organising and coordinating the initiatives), to the leaders in teams who make the change happen, effective Agile leadership is key to success

Agile Enablement and Governance – recasting PMO services away from their traditional heartland of process compliance and standardisation, centred around bureaucracy, to embrace a philosophy of enablement and governance centred around people

Agile Service Evolution – focusing on developing business services (with or without IT enablement) exploiting an Agile, iterative, collaborative, customer-centric approach that has proved so effective in the software product development space

Becoming more Agile (see chart above)

Each of the above value statements embrace potentially conflicting positions and every organisation interested in becoming more Agile will need to find a balance point appropriate to their needs, constraints and Agile ambition. Each value statement should be considered as a continuum rather than a choice.

At the Agile Business Consortium, we believe that optimal business Agility will be achieved through valuing the position on the left of each value statement and that this should be the default focus of any Agile organisation. At the same time, we recognise that the position expressed on the right has value and for any businesses must be accommodated but without it becoming dominant.

Your journey to optimal business Agility

Regardless of your starting point, the Agile Business Consortium, through its growing network of Accredited Implementation Partners, can help you on your journey to becoming a more Agile enterprise. Helping you move from where you are now to the balance point appropriate for your organisation between:

- The declining relevance of the status quo and a world of innovation for business advantage
- Old-school conservative management and inspiring leadership of your greatest assets, your people
- An environment of human machines under hierarchical control and one that exploits the collaborative autonomy of your creative teams
- A conservative culture of individual or organisational self-interest and an unrelenting, immediate customer focus for all you do

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Reforming Britain's apprenticeships

Mark Dawe, Chief Executive of the Association of Employment and Learning Providers, discusses the reform of apprenticeships in the UK and what the outcomes should be...

The far from smooth reform process has lasted over 4 years and could one day make for a very interesting academic case-study in government policymaking, where the evidence base has often been ignored in the pursuit of dogmatic principles. Widely shared concerns have been upheld by the UK's National Audit Office which recently reported on a lack of a clearly defined strategy. However it is important to recognise that the potential reform outcomes could be very beneficial in improving UK workforce productivity and as a driver for social mobility in a country where 620,000 young people remain unemployed.

Apprenticeships have established themselves as our flagship skills programme, attracting government subsidy of up to £1.5bn a year. Larger employers contribute to half the cost of their programmes for people aged over 19 but the public funding means that over half of apprenticeship opportunities are offered by small and medium sized enterprises. Under the coalition government of 2010-15, 2.7 million apprenticeships were created and the Conservative government, now in office, has committed to 3 million more.

The reform process is now being driven by the need to achieve that target by 2020, but this was not the case when it started. Under a government commissioned review led by entrepreneur Doug Richard, arguably the most important aim was securing an increase in the number of employers offering apprenticeships. There were also concerns about the quality of the programme, particularly at the intermediate level of learning (level 2), although the training providers that I represent at the Association of Employment and Learning Providers (AELP) would argue that the largely anecdotal concerns were overblown and did not in themselves justify the launch of a major review. After all, the government's quality inspectorate Ofsted has judged 79% of inde-

pendent training providers to be good or outstanding and these are the providers who support the training of 76% of England's apprenticeships. Often commentators get very confused between the level of learning (e.g. is it the equivalent of GCSE level or A level?) and the quality of training and learning.

For a review that was supposed to lead to more employers engaged in apprenticeships, Doug Richard's recommendation in 2012 that businesses of all sizes should make a direct financial contribution to the cost of the apprenticeship training upfront, was perplexing and misguided. Even the smallest companies already make so called in-kind contributions, such as paying the apprentice's wages and providing supervision of their training. AELP warned then that an upfront payment could lead to a major market failure in terms of employer demand for apprenticeships and this well-grounded fear, backed up by employer surveys, continues to persist.

In 2015, the government under pressure with the general state of the public finances decided that something far more drastic was required and it announced that from April 2017, the apprenticeship programme would be funded by a levy in the form of a payroll tax imposed on large employers. The obvious gain for the programme is that by 2020, the funding should be £2.5bn in England instead of £1.5bn now. In theory, it should also fund the 3 million new starts to which the government is committed.

The government made clear that levy-paying employers could reclaim the tax providing the money was spent only on apprenticeship training. This should at least guarantee that the number of large employers offering apprenticeships will increase. What has been interesting in recent months is hearing from employers how



they intend to spend their levy money. Many are planning to offer apprenticeships at higher levels of learning, including degree level apprenticeships which are rapidly increasing in number. They will also use apprenticeships to undertake management training of existing staff, while another area of strong growth is apprenticeships being used to train the professions, such as lawyers, accountants and nurses.

This is all very welcome, particularly for a post-Brexit Britain where the need to train more home-grown talent has become more acute with the real possibility that the free movement of labour might end. The worry, however, is that in committing to high level apprenticeships, the levy paying employers will use up all of the programme's budget, leaving nothing or very little funding available to smaller businesses who account for so many apprenticeship opportunities.

UK Prime Minister Theresa May has made social mobility a big theme of her new government and apprenticeships offer thousands of young people a high quality learning route to a successful career. So if there is no

programme budget available for smaller non-levy paying employers, including those that operate in towns and rural areas where there are no large businesses, then the proposed reforms will fail these young people. We estimate over £1bn of apprenticeships are delivered in non-levy paying organisations at the moment. All we are asking is that the government commits to maintaining at least this amount of funding for the non-levy payers. Other aspects of the reforms also give grounds for serious concern which is why we are urging government ministers to reconsider them if the objectives for improved social mobility and increased productivity are to be fulfilled. ■

Mark Dawe
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Is inequality in educational systems ‘homemade’?

Inequality in educational systems is a complex issue based on interacting mechanisms, write Professor Dr Katharina Maag Merki and colleagues...

The way educational systems and schools are organised is of pivotal importance, not only for the development of young people, but for providing equal educational opportunities for all pupils. However, we know that not all educational systems and not all schools are equally successful in supporting pupils in their development. Furthermore, in many countries pupils with a high socioeconomic family status outperform their counterparts significantly. But why is that the case? Is this because socially advantaged children are more intelligent or motivated than other children? Or are they better supported by their teachers and favoured by the educational system?

The grammar of inclusion and exclusion within educational systems

In our research project ‘KoS – Context-Oriented School Development’, we assume that there are certain mechanisms and processes in the educational system and schools that cause some pupils to be favoured while others are disadvantaged. By analogy with a language, which is based on a certain set of rules, e.g. those of syntax or semantics, we assume that those mechanisms do not occur randomly, but that they are equally governed by a system of rules. We call the sum of these mechanisms ‘grammar of inclusion and exclusion’. Based on empirical results, which kind of mechanism can be identified? Since the educational

system is multilevel in nature, mechanisms at the system, school and teaching levels have to be differentiated (see figure 1).

Grouping pupils on secondary level one by several tracks:

Separating pupils into different tracks with different achievement requirements after primary school is one such mechanism. Due to special resources and interests of families, pupils from families with a high socioeconomic status can manage those transitions better than pupils from a lesser socioeconomic background. In educational systems without such transitions, therefore, the disadvantage is not as distinct.

Differential support strategies at school level:

In a system with strong vertical and horizontal stratification, the allocation

of pupils in primary schools to school tracks with extended or basic requirements at secondary level starts early. Schools regulate who will get talented support or access to support strategies as a preparation for ‘gymnasium’ (highest level of requirements on secondary level one). In turn, pupils identified as low-achievers or labelled as pupils ‘in need’ are pre-selected for lower school tracks. This activates a mechanism of social closure and educationally handicaps these groups of pupils, because they don’t receive the relevant support for access to schools with extended requirements.

Grouping pupils within classes:

Also, on class levels, teachers often make decisions regarding single pupils while looking at more than just their abilities. When selecting adequate support measures for fostering pupils or when deciding on promotion of

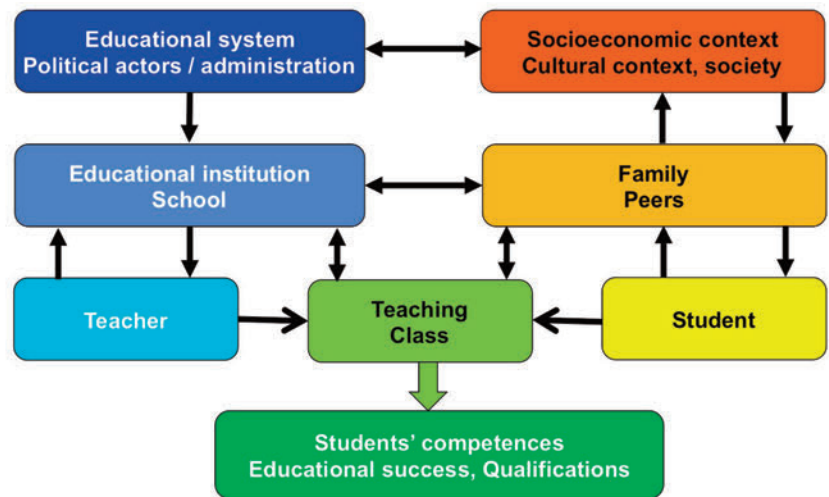


Figure 1: Students’ school success is the result of a complex interplay between several actors in the multilevel system

PROFILE

pupils at the end of the school year, teachers consider pupil's familial background at the same time. Pupils who do not come from the 'right' families are often thought incapable of and discouraged from attending more demanding courses, even when in fact they would have the competences to do so.

Summary

The empirical results show that inequality in educational systems and schools is influenced by several factors. Findings showed that educational outcomes are not limited by pupils' academic abilities or family educational aspirations alone, but are also influenced significantly by structures and processes within schools and school systems. This means that inequality in educational systems and schools is also 'homemade' and influenced by the school system, the schools, and the teachers themselves.

Considering this important result, it is obvious that educational institutions and teachers are responsible for adapting learning opportunities to pupils' capacity for using them and to develop support strategies that help all pupils to achieve educational success.

Accordingly, the key determinant of high educational equality is how well educational systems are structured and how educators and teachers adapt their learning opportunities, curricula and resources within the educational system to each pupil's specific requirements, abilities and family background.

Strategies to reduce educational inequality

Reducing educational inequality is very challenging, but is of high importance for modern society. Although

the goal of decreasing educational inequality cannot be achieved by educators and teachers alone, there are several strategies that have the potential to reach the goal, particularly if the 'grammar of inclusion and exclusion' within educational systems is considered:

- Strong public educational systems with a wide range of educational opportunities for all pupils in order to provide all pupils 'short distances' to the next high quality and demanding school are very important in every society. If these distances are too great, socioeconomically or ethnically disadvantaged pupils will not have the resources or the skills to deal adequately with this challenging situation;
- The stronger the stratification system implemented in educational systems, the more important the family background for successful learning. Therefore, reducing vertical and horizontal stratification in school systems where students get selected at a young age for different tracks and providing a comprehensive educational system are important strategies to reduce educational inequality;
- Building up a high capacity for managing change on organisational, teacher and class level is a core requisite to improve school and teaching practices and processes;
- Implementation of sustainable co-operation between principal, teachers and further educational staff, and the reflection on support and selection practices within schools and classes;
- Critical analyses of grouping prac-

tices to foster pupils single classes and access to support measures;

- Continued professional learning of teachers helps to bring awareness to specific diagnosis, selection and grading biases.

Reducing educational inequality is hard work, takes time and requires shared responsibility between society, policy makers, school authorities, schools, and teachers. Therefore, teachers and educational staff in schools have only limited leeway to change practices if regulations, guidelines and rules at the system level hinder the implementation of more effective practices in schools that foster better equality between pupils. Without a joint effort, educational equality will not be easy to achieve.



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The value of public policy education

Public policy programmes have grown in popularity over recent years, but what is the value of a degree in this subject? Aika Bolat explores...

A decade ago, the value of public policy education was not as well recognised as it is today. Some universities offered public policy programmes, but independent schools of public policy only became popular in the early 2000s in Asia. Since then, the number of newly established graduate schools and programmes has grown tenfold worldwide. The teaching of public administration goes back to the 17th and early 18th centuries when government officials in the Kingdom of Prussia were trained to combat corruption and nepotism. As Stavros Yiannouka, CEO of WISE (under the Qatar Foundation) has written: “The study of public administration and public policy at universities is both a tradition and universally accepted belief that good governance can be and should be both studied and taught.”

The list of well-known public policy schools includes the Kennedy School of Government at Harvard, the Woodrow Wilson School of Public and International Affairs at Princeton, and the Lee Kuan Yew School of Public Policy (LKY School) at the National University of Singapore, as well as the Hertie School of Governance in Berlin, the London School of Economics (LSE), Sciences Po in Paris (members of Graduate Public Policy Network), the Crawford School of Public Policy in Canberra, those at Columbia and NYU in the USA, and – the most recent addition – the Blavatnik School of Government at Oxford, to name a few.

In the USA alone, 50 public policy programmes were identified as the most innovative in 2015. In Italy, the SDA Bocconi School of Management (SDA Bocconi) now offers a Master of Public Administration (MPA) programme; a revamped version of its Master of Public Management (MPM) programme, which has run in Milan since 2004. In the UK alone, in addition to the Blavatnik School of Government, there is also a school

of public policy at UCL that focuses on research and graduate teaching, and the University of Edinburgh’s Academy of Government that offers an MPP programme. The Centre for the Public Policy at Aberdeen also offers a professional Masters programme in public policy.

“People often fail to see the need for training in the craft of government. Some think that public policy is simply a matter of good sense and general knowledge. These perceptions are mistaken. In fact, good public policy education is critical to better governance.”

Public policy schools – a global trend

Several other countries in Asia have recently launched their own public policy schools, including the Republic of Kazakhstan, Brunei Darussalam, Indonesia, Azerbaijan, Russia, South Korea, and various regions of China. The creation of these public policy schools is an important demand-driven trend that plays an important role in training future policy makers in tackling the most important issues faced by countries including generating employment, alleviating poverty, combating corruption, tackling climate change, and managing international migration. Governments need skilled policy analysts and managers with negotiation, communication and management skills to lead people and processes, and committed leaders with vision to serve in public sector.

As Dean Kishore Mahbubani of LKY School said, such people can be prepared at “institutions that are focused on good governance and where the best practices of public policy around the world can be compared and discussed”. These institutions are free academic environments where young people can come together to challenge conventional thinking, ask critical questions and propose innovative solutions.

Teaching methodology and curriculum

Public policy programmes are practical, applied and focused on the processes by which various types of policies and regulations that affect the public are created and implemented. Their core modules often provide the tools to analyse and evaluate policies and to conduct relevant research on the effectiveness and feasibility of public policies. The curricula is designed to foster critical thinking or “thinking outside the box”. Unlike Master of Science programmes that require a scientific thesis, most public policy programmes include a practical policy analysis exercise on an existing policy issue that draws upon the knowledge the student gained in the classroom.

Types of public policy programmes

There are three main types of masters’ degree programmes offered at the majority of public policy schools: the two-year Master of Public Policy (MPP) and one or two-year Master of Public Management (MPM) and Master of Public Administration (MPA) programmes. The MPP programme prepares junior policy analysts with skill sets needed for the research analysis, policy evaluation and assessment with the use of statistical tools and cost benefit analysis as well as a basic knowledge of micro and macroeconomics. In general, the MPP programme targets junior level public officials with a minimum two to five years’ work experience.

The MPA and MPM programmes are targeted towards more mid-senior level officials with five to eight years of work experience who are transitioning to senior positions such as managers or directors of departments. Both programmes provide skill sets required to lead people and processes, manage large-scale projects, implement programmes and approach problems with a helicopter view and, as a result, become able decision-makers and committed leaders. Both the MPM and MPA programmes mainly prepare professionals for managerial roles and to be effective public sector administrators both locally or globally.

Career opportunities after graduation

For those considering a career in the public sector, international development, non-profit sector or even with corporations that deal with governments, public

policy education is the right choice. More and more governments are aware of the existence of professional and applied public policy programmes and recognise the value of graduates with a solid understanding of public policies. Public servants that attend public policy programmes are usually promoted to higher-level decision-making roles. A 2013 study in which 300 SDA Bocconi’s MPM graduates were surveyed, showed the salary increase after graduation was about 60%. Many graduates that were trained in public policy schools are now serving their countries in important positions where they contribute to local, regional and global growth and prosperity. I know personally many Alumni of LKY School and SDA Bocconi who now serve as Prime Ministers and Ministers or Vice Presidents of large corporations dealing with governments and as leaders in many international or local NGOs around the world. Some even set up their own foundations and NGOs in Developing Asia and Africa.

“The study of public administration and public policy at universities is both a tradition and universally accepted belief that good governance can be and should be both studied and taught.”

The importance of public policy education

As governments strive to improve public services and standards of governance and develop the next generation of leaders in the public sector, the importance of public policy education is increasing. As the Prime Minister of Singapore, Mr Lee Hsien Loong said, “People often fail to see the need for training in the craft of government. Some think that public policy is simply a matter of good sense and general knowledge. These perceptions are mistaken. In fact, good public policy education is critical to better governance.” ■

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What does it take to be a public sector leader in contemporary Britain?

Jody Goldsworthy, Senior Partner, GatenbySanderson outlines the ever-changing role of the public sector leader and what it entails...

The UK is facing an unprecedented period of change. Demand for public services is at an all-time high, meanwhile budgets are under more pressure. And, following the result of the EU referendum, Britain must go through the process of reviewing all legislation of the past 40 years, creating even more strain on our vital public sector organisations. In this context, the case for senior public service leaders with vision and expertise is even stronger. But, even more important questions remain – what do we expect from our public sector leaders? What attributes and skillsets do we need these leaders to have? How do we measure their success? And, where will we find them?

To answer these questions, we need to have a clear and fair idea of what we want from public sector organisations, and what they are capable of achieving in the current circumstances. With a clear vision of what we want our public services to achieve, we can then start to understand what is required of our leaders.

A new way of thinking for a new reality

'Jobs for life' is a thing of the past across all areas of our economy and this certainly rings true in public services. The average tenure of senior leaders has reduced over the years with mobility within and between sectors increasing. While a deep understanding of the public sector and policy development will always be important, the skillset required of a public sector leader in contemporary Britain has changed.

Modern politics is under an even bigger microscope given the rise of social media and 24-hour news cycle. This impacts policy and how it is created, the strategic objectives of public sector organisations and their leaders. While increased visibility and transparency is mostly positive, we've seen increased accountability, particularly in the health sector, can have negative

impacts. Regardless of the area, be it local government, health, education or not-for-profit sectors, the leaders are being brought in to make big, often difficult decisions that are not always going to be popular. Leaders in the public sector need a thick skin. They must be able to make hard decisions and have the courage of their convictions to implement change, even in the face of very public criticism – as the Chief Executive of the Southern Health NHS Foundation Trust's recent resignation highlights.

“Public sector organisations are facing a great deal of change and increasing scrutiny, so the stakes are certainly high for their leaders. They require a new way of thinking and working to help deliver vital services that the public sector offers, but that is in line with the new reality.”

Similarly, leaders now need to be more open minded than ever before. Public sector organisations can be quite rigid in their structure and processes. Our leaders must be open to new ideas and ways of working – from being open to new partnerships, to changing to more flexible work practices to accommodate preferences of an upcoming millennial workforce.

As service models change and new approaches are implemented, good leaders must be more collaborative in terms of how they engage their teams, their partners in delivery and the public. They need to better engage with local communities to devise and articulate a shared vision and then implement new plans to deliver these vital services. Decisions can no longer be made in isolation, rather success relies upon an engaged workforce within the core organisation and any partner organisations, who have been consulted and are motivated to implement change and introduce new ideas

effectively. The newly formed NHS Transformation unit is a prime example of this. Having grown out of Greater Manchester's devolution processes, it exists to support NHS organisations as they adapt to embrace change and also to support NHS leaders to recognise their vital role as system leaders.

Finally, business skills have become even more important in the current financial climate where budgets are shrinking. This is not just about managing the public purse, leaders need to be able to identify and negotiate commercial opportunities which will help fund community services in a more sustainable way. This is where experience beyond the public sector has become more important, helping to open up doors and expand networks to create more public and private sector opportunities. This has driven a shift towards trying to recruit leaders from the commercial sector to find people with the skills and ability to deliver the transformation needed. Recently, these private sector appointments have been made to lead specific commercialisation change agendas, add value as a non-executive board member, or in the cases of DVSA and The Crown Prosecution Service, provide a Chief Executive. These cases demonstrate the need for a more transferable leadership skill set to land the biggest jobs in public service.

Measurement and development: setting leaders up to succeed

Given the new circumstances in which public sector leaders operate, organisations need to think more about measuring, assessing and developing leaders. Assessment processes need to go beyond traditional criterion, covering fit for the role, cultural fit and a personality fit for the team. Most senior public sector leaders join organisations in challenging times and have to make many hard decisions, fast. The expectation is on newly appointed leaders to hit the ground running and achieve success quickly. However, is the organisation itself doing everything it can to facilitate this?

It's vital that leaders are given the right tools and processes to adjust quickly to their new post. This includes sufficient onboarding processes and training. Measurement, benchmarking and development play vital roles in setting up new appointments for success. For example, does the organisation know what success looks like for the first six months of a newly appointed leader?

What about after the first year? Then, most importantly, new leaders need to be measured and benchmarked throughout their appointment to help them do the best possible job – as well as demonstrate success.

Measurement should not just be rough concepts and outcomes; it needs to be as granular as possible. If they are being brought in to manage change, what should the objectives be and within what timeline? Leaders should be measured frequently and also benchmarked, and their aims need to be realistic. Change doesn't happen overnight, it happens incrementally. Measuring specific objectives and deliverables frequently will help bring a level of accountability that organisations and public sector constituents crave – but will also help leaders thrive.

Finally, leaders need help to develop into their role after their hire. This includes assessment, feedback, coaching and specific learning programmes. Ultimately the success of an organisation – large or small – depends on bringing out the best in the people; identifying, nurturing and retaining talent to find tomorrow's leaders.

Final thoughts

Public sector organisations are facing a great deal of change and increasing scrutiny, so the stakes are certainly high for their leaders. They require a new way of thinking and working to help deliver vital services that the public sector offers, but that is in line with the new reality. Organisations have a key role to play to set themselves up for success. They must define the changes they want to see in the organisations, set clear and measurable objectives and outcomes. But they must go beyond this to also include behavioural outcomes and attributes of their leaders. ■

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The Powers of Art, Science and Hypernormalisation

Dr Kevin J. Flint from the International Association for Practice Doctorates looks at how you can apply hypernormalisation to current society

Adam Curtis's latest documentary, 'Hypernormalisation', makes interesting viewing. It is premised on the assumption that in our globalised and technological age there is a significant danger that we have become collectively lost in an over-simplified re-presentation of our complex world; a sublime Disney World increasingly engulfing the whole planet. In being lost in this fake world it becomes ever more difficult to see reality outside it. Is this a re-run of life in the Soviet Union before its collapse?

Indeed, in reflecting critically upon the various articles I have written for Adjacent Government over the past year,

they are all in danger of being located in the same fake world. Moreover, for many people who are variously conforming to 'regimes of truth' in research, art, science, law... indeed all of our institutions, increasingly there is little basis for radical challenge of this fake world. Many institutions, in accord with the prime tenets of Guy Debord's *Society of the Spectacle*, have sought to simplify the complexities of being human down not just to what we have, but what merely appears.

Dubord argued that commodity relations had supplanted complex inter-relations between people. For him the 'commodity form is through and

through equal to itself, the category of the quantitative'. Today this might be reiterated in terms of binary codes.

Approached in this way, it is no surprise in Curtis's film of the story in the mid-1980s of the banks and newly emerging multi-national corporations, with their bases in America increasingly gaining power to run society through computer systems. It marked the opening of what the writer William Gibson called 'cyberspace', carrying with it extraordinary powers of control; especially when combined with the sublime powers already in existence gained from the use of Panopticism, which is used in all Western countries.



“

...it is no surprise in Curtis's film of the story in the mid-1980s of the banks and newly emerging multi-national corporations, with their bases in America increasingly gaining power to run society through computer systems.”

With the ever-growing powers and speeds of computing, and with newly developed algorithms, information technologies have come to create simplified pictures of our everyday world. Some of the success of these developments can be attributed to the consonance of such technologies with specialised discourses and practices found in just about every walk of life, whose grounds appear to have been cultivated in the sciences and their underlying epistemologies. There, real success comes from the way their binary coding and logics have come to re-shape and delimit the mind.

Unfortunately, much education has been sucked into this largely all-embracing Disney World *system*. Overriding forms of education, like much politics, in the invisible architectural space created by these large computerised networks used in the management of informa-

tion about predictable bodies [not complex beings], are always in danger of being reduced to two extended-arms vital to such information management on a sublime global scale.

As I have argued in my recent book, *Rethinking Practice, Research and Education* [Flint, 2015], what is missing in this system is any consideration given to the hidden complexities of the naming force and the sublime gathering powers of being as presence, the 'is', and the ontotheological structuring of space driving enframing – or ways of revealing the emplacement of practice – around the globe. We are always in danger of becoming puppets of enframing in this fake world we are creating. Indeed, contemporary events that people have found difficult to explain involving Brexit, Donald Trump, Vladimir Putin, and suicide bombers are all entirely predictable

outcomes of this global fake world. Global warming is another inexorable consequence.

Viewed in this way the space for much needed radical education and radical politics lies outside this global fake world – the subject of my next article.

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Non-Indigenous individuals' responsibilities within higher education contexts

Dawn Zinga, from the Department of Child and Youth Studies at Brock University explore the responsibilities of non-Indigenous individuals within higher education settings and the inequalities that exist...

As a non-Indigenous scholar working in the area of Indigenous education, I spend a lot of my time thinking about my own role in perpetuating inequality within higher education and answering questions posed by non-Indigenous faculty, staff, and students. These questions usually fall into two broad categories. The first category consists of questions about why I am raising an issue or why something is important, while the second category tends to focus on questions about what individuals can do now, so that they know about the inequities that exist. These two categories of questions point to some interesting aspects about the responsibilities of non-Indigenous individuals' within higher education settings. One of the first responsibilities is to become educated about the realities of Indigenous peoples and related the systems of inequality. The second responsibility that I will focus on is what to do with the knowledge that you gain when you become educated.

Starting with myself, I am a several-generations-removed immigrant to the ancestral lands on which I reside and I have experienced a position of some privilege in the mainstream structures of society, such as education, health services, and other governmental systems. While I grew up in a blue-collar home and experienced



the discrimination that can be associated with class and being a girl, I was afforded many privileges and rarely had cause to question that I belonged in the classrooms that I occupied. I frequently saw myself and my life experiences reflected in the classroom and my experiences within society. From a young age, I had a questioning mind and often challenged teachers about why some voices and some life experiences were not represented in the curriculum or were represented in very narrow and proscribed ways. Through my own search for knowledge and the generous teachings of my Indigenous colleagues, I became aware of the systems of racism and inequity experienced by individuals who are

minoritised by the mainstream systems of privilege and discrimination that continue to be reinforced throughout society and particularly within systems of education. In my role as a university professor, I am also responsible for exposing undergraduate and graduate students to these systems of inequity and to challenge their taken-for-granted assumptions.

Some of my students resist any challenges to their understanding of society and the status quo and remain facing the first responsibility of education. Other students engage in the teaching but sink into guilt and seem paralysed by the immensity and com-

PROFILE



plexity of the issues they have just learned exist. The second responsibility of what to do with the knowledge once you have learned it is easier to address than the resistance to learning that the world does not necessarily operate in a way that you thought that it did, and that with or without your knowledge, you have occupied a position of power and privilege. The first thing for non-Indigenous individuals to realise is that guilt is an emotion that will not be helpful. It must be experienced but in the end we are not responsible for the actions of those who preceded us, but we are responsible for how we address the legacy

that was left behind. Essentially, non-Indigenous individuals must focus on how to act on the knowledge that has been gained.

Non-Indigenous individuals have a choice. They can choose to close their eyes to uncomfortable realities and continue on perpetuating them or they can choose to use their individual voices to make a difference. Using one's voice can be as simple as speaking up when an inequality is being perpetuated, or challenging a policy that negates other people's experiences or lived realities. It can be exposing others to knowledge they

may not be aware of or supporting someone when that person's viewpoint is being shut down as invalid or irrelevant. Sometimes it can be listening to another perspective and being open to being challenged and educated about how your own actions or lack of action may have reinforced inequalities or alienated Indigenous individuals.

Addressing these two responsibilities within educational contexts can lead to educational settings in which Indigenous students and other Indigenous individuals feel welcome and accepted. It can open up important spaces to talk about ways of moving forward together towards positive change that does not reproduce or perpetuate systems of inequality. While I have focused on higher education contexts, this can also be extended to other educational contexts. Making a choice to address these responsibilities daily is a choice to move beyond resistance and guilt to positive action and strong relationships that can help us all negotiate a new future of education for all students.

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LGPS – who’s in control?

John Hanratty, Head of Pensions North at Nabarro LLP discusses the Local Government Pension Scheme (LGPS) and how the new regulations might impact...

With the introduction of the Local Government Pension Scheme (LGPS) asset pools and an increased focus on the investment of LGPS assets in to the infrastructure asset class, the investment of LGPS assets is under the spotlight like never before.

Coming into force this month are the Local Government Pension Scheme (Management and Investment of Funds) Regulations 2012 (the Investment Regulations).

The removal of many of the restrictions on how administering authorities invest funds under the LGPS has largely been welcomed; it allows the LGPS to use investment vehicles and strategies more in line with other modern, large pension funds.

There have been concerns expressed, however, that the changes have politicised investment in the LGPS.

Further, the government’s position that there are “...large sums of public money at stake...” (Quoting from the Department for Communities and Local Government (DCLG) consultation response referred to below) has been questioned by those who believe that the “large sums of money” are held beneficially for the members of the LGPS rather than to do the work of government.

The government took the unusual step of releasing statutory guidance (the guidance) relating to how administering authorities under the LGPS should formulate, publish and maintain their Investment Strategy Statement (ISS). An ISS is required under the Investment Regulations and replaces the previous requirement to prepare and maintain a Statement of Investment Principles.

Much of the guidance is straightforward covering issues such as diversification and suitability of invest-



John Hanratty, Head of Pensions North at Nabarro LLP

ments and setting out the authorities’ attitudes to risk and social, environmental and governance issues.

But, the guidance is controversial in 2 ways:

- First, it provides for the Secretary of State to issue a direction and to effectively step in if an administering authority is not following the guidance in respect of how it invests; and
- Secondly, it restricts the social, environmental and governance policies which may be adopted by an administering authority by requiring those policies not to be contrary to the UK government’s foreign and defence policies.

According to the DCLG’s response to the consultation on the Investment Regulations, which was issued during the week beginning 26 September 2016, the DCLG received more than 23,500 responses to the consultation.

More than 23,000 of those responses were from members of the general public objecting to the Secretary of State having the power to intervene in administering authorities’ investment decisions.



The key objections were broadly grouped in to three categories:

- That the intervention powers undermined the independence of administering authorities to act in LGPS members' best interests;
- That the guidance, in requiring administering authorities not to pursue investment policies that are contrary to UK foreign or defence policies, prevented administering authorities from practising ethical investment management; and
- That the intervention power undermined the government's commitment to devolution and the transfer of powers to local government.

The government's position could be summarised as being:

- Regulation 8 of the Investment Regulations contains appropriate safeguards before any intervention and the locally elected members retain the duty and the power to set investment risk, strategy and allocation. It is only where elected members fail to do this in accordance with the regulations and the guidance will an intervention happen;
- That the funds in the LGPS are constituted largely of public money (including liability for deficits) and, as such, public money should be used in compliance with UK government policy including foreign and defence policies; and

- That the freeing up of the investment criteria does promote local democracy and an intervention will only take place once the safeguards have been exhausted.

The first major concern is that, whilst the Investment Regulations are comprised in secondary legislation, changes to which would have to be laid before parliament for proper scrutiny, the guidance is precisely that – guidance issued by a Secretary of State.

“The removal of many of the restrictions on how administering authorities invest funds under the LGPS has largely been welcomed; it allows the LGPS to use investment vehicles and strategies more in line with other modern, large pension funds.”

This gives rise to questions about who scrutinises such guidance and whether there are any constraints on a new Secretary of State amending or revising the guidance for his or her party's own political ends.

Another major concern is whether the Secretary of State is the appropriate person to intervene in the investment matters of the LGPS.

Regulation 8 deals with the issue of a direction by the Secretary of State and the intervention powers he or she has. The powers range from a direction to require the administering authority to make such changes to its investment strategy or invests assets as the Secretary of State considers appropriate or directs, through to full intervention where the investment powers of an administering authority fall to be exercised by or under the direction of the Secretary of State or his or her nominee. ■

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Infrastructure investment – will Westminster deliver?

Julian Francis, Director of Policy and External Affairs at ACE discusses what should be expected from the upcoming Autumn Statement and its impact on infrastructure investment...

Westminster is in full swing following the recess and political turmoil of the last few months. As such, we are beginning to get a glimpse of a new political landscape as the mist settles following the EU referendum. It is becoming clear that the landscape has changed so much that our industry needs to prepare itself – as many in the industry may not recognise this new world.

The best insights as to what this new political reality will look like emerged during the Economic Affairs Committee's questioning of Philip Hammond. We were told straight away that the Autumn Statement would be given on the 23 November, with the outline of governmental fiscal thinking based on a series of industry round tables.

It is widely believed that this statement will not be a rehash of the previous statements by George Osborne but will mark a divergence from previous government policy. Hammond has quickly confirmed this, with strict fiscal discipline and the cutting of the deficit to achieve a surplus by the end of the Parliament being just 2 of the policies that will fall by the wayside.

When pushed on this, Hammond stated that although a fiscal surplus was an important part of overall governmental thinking some flexibility may be needed. When subsequently challenged on the need for a surplus given the state of UK infrastructure and the low cost of borrowing, the Chancellor highlighted that growth was the key, for him, rather than deficit reduction. Although the UK could not remain 'cavalier' about debt levels, he stated, debt would continue to rise regardless unless there was significant growth in the UK economy.

Clearly, this Chancellor will make his spending decisions based on the potential of spending to produce growth.

This led very quickly into a ground-breaking announcement that must be fully understood by everyone who is involved in the built and natural environment. Hammond informed the committee that the government had the opportunity to reset fiscal policy, particularly by eliminating the 2020 surplus target. In place of this target, he would outline a new fiscal rule. Although he refused to outline what this fiscal rule would be ahead of the Autumn Statement, he did echo Mark Carney's comments that 'further ammunition' was needed in terms of monetary policy. In the Governor's view monetary and fiscal policy needed to function more effectively together to respond to the post-referendum reality.

For this reassessment of governmental economic policy, infrastructure and house building would play an important part, with hints given that the Autumn Statement would contain substantial announcements on infrastructure investment. Outlining his views further, Hammond explained: "I would hope that in designing a new fiscal stimulus, a sensible chancellor would seek to do as much as possible through investment that will not only deliver short-term demand stimulus but will also address long-term, structural problems in the economy."

What this means in reality, is that the Chancellor has set a two-part test to determine the viability of any new infrastructure investment.

Do the projects provide short-term demand and does it address economic structural problems by improved productivity and growth rates?

If the project does not meet both of these conditions, it seems likely that the project will not go ahead. Hammond highlighted this by looking at big strategic projects such as HS2, Hinkley Point, and Heathrow by stating



that, although they could have a role to play, they were “unlikely to ever be able to contribute to a fiscal stimulus because of the timelines involved.”

This statement did cause some alarm amongst MPs and Peers, to the extent that when questioned on the future of HS2 phase 2a on Monday, Andrew Jones MP- Minister for Transport- had to confirm that the government was fully committed to HS2 and wanted to bring phase 2a to completion 6 years early.

Though it is often not what is said as much as what is not said that really counts. HS2 is now so far along that the government could not realistically pull out without causing a major crisis for itself but nothing had yet been said about Heathrow or Hinkley. While Hinkley has since been announced, it is important to note that when pushed by the committee on Heathrow and Hinkley, the Chancellor was equivocal on stating that announcements on these projects would be made soon.

Rather than backing large set piece infrastructure projects, the Chancellor sees more gain for UK plc in more moderate and rapidly-deliverable projects in the road and rail sectors. This will mark a considerable change in governmental thinking on infrastructure development and investment and our industry must be ready to respond.

Key to this new landscape will be the new industrial strategy that will be focused on improving the UK’s productivity both internally with regards to London and the rest of the country and externally with other leading economies. The basis of government thinking for this strategy will be the ‘Northern Powerhouse’, but it is intended to go much further and address all regions of the UK with the aim of creating more intergraded labour and goods markets. Projects that show how they can achieve this will be welcomed by the government.

Hammond went on to state that the National Infrastructure Commission could play a role in the industrial strategy but that he was not yet convinced of the need for the commission to be placed on a statutory footing. It is clear that the NIC will now be a subsidiary body to the industrial strategy and that any new National Infrastructure Delivery Plan will have to meet the objectives laid out in that strategy.

What all this means is that the Autumn Statement is going to announce a fundamental readjustment of governmental thinking with regards to fiscal and investment policy that will challenge the current assumptions of our industry. Firms that wish to thrive in this new environment are going to have to take note of the new fiscal rule and its 2 requirements by recognising that smaller projects may be preferred by the government to large scale projects.

The mist covering the new political landscape is beginning to lift and soon we will be able to make out the new geographical features. We are bound to get a further glimpse of the scenery with the Chancellor’s conference speech but make no mistake the overall lay of the land will be very different to what we thought it was just five short a month ago. ■

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Infrastructure investment and the impact of Brexit

Investment in infrastructure will shape the UK economy through Brexit, says Francisco Sebastian, Fellow of the Institute and Faculty of Actuaries...

Infrastructure is a vital element of the UK economy. More recent public policy initiatives such as the National Infrastructure Delivery Plan and the National Infrastructure Commission follow on from a long tradition of investment in infrastructure by both the private and public sectors. Infrastructure investment represents a large fraction of total fixed capital formation and is a primary channel for public expenditure. It will be instrumental in shaping the UK's economy during and after Brexit.

Uncertain times

Infrastructure will be subject to the changes in growth, inflation and policy stemming from Brexit.

The more volatile and uncertain institutional and policy environment is likely to decrease the level of private investment in infrastructure in the UK. Financial markets have already reacted by pushing gilt yields and Sterling to multi-decade lows. The market movements also reflect an expected economic slowdown, and the Bank of England's shift to increasingly expansionary monetary policy.

The impact will be uneven

In this environment, from the perspective of investors, operating infrastructure may be an attractive investment relative to other asset classes for several reasons:

- Services from infrastructure are often domestic and dominated by a handful of major suppliers. In addition, as infrastructure projects take years (or even decades) to develop, their sensitivity to short term economic fluctuations is very limited. Both features, combined, shelter revenue against weaker demand. Furthermore, in the medium term, potential inflation pickup from weaker currency may support price increases on services derived from infrastructure. Nevertheless there

are relevant exceptions in the energy (e.g. oil and gas), transportation (e.g. ports and airports) or commercial real estate subsectors, which are more exposed to the dynamics of global competition and require more granular analysis.

- Lower interest rates since the EU Referendum decrease the cost of funding and further enhance valuation of existing projects.
- The slower growth environment following the Referendum may release some pressure on usage of existing infrastructure. This may be helpful for some sub sectors, such as transportation, in which it may be possible to postpone or slow down the rate of investment.

In summary, most existing infrastructure projects are relatively well positioned to withstand the Brexit process without major difficulties. Valuations may be positively affected, in most cases, due to the combination of steady cash flows and lower interest rates.

By contrast, the outlook for new infrastructure projects in the short and medium term is mixed:

- Legal and regulatory uncertainty impedes potential investment, especially as the UK's strongest investment ties are with EU countries, which would be most affected by Brexit. The possible re-emergence of the Scottish secession debate further increases this risk, notably for pan-UK transportation and energy projects.
- Funding uncertainty is another negative factor for new infrastructure development. With lower yields and higher legal uncertainty, neither international banks nor non-traditional sources of funding (such as foreign insurance companies) are incentivised to finance fixed



investment in the UK. EU-related lines of funding (e.g. the European Investment Bank), are also likely to weaken. Nevertheless, the lower yield environment may encourage pension funds and other domestic investors to partially fill the gap left by international investors, as infrastructure may continue to provide the long-dated, inflation-sensitive cash flows that they need for balance sheet management purposes – along with certain yield pickup.

- Weaker Sterling makes importing materials and technology more expensive. Together with a tight labour market and potential obstacles for immigrants to fill that gap, construction costs will inevitably increase and returns on new projects will compress.

The policy perspective

To date, the UK Government's policy response to the phenomena described above has aimed at providing stability:

- From the fiscal side, the Government has signalled that infrastructure will continue to be a priority and that the deficit targets will be relaxed. This will likely be positive for social (e.g. housing, healthcare, schools) and transportation projects, as the public sector tends to be the primary investor in these areas, and may have positive spillover effects on other subsectors.

- The Bank of England's asset purchase programme has increased domestic private investors' quest for yield, which increases interest in infrastructure.

Looking to the future, uncertainty is likely to dominate, despite the positive effect that fiscal and monetary policy may have on funding of infrastructure projects. Furthermore, the combination of lower expected returns, government intervention and domestic investors' need for yield may result in elevated valuations of infrastructure projects. From a policy perspective it may be tempting in the short term for the UK Government to use infrastructure investments to boost demand in the economy. A more suitable policy approach for the longer-term, post-Brexit period may be to establish a robust framework that encourages regulatory stability, that prevents legal fragmentation, and that facilitates competitive conditions for domestic and international investors in UK infrastructure. ■

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A new chapter for privacy protection in Europe

David Martin, Senior Legal Officer at the European Consumer Organisation, outlines what the new General Data Protection Regulation means for consumer trust and meeting today's challenges...

On 5 May 2016 the new European General Data Protection Regulation (GDPR) was published in the European Union's Official Journal, marking the end of a long and complex legislative process that lasted over 4 years. The GDPR will be directly applicable in all EU countries from 25 May 2018.

Goodbye to patchwork of rules

This new regulation is good news for consumers. They will have more information about what happens with their personal data online. It also gives consumers greater control over how, when, by whom and for what purposes their personal data is collected and used.

The adoption of the GDPR is a positive development for the EU's Digital Single Market. The current patchwork of national data protection laws developed to transpose the 1995 EU Data Protection Directive will be replaced by a single piece of legislation, directly applicable all across the EU. This should make it easier for businesses to operate in the EU. It should also result in more coherent and efficient enforcement of the rules by national data protection authorities.

The GDPR will boost consumer trust in digital services and ensure that the online marketplace develops in a way which is respectful of our fundamental rights and values.

Meeting today's challenges

The EU needed a modern and unified legal framework to face the privacy challenges posed by the digital revolution. The present is digital and the future will be even more so. Technology and 'big data' are transforming our societies, changing the way we live, the way we work, even the way we think and take decisions. The predominant internet business models are built around the monetisation of consumers' personal data.

Yet, consumers remain oblivious to the massive collection, processing, storing and monetising of their data. All they encounter are the never-ending and unintelligible terms and conditions, which are difficult to read, even more difficult to understand, and often do not come close to what is actually going on inside the 'black box'. Terms and conditions often do not even respect basic consumer and data protection rules. Yet, the only real option is to click 'I agree', as the case of the recent changes in WhatsApp and Twitter's privacy policies has illustrated.

“The powers of national data protection authorities have also been strengthened to make sure that all companies, big or small, comply with the rules. Consumer organisations will also be able to play a greater role defending consumers' privacy.”

Principle-based evolution

Privacy concerns are only likely to grow as technology, big data and connected devices become even more predominant in our lives. From a consumer perspective, the GDPR is not a total revolution but a much-needed evolution. It builds upon well-established principles and elements of EU data protection law and seeks to adapt them to a new technological reality – giving people greater control and transparency.

The GDPR introduces quite detailed obligations in terms of the information that has to be provided to consumers when their data is processed. It also reinforces existing consumer rights such as the right to object to the processing of your data, the right to access your information and the right to have it erased.

The regulation also establishes new rights. Worth highlighting is the right to data portability (i.e. consumers



have the right to take their data with them when they are switching from one service to another). There are also stricter rules on how to seek consumers' consent for the processing of their personal data. Consumer redress mechanisms have been improved. Consumers have the right to compensation for material or immaterial damages when their rights have been breached. Another new element is an obligation for companies to abide by the principles of privacy by design and by default. Privacy must be embedded in every step of the development of a product or service and the strictest privacy settings must be set on by default when a consumer uses a new product or service. The GDPR will apply to any company offering goods and services to consumers in the EU or monitoring consumers' behaviour in the EU, regardless of the company's nationality or whether it is established in the EU or not. The powers of national data protection authorities have also been strengthened to make sure that all companies, big or small, comply with the rules. Consumer organisations will also be able to play a greater role defending consumers' privacy.

All these new rules shall help build trust in digital services and technology, foster the development of privacy

friendly technologies and help consumers to safely enjoy the individual and collective benefits of the digital revolution without compromising their fundamental rights.

“The GDPR will boost consumer trust in digital services and ensure that the online marketplace develops in a way which is respectful of our fundamental rights and values.”

Overall the GDPR opens a new chapter for privacy protection in the EU, but this is just the beginning. The story now shifts towards how to apply the GDPR in practice. The battle for consumer privacy continues. ■

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The importance of preparing for the new General Data Protection Regulation

By Kevin Jefcoate, iStorage Marketing Director

The more data we are producing the more people there are that want to avail themselves of that data, especially if it's personal. Sure, a large percentage of the threats are via the internet in one form or another; The Regional Organised Crime Unit suggest there were 2.5 million cyber-crimes reported in 2015. Aside from the disruption and inconvenience this may cause, the impact on the UK economy in 2014 was estimated at £49 Billion!

What doesn't get discussed as much and is actually nowhere near as sophisticated as some of the internet attacks, is data loss, or data breaches, as a result of negligent removable media usage.

Anecdotal evidence suggests that:

- 12,500 hand held devices, including USB drives get left behind in taxi cabs in London and New York every six months
- UK dry cleaners find over **22,000** USB drives every year!
- Globally, more than 20 million unprotected USB drives are lost a year!
- One fifth of people finding a USB drive will use them...

Whilst this is all costly, wait until 25th May 2018 when the Eu GDPR(General Data Protection Regulation) will be in effect and a data breach could lead to fines of up to €20 Million or 4% of global revenue, whichever is greater!

The question is not IF, but WHEN will you be exposed? To minimise the risk, now is the time to consider using highly secure removable media and having the policies and procedures in place to avoid; loss of information, the introduction of malware, reputational damage and of course, financial loss.

With removable media the risk is more than likely from human error and not necessarily the devices. If you invest in the right kind of portable data storage solutions & educate users to encrypt all the information they hold, the return on investment will be evident...

GDPR requires information of a confidential nature such as, customer and staff records within organisations, to be encrypted, especially because this data is highly sought after. iStorage overcomes these issues with its wide range of ultra-secure hardware encrypted removable media products.

The range includes USB 3.0 Flash Drives, Hard Disk Drives, and Solid State Drive formats, with capacities ranging from 4GB up to 8TB.

The products operate straight out of the box, do not require any software or drivers to be installed and are compatible with Windows, Mac, Linux, Chrome, Citrix, Android and Embedded Systems.

iStorage products are selected by government entities, financial, legal

and educational institutions, as well as many other organisations. These products are considered as the removable media of choice because of military grade AES 256-bit encryption, supported by FIPS 140-2 Level 3 certification and various other pending certifications to include CESG, CPA and NLNCSA.

Beyond the high level of security, the certain iStorage range of flash drives benefit from being rated for water and dust resistance to IP57. However, where the iStorage range really brings value beyond other types of secure media, is through the integrated keypad. This unique feature allows users to create an administration and user pin, which until entered, renders the device not recognizable by any system. By entering the unique, user created PIN, 7-15 digit in length, the data can be accessed by simply plugging the product in to the USB port of any host device. This means that your data is not only protected by hardware encryption but also PIN authentication. This further protects your data from Brute Force and key logging software attacks. Should an incorrect PIN be entered more than ten times, the data will be destroyed automatically...

By combining the power of strong, easy to use, PIN authentication and the highest hardware data encryption, iStorage can ensure you are GDPR compliant, keeping your data safe, further ensuring peace of mind.

Don't leave any door open to cyber threats...

Use hardware encrypted portable data storage products



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Swiss Distance Learning University

Education my own way

3 reasons why you should train in Biometrics and Privacy

Biometrics includes all data generated by the measurement and statistical analysis of people's physical, behavioural and technical characteristics: fingerprints, face, iris or passwords, photos and activities recorded on various devices. New applications using these technologies are launched every day. They change our vision of society and pose challenging questions regarding citizen's identity and the end of privacy.

Personal computers and mobile devices such as smartphones and tablets use biometric-based technologies, functions and applications (fingerprint and face recognition for example). Most leading research organizations foresee a significant growth in this area in the next 5 years and beyond.

1. Get ready for the EU General Data Protection Regulation

The ratification by the European Parliament of the General Data Protection Regulation (GDPR) will have a huge impact on privacy and data protection. All organizations dealing with EU data subjects will be affected as of 2018. This regulation is an essential step to strengthen citizens' fundamental rights in the digital age and facilitate business by simplifying rules for companies in the Digital Single Market.

In order to help private individuals, business and government employees, decision-makers from the public, private, finance and healthcare sectors as well as data protection officers facing this challenge, Swiss Distance Learning University offers a short but complete online training course in Biometrics.

2. Understand concepts and technologies in the area of biometrics and privacy

This online programme aims to help citizens and authorities to better understand biometrics as well as privacy and data protection. It provides participants with a full understanding of data protection, privacy preservation, compliance with privacy regulations and potential privacy losses.

Biometrics poses an increasing challenge in many areas: Where is the data stored? Who can access it for what purpose? Could it be hacked and misused? How can citizens protect themselves? How should employee files be managed?...

3. Get trained by the best experts in Europe

The best experts in biometrics and data privacy protection will teach Swiss Distance Learning University's short programme on biometrics & privacy.

The online CAS Biometrics & Privacy course comprises 6 modules of 2 ECTS credits each.

M1 – Biometric Technologies. Introduction to biometrics (definitions, concepts, examples and applications)

Dr Sébastien Marcel

M2 – Security and Privacy-Preserving Biometrics.

Complete insights of privacy-preserving biometric authentication, challenges and methods

Professor Dr Katerina Mitrokotsa

M3 – Biometrics Standards. ISO standards and terminology in Biometrics

Professor Dr Christoph Busch

M4 – Legal Aspects of Data Protection and Privacy.

Presentation of the methodology, systematic and leading principles of European data protection legislation

Dr Els Kindt (LL. M)

M5 – Ethics, Culture and Society. Introduction to principal themes and concepts in ethical, cultural and societal implications of biometrics

Dr Emilio Mordini (MD, MA)

M6 – Forensic Science. Deployment of biometrics systems in Forensic Science practice around the world. Use and misuse of faces, fingerprints and DNA by law enforcement agencies

Professor Christophe Champod



Left to right: Ivo Emanuilov, Leiden University;
Dr Els Kindt, Professor and legal researcher, Leiden
University; Dr Sébastien Marcel, Senior researcher and
Director of the Biometrics Institute at the Idiap research
institute, Prof. Dr Christophe Champod Full professor in
forensic science at the University of Lausanne.

Choose when and where to study

The programme is designed for professionals and can be attended in conjunction with full-time work.

You don't have to put your life on hold to get the qualification you want. The CAS Biometrics & Privacy is a full distance learning programme. The course consists of personal homework, assignments published on an online platform, online support and virtual classes. There is no such thing as a classic campus course in this programme. You can study whenever and wherever you choose, to fit in with jobs, families and other commitments.

The programme can be completed within 3 months (minimum) and 12 months (maximum) and you can choose when you want to start from 3 starting dates a year. You can follow the modules in each of these sessions, provided that you start with Module 1 and finish with Module 6 within the 12 month timescale.

About us

The Swiss Distance Learning University is the only institute recognised as a distance learning university in Switzerland and has been offering an extensive range of distance learning courses since 1992. The structure of the courses is in line with the Bologna Directives and the degrees are equivalent to those of traditional Swiss universities.



This programme has been elaborated in collaboration with the Idiap Research Institute

Course details

Certificate of advanced studies Biometrics and Privacy

Credits

12 ETCS

Duration

3-12 months depending on your pace

Start dates

In 2017: April and September.
From 2018: 3 times a year

Admission requirements

Candidates for admission must satisfy the following requirements:

- Diploma of Higher Education (university or equivalent)
- And/or at least 3 years relevant training or professional experience
- English proficiency

Selection is made by the Admissions Committee, based on the application file.

Fees

Application Fee

CHF 200.00

Tuition Fee

CHF 6,000.00 for the whole CAS programme
CHF 1,300.00 for each module taken separately

How to apply



Five steps to a digitally integrated justice system

John Wright Head of Strategic Initiatives at Unisys discusses how digital integration and collaboration could enhance the crime and justice system...

European central and local governmental departments are perpetually challenged by the need to drive greater digital initiatives to enable integration across their own departments and between those which they collaborate and coordinate with.

Firstly, there is a constant pressure to reduce costs while driving efficiency through intelligent IT deployment. Secondly, there is a certain level of expectation from tech-savvy citizens that demand customer-friendly services through mobile devices, the cloud and in real-time.

Crime and justice services in particular have much to gain from embracing digital integration. However, the complexity of their structure – containing multiple and contrasting departments – and the sensitive nature of the information processed makes this development a slow one. Across much of Europe, departments delivering crime and justice services to citizens are tied down by bureaucracy and the fear of public inquest and litigation if something is found to be wrong.

Totally autonomous departments with their own budgets, lack of cross-agency funding and no centralised leadership means that a lot of departments that need to collaborate with each other on a daily basis are usually divided by digital walls.

An end-to-end crime and justice system that is linked by a single IT system is unlikely. Despite this, departments cannot afford to ignore the obvious benefits of innovative technology, nor should they be railroaded into short-term fixes that are not equipped to deliver long-term benefits.

There are many examples of departments within crime and justice improving operations through the innova-



**John Wright,
Head of Strategic
Initiatives**

tive deployment of technology. We have seen police forces harnessing big data and analytics via case management systems which capture and process vast quantities of data and case evidence. There has even been integration between courts, police and probation services to improve the efficiency of trials by optimising document and evidence tracking across departments improving the chances of successful trial completion.

So what are the crucial decisions CIO's and digital leaders within the justice system need to consider when trying to integrate departments under one unified IT strategy? Here are the important factors that need to be taken into account before making a change:

1. Make any changes incremental. In the absence of a holistic, cross-sector strategy, look closely at the small measures you can make across your department

2. Plan for future needs. Pick solutions which offer openness and standardisation. Whilst integration with certain departments might not be possible now, maximise the future potential for integration by choosing solutions that present data in standardised, open formats.



3. What are the infrastructure requirements?

Ensure that infrastructure can support new services and the necessary data requirements to power those services. For example, many police forces are now gathering huge volumes of video data from body worn police cameras and as video evidence from witnesses. But if back office infrastructure can't securely store such data, then investment in expensive recording devices, or video gathering platforms will not show ROI.

“We have seen police forces harnessing big data and analytics via case management systems which capture and processing vast quantities of data and case evidence.”

4. Integrate the needs of citizens. Citizens demand a better service from their government. Victims and witnesses expect access to government to be on a par with their consumer experience – mobile apps, web portals, 24/7 access to services and information are pre-requisites, not exceptions

5. Adopt best practice. With widespread impetus towards digitising government processes, leaders in crime and justice should seek out best practice and

learn the lessons from other government departments. In doing this they can get ahead of the digital curve on what citizens want.

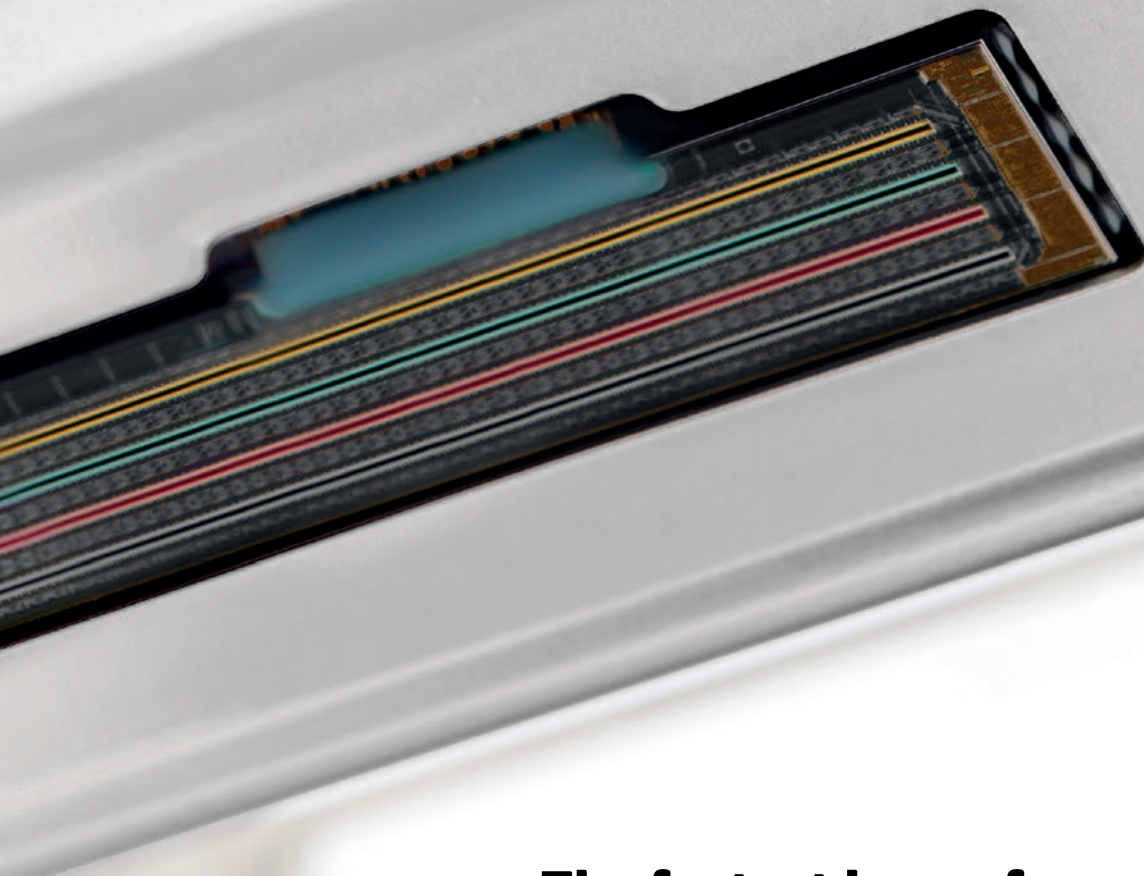
Crime and justice departments across Europe are at a severe risk of missing out on the advantages of the digital revolution. They all need to understand that the consequences of failing to join-up justice departments though increased digitisation and integration are not just financial. Increasingly, citizens will lose confidence in the public justice system if they don't see their experiences mirroring those which are commonplace elsewhere in their lives. ■

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John Wright

Head of Strategic Initiatives

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1. Fastest based on internal HP testing and methodology compared to alternatives for large-format printing of technical documents, GIS maps, and point-of-sale (POS) posters under \$200,000 USD as of March, 2015. Production costs savings based on comparison to a setup consisting of one monochrome LED printer and one colour production printer, both under \$150,000 USD, as of April, 2015. Production costs consist of supplies and service costs, printer energy costs, and operator costs. For testing criteria, see www.hp.com/go/pagewidexlclaims.
2. With a maximum linear speed of 23 meters/minute (75 feet/minute), the HP PageWide XL 8000 Printer is 60% faster than the KIP 9900 printer which, at 14 meters/minute (47 feet/minute), is the fastest rated LED printer as of March, 2015.
3. Using HP SmartStream software compared with using equivalent software programs. For testing criteria, see www.hp.com/go/pagewidexlclaims.

Meeting the Printing needs of the AEC Industry

How new technology enables the production of high-quality prints more efficiently and cost-effectively



Thomas Valjak, EMEA Head of Large Format Printing HP Inc in the Graphics Experience Center in Barcelona, Spain

Repro houses play a critical role in reproducing high-quality technical drawings and other documents for AEC customers. This includes architectural and engineering blueprints and renderings, and folded and finished bid sets containing all the drawings and construction sets needed to complete a project.

Although traditionally a high number of AEC technical documents are produced in black and white, coloured prints are increasingly becoming a pre-requisite. The move into colour can be attributed to the belief that it improves communication, readiness and indirectly saves time and costs throughout the bid, design and construction process.

Eliminating complex workflows

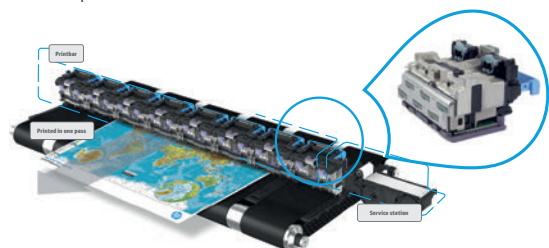
Many repro houses use an LED printer for monochrome print runs and an inkjet printer for colour. Managing both monochrome and colour printing, along with bid sets that consist of a mixture of small format and large format pages, means having to rely on a wide range of printing hardware and software. This has often led to inefficient processes, where costs are greater and workflows can contain an increase in the number of stages needed. As AEC clients face tighter project completion times, repro houses are also under increasing pressure to deliver high-quality short-run print runs with quick turn-around capabilities.

Automation is one of the key factors of a smoother and faster print process. Technology including end-to-end workflow software, combined with peripherals such as on-line folders, makes print management more efficient. Additionally, automatic detection and correction of corrupted PDFs, automatic selection of small and large format pages and on-screen soft-proofing can all help reduce job preparation time by up to 50 per cent. This frees up time to take on more jobs. Easy-to-use workflow software like HP SmartStream can also make a repro house better able to weather workforce turn-over, as it minimises the need to train new workers in complex operations.

When speed matters

Streamlining workflows is one way to speed up turn-around times but increasing the speed of printers is also critical. In 2015 HP was bringing the record-breaking speed of HP's PageWide Technology to large-format printing. HP PageWide Technology uses tens of thousands of tiny nozzles on a stationary print bar rather than a scanning print-head. This results in print speeds of up to 30 A1 pages/minute. Instead of using two separate devices, one printer can be installed for both monochrome and colour, and colour prints can be produced at the same cost as black-and-white. In addition, new graphic applications such as retail temporary posters and maps can be added to the offering.

Based on proven HP Thermal Inkjet technology, HP PageWide print heads are designed to have a long life. The reliable drop ejection process reduces print quality defects from 'nozzle outs'. Automated print head servicing and calibration, including nozzle compensation, ensure consistent operation and minimal service intervention.



HP 841 PageWide XL Printhead module

Costs under control

For print service providers looking to meet the demands of AEC clients, gone are the days of the LED and inkjet printer sitting side-by-side. Both colour and black & white printing will be able to be produced at much lower costs than ever before. This will make it easier to meet clients' increasingly high expectations whilst having a much needed positive effect on the bottom line.

Additional information under hp.com/go/pagewidexl

Taking the police force back to Neighbourhood Watch

The police force must reconnect with the community to successfully tackle crime. Digital platforms offer a solution to this, says Darren Hunt, Director, Public Sector at SAP...

On a typical day, officers in a force will make around 50 arrests, deal with 101 anti-social behaviour incidents, respond to approximately 12 missing person reports, carry out 37 stop and searches, deal with 9 road traffic collisions, and respond to 14 incidents flagged as being linked to mental health issues. Despite this hugely impressive repertoire, the police appear disconnected with the community.

The public is becoming more digitally savvy, which is changing the landscape of crime and public engagement. Online publications and social media have caused a decline in public perception, with articles presenting the police as vacant and unavailable. Often Police agencies are hindered by legacy ICT systems, which don't provide them with the tools required to readily communicate with the community across an omni-channel platform. [A recent study](#) conducted by Her Majesty's Inspectorate of Constabulary (HMIC) shows that Police communications and reassurance strategies can play a key role; with those who feel more informed confident they can get hold of police when needed.

Greater public engagement

In 2012 steps were made to address this, with the first generation of [Police and Crime Commissioners](#) (PCC's) elected to act as the human face of these organisations, to improve public perception and police visibility. While this demonstrates an understanding of the need for greater public engagement, these public figures alone are not enough to achieve the desired levels.

In fact, 73% of PCC's surveyed in 2016 said that public engagement was their number one concern. With rising expectations for interaction with local government, police increasingly need to provide a "customer-centric" experience to the citizens they protect. While traditional back office platforms have been crucial in simplifying

back end processes – such as HR and Payroll within the police sector – there has been little adoption of public engagement solutions to manage the relationship.

Digital platforms allow better interaction and flexibility

The primary benefit of implementing digital platforms and solutions is that the police force can effectively interact with citizens across a number of touch points. When you think of contacting the police, your first thought would be to dial 999. But omni-channel solutions are available now to support members of the public in logging crimes through an instant message on WhatsApp or direct message on Twitter. Greater flexibility and access to the services provided by this department make the police force a more approachable and familiar organisation, further developing and improving the relationship with the public.

The likes of Facebook and Twitter have incredible applications to open up avenues of communication. For instance, London's Metropolitan Police force has a Twitter account that is used to inform the public in times of crisis, reach out for support and even report their latest news. Keeping the community informed is a crucial use of these channels, but they also provide police forces with greater insight.

Social media plays an important role in fighting crime

Using digital innovations, police can scan social media platforms to better protect citizens, particularly with the growing concern for cyber-crime and radicalisation. While these channels offer endless positive possibilities, in the wrong hands they can be used to abuse, harass or even radicalise civilians. Having innovations that are able to monitor countless threads across the internet and social media puts the police in a much better position



to prevent digital crimes, such as cyber terrorism, which has seen a rapid increase in recent years as individuals leverage the power of the internet.

Empowering the police force with real-time data insight enables them to approach investigations with the latest and most accurate data. Armed with this police on patrol can become a fully connected officer, tackling front line needs more efficiently. Bavaria's state police service is actually using digital solutions to run analytics on countless pieces of seemingly unrelated data, which enables them to detect patterns and better resolve crimes.

Real-time insights

Equipping police officers with simply presented real-time insights can vastly improve the efficacy of their service. But in order to reduce public fears and improve confidence in policing there must be a focus on crime prevention. Predictive analytics have been used to support various security agencies with their preventative strategies by leveraging patterns and trends in data to predict where crime is most likely to take place. Armed with the potential to forecast where and when criminal activity is likely to take place, police organisations can better prepare and advise officers on the front line, increasing safety not only for civilians, but for officers themselves.

While public sector bodies are stretched to the limit of their capabilities, improved safety for both citizens and employees can be achieved through collaboration

across all local agencies, such as fire, health and local government, using digital innovations. Often police officers manage the impact of community disturbances supported by other government agencies. But in order to better prepare, protect officers and serve the community these agencies need to have access to the information held by each other.

Transparency will drive improvements

This improved transparency will be key to driving improvements in service delivery across all local government agencies, invariably driving public perception of police presence and availability. This will make them the 'human' face of local government. Equipped with detailed insight and understanding of citizen's needs they are better able to prevent crime, serve the community and build trust.

There are a range of solutions on the market that can be tailored to the needs of different communities to provide police with the best possible tools to engage with their community, something SAP will be talking about a lot in their upcoming Public Sector event on 11th October. Ultimately technology will shape the police force over the coming years, not only making it more accessible but more inclusive. What I mean by this is members of the community will be directly supporting police across omni-channel solutions, highlighting criminal activity and potential disturbances in real-time to provide officers on the front line with greater insight. Police won't need to focus on building up public appearance, but will be striving for complete public collaboration. ■

.....
Darren Hunt
Director, Public Sector

SAP
<http://go.sap.com/index.html>
www.twitter.com/sap



Virtual desktop infrastructure and mobility-solutions

Winifried Schultz, Marketing Director at Black Box EMEA outlines how to prepare for the future of control rooms and emergency call centres with mobility-solutions...

Our world is changing. Mobility not only affects our private life but also our professional environment. We expect our work places to support today's communication methods such as BYOD (Bring Your Own Device), and for workflows, processes and IT-hardware to adapt to our demand for real time data. In modern control rooms, process control centres and emergency call centres the reliable supply of information can mean the difference between life and death. In these environments, it is crucial to work with systems that reliably allow visualisation with no

delay and give the operators simple and intuitive control over access to multiple data sources and servers, while maintaining network security.

The technological ability to switch between virtualised desktops over IP or RDP (Remote Desktop Protocol) via touch panels and mobile devices is now a reality. Users can access both virtual machines and physical PCs without ever losing the "real" desktop experience, and more importantly without noticeable delay. Video signals can be extended at up to 4K quality, and peripheral signals (mouse, keyboard,

input devices) and digital audio signals – e.g. for internal communication purposes – are routed to the correct operator or loudspeakers. Collaboration devices allow any registered user to upload and download data, such as images or videos, and even mirror and share complete screens on common displays. Content can be sent from a mobile device at the place of interest directly to a distant control room. The team leader can then quickly decide whether the data obtained should be displayed on one or more video walls by simply pressing a button on a touch screen panel. There are virtually no

PROFILE



limits to the transmission distance: just think of the transnational operations after the earthquake in Italy in August, when international emergency services were coordinated within hours.

“The technological ability to switch between virtualised desktops over IP or RDP (Remote Desktop Protocol) via touch panels and mobile devices is now a reality. Users can access both virtual machines and physical PCs without ever losing the “real” desktop experience, and more importantly without noticeable delay.”

In the manufacturing and energy production sectors, controlling production lines in multiple locations from mobile devices, and retrieving status updates is already daily routine. Status messages, logged data and circuit diagrams can be distributed to different control rooms and video walls; this is especially important if it is necessary to ensure critical monitoring and controlling of processes

from a secondary “backup” location. One example could be preserving the energy supply of an entire region in a threat situation.

Virtual Desktop Infrastructure (VDI) will be an increasingly important topic, because the use of virtualised desktops can incorporate huge cost savings with regards to energy, hardware, and maintenance costs. However instead of writing off all physical servers today, it often makes sense to run physical and virtual servers side by side. The solution to this is to utilise a bridging technology, such as Black Box InvisaPC. It enables users to access both PCs/servers and virtual machines over IP in real time, transmitting HD video and peripheral signals at a very low bandwidth consumption (more than 40 Mbit). Applying a corresponding hardware manager, traffic between user and server is strictly limited to authorised users, even when transmitting from one country to another over the internet. Another advantage of this VDI technology is that the access to mirrored virtual “backup systems” can be carried out almost instantaneously. If one system fails, it will be replaced by switching to another virtual machine.

For both redesigning existing, and designing new control rooms and emergency call centres, you should plan properly to ensure that the applied technologies are future-proof and can flexibly adapt to new requirements. With Black Box modular high-performance KVM Matrix Switches, KVM-for-VDI (InvisaPC™), Video Wall Processors, as well as Room Control Solutions and

Collaboration Solutions, you can make sure that your investments are safe for many years, and corresponding data visualisation and workflow reliably meet the requirements of your individual working environment.

Black Box designs and equips more than 500 control rooms per year globally, and consults customers about future-proof technology combinations throughout all phases of their projects, and beyond. Furthermore, Black Box implements all infrastructure and sets up all hardware components from the IT-room to the operator desk. Contact our Application Experts across Europe for project consultation and answers to your questions on network security and IP technology: visit www.black-box.eu/CRConsultation or call us toll free at 00800 2255 2269.

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Reasons to be cheerful about public sector cloud

Jessica Figueras, Chief Analyst, Kable talks about how public sector IT is utilising cloud technology and why it remains a bright spot in a static market...

Thanks to the Brexit vote, the public sector IT community faces an environment where the only certainty is uncertainty. As the machinery of government is reshaped to negotiate and deliver a new role for the UK in the world, it is becoming harder to get stressed and distracted ministers and mandarins to think about much else.

Brexit complicates life for government CTOs and CDOs. No-one knows which form Brexit will take, and there are many possibilities, so its impact on the wider public sector in the 4 nations of the UK is hard to pin down. That means government policy on everything from borders to farm payments could be up in the air for years. Digital and technology projects linked to policy will have to wait for a clearer picture.

However, there are reasons to be cheerful. Rather than waiting for the green light on projects that might never see the light of day, CTOs should take the opportunity to fix their underlying IT infrastructures. With flexible, low cost infrastructure and skilled development teams in place, technologists can be agile when the time comes for them to implement new government policies. Now is the time for cloud.

A bright spot in the market

Cloud is one of the few bright spots in a static public sector IT market. Ex-Minister Francis Maude set the tone when he announced the 'Cloud First' policy for central government in 2013. Cloud services, including SaaS, PaaS and IaaS, only accounted for around 2% of overall public sector IT spend at that time, but has been growing at a very healthy 45% per year since.

'Cloud First' was characterised as a policy that would drag the unwilling dinosaurs of government IT into the 21st century. This was unfair; public sector IT profes-



sionals have long since understood the potential benefits of cloud and as-a-service delivery models. In Kable's 2016 survey they told us they expected to gain:

- Greater flexibility and scalability in computing resources (19%);
- Improved IT efficiency and agility (17%);
- Great cost effectiveness (17%);
- Reduced capital expenditure (16%);
- Mobile and ubiquitous access to applications and services (15%);
- Greener IT (11%);
- Other (5%).

Public sector cloud 1.0

In the atmosphere of optimism after GDS was founded, 'Cloud First' – with its focus on commodity public cloud services – was greeted with enthusiasm. New digital

teams, bringing agile working practices to government for the first time, often found public cloud services quicker and easier than their own IT departments to work with. And the first generation of digital services were well suited: greenfield, handling little sensitive data, and with light backend integration requirements.

G-Cloud has been an excellent vehicle for those early cloud projects: not just commodity IaaS, but also SaaS tools supporting new collaborative ways of working. It offers buyers a simple and quick route to access a wide range of suppliers, especially SMEs who are often shut out of the public sector market. On average, the public sector is now spending over £50m per month via G-Cloud (although some 80% of that has been for professional services rather than SaaS, PaaS and IaaS).

Where there’s hope, there’s hype

But Kable analysis of G-Cloud sales data – supported by anecdotal evidence from suppliers – suggests that sales growth has reached a plateau. Public sector cloud is still in its infancy and has huge growth potential, but much of the low-hanging fruit has gone.

The next wave – call it public sector cloud 2.0 – is being driven by the transformation of existing services, rather than brand new projects. Opportunities will be opened up as legacy IT outsourcing contracts come to an end, and organisations look to shift workloads to the cloud.

And herein lies the issue. As my colleague Gary Barnett has argued, people sometimes talk about cloud as if it had magical, unicorn-like properties. The nitty gritty reality of cloud migration is ignored. Buyer enthusiasm is not always backed up by expertise. We see evidence of this in cloud-hosted government digital services apparently not architected for cloud, crashing under completely predictable demand spikes – DVLA’s digital tax disc registration, and GDS’s Register to Vote service, for example.

So making a success of cloud is not about swapping out expensive infrastructure for cheap public infrastructure, and it’s not about G-Cloud. It’s about enterprise architecture; data quality projects; new deployment processes, governance models, security policies and service management. It’s about hybrid cloud and cloud orchestration. It’s anything but simple.

Public sector cloud 2.0

As requirements evolve, the competitive landscape is also changing.

A number of UK-based SMEs have succeeded on the back of a public sector preference for UK data centres. Life will get harder for them as public cloud giants Microsoft and AWS open UK data centres this year. Systems integrators, including IBM, CSC and others, can also provide hybrid cloud services on a large scale as well as UK presence.

Smaller players could end up relying on client fears about data sovereignty to keep them in business, especially in the wake of Brexit. But it would be preferable for suppliers to offer a positive vision to the public sector, not just a negative one.

They should be tackling the barriers to cloud adoption with services such as data governance frameworks, security audits and migration programmes. SMEs also need to get over the G-Cloud hype. Some have learnt the hard way that Digital Marketplace is no substitute for sales and marketing, and this is becoming even more true as buyer needs become more complex and less suited to G-Cloud. Those suppliers that wish to remain in the commodity space will need partners that can bring them into clients’ hybrid environments.

Above all suppliers should be helping clients to build their own expertise, so that government can become the intelligent customer for cloud services that it aspires to be. And, perhaps, get its infrastructure into shape for the day when politicians and the public finally decide what Brexit means. ■

Founded in 1990, Kable is the UK’s leading public sector ICT analyst firm. We provide practical, evidence-based intelligence to the public services community including buyers, practitioners and suppliers.



Jessica Figueras

Chief Analyst

Kable

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Cloud technology: A mandate for local government

When the bottom line is all-important, cloud technology can help local government with everything from disaster recovery to shared services...

Local government needs to meet local needs. Government leaders are now expected to find ways to adopt technological innovations to increase citizen and business satisfaction against a backdrop of reducing costs, deficits and debt.

Protecting critical IT systems within local government is paramount. With emergency services such as police, healthcare or fire and rescue, plus payment-based systems, such as council tax, childcare or benefits, it is key that local government organisations are prepared and protected against IT outages of any kind.

In an incident at Lincolnshire County Council last year, their systems were compromised as a result of a ransomware infection, leading to multiple sections of the site being shut down for a week. Staff resorted to proceeding workflow using only pen and paper. Citizens were unable to access the service, resulting in the hindering of business processes and a profusion of negative attention.

Local government has a duty to its citizens to ensure that their disaster recovery plans are implemented, up to date, tested and verified. The impact of not being able to recover systems successfully and quickly from a disaster can be catastrophic. Local government organisations need the ability to orchestrate and automate disaster recovery failover, testing the



failover frequently. Without this capability, a business is at risk.

With Zerto's solutions for replication, disaster recovery, data protection, failover testing, and data migrations, local government organisations can be fully protected.

No need for expensive, space-consuming hardware

One of the key benefits to IT management is how vendor lock-in is removed at the storage layer by moving replication up the stack to the hypervisor. IT leaders will no longer need the same storage vendor with costly licensing in order to replicate data, as Zerto not only replicates data from any storage to another, but provides the mechanism to move applications and data as a whole via

its unique consistency group functionality. Cost cutting is key, but by removing the technology barriers to embracing the cloud organisations can simplify processes, minimise risk and enable business agility.

Optimising procurement and financial processes

Procurement performance and financial targets will be enhanced and streamlined. In OPEX-structured departments, IT pays only for the hardware capacity that they use. Costs are reduced, data can be accessed quickly and opportunities for shared platforms can be gained. The public sector will acquire the ability to purchase independently through a common procurement vehicle, a cloud environment that will optimise and shape the government's new "pay-as-you-go" financial processes.

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Transformation and change management

The UK public sector is undergoing dramatic digital change, moving away from legacy applications. These outdated systems have exposed many government departments to risks as they fail to achieve the Government's vision for public sector digital transformation.

As the public sector transforms, citizen services improve and efficiency savings can be experienced. Many organisations are now choosing the power of cloud models, favouring flexibility and mobility. With new and innovative technologies, organisations can achieve responsiveness and agility to specifically meet business and citizen needs.

As the government drives the adoption of cloud technology through the G-Cloud framework and its cloud-first strategy, organisations must undergo significant transformation in ICT and business operations.

Common resources:

Shared services and delivery

In order to deliver effective services to a wide and varied customer base, the sharing of information is the way forward. The advantages of collaboration through shared services are compelling as they span the whole public sector, saving money, boosting productivity and enhancing efficiencies.

Risk management:

A choice of clouds

Security and risk remain a chief concern for the public sector when considering cloud technologies. Placing sensitive data in cloud environments has highlighted challenges for various

organisations. There are three types of cloud implementations, with varying degrees of risk and flexibility:

- Private cloud offerings are under complete control of the enterprise. All functions, including business continuity and disaster recovery, are managed by an internal IT team. Organisations create internal 'clouds' by utilising shared IT environments and resources between teams and departments.
- Public cloud utilises a cloud service provider's hardware and datacentre to reduce IT cost and simplify service delivery. These include providers such as Amazon and Google, also offerings from cloud service providers who create individualised 'Managed Clouds' for customers with specific needs for greater management and control.
- Hybrid cloud is a combination of public and private cloud elements, utilised by organisations that do want to retain some degree of management over their datacentre, but also have the need to send some functions and applications to a public or managed cloud.

The utilisation of cloud environments is a necessity for optimising a multitude of business operations and nurturing innovation. Widespread cloud adoption could significantly reduce the estimated £16 billion spent by the public sector on IT every year. It also has the capability to enable vast savings across government departments, agencies and councils. The government's Digital by Default Agenda puts ICT at the centre of public

services and the implementation of cloud computing is central to meeting these challenges.

The Cabinet Office has stated that "public sector organisations should consider and fully evaluate potential cloud solutions first – before they consider any other option", making the cloud-first policy a mandate for central government departments and "strongly recommended" for other public sector organisations.

High levels of security can be achieved at all levels with Zerto's solution, providing complete peace of mind for leadership and risk professionals in the public sector.

Zerto seamlessly installs into an organisation's existing infrastructure with no need for configuration changes. This means that the public sector's carefully architected applications will not need to be changed. By unifying the disparate technologies used across the public sector, Zerto's Cloud Continuity Platform provides a simple and flexible stepping-stone to the cloud and shared services provision.

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Reducing online threats throughout Europe

Europol looks at the Internet Referral Unit a year on and the strides it has made to reduce cybercrime and the threat of terror attacks...

Earlier this year, Europol [highlighted to Adjacent Government](#) how the internet had become a powerful tool for terrorists. In order to combat this, in July 2015, the Justice and Home Affairs Council of the EU set up the European Union Internet Referral Unit (EU IRU).

The unit was set up in order to combat terrorist propaganda and related violent extremist activities on the internet. A year since it was launched, here Europol answers [Adjacent Government's](#) questions regarding the Internet Referral Unit and how it has helped to reduce the threat of terror attacks.

A year on has the Internet Referral Unit achieved what it was set up to do?

The EU IRU is part of the European Counter Terrorism Centre (ECTC) and its main tasks have been to:

- Coordinate and share the identification tasks (flagging) of terrorist and violent extremist online content with relevant partners;
- Carry out and support referrals, in close cooperation with the industry;
- Support competent authorities by providing strategic and operational analysis.

The EU IRU has fulfilled 2 first tasks both in reply to specific requests from the European Union Member States and through active detection of online content inciting terrorist acts. All EU IRU activities have been performed in accordance with the data processing rules established in the Europol Council Decision.

The EU IRU informs the online service providers, on whose platform the identified contents are hosted,

inviting them to review the material against their own terms of use. This process is called referral. Before referrals are carried out, any content is carefully assessed by the EU IRU. The decision to remove identified terrorist online content is taken by the concerned service provider under its own responsibility and accountability (in reference to the terms and conditions).

“The EU IRU works closely with the EU Member States as part of the referral process and can also provide Internet investigation support in the field of Counter-Terrorism.”

In its first year of operation (July 2015 – July 2016), the EU IRU assessed over 11,050 pieces of terrorist and violent extremist online content, which triggered over 9,787 decisions for referral to social media providers and file hosting platforms, with a success rate of removal of 91.4%. This means that in over 9 out of 10 instances, the online service provider shared the assessment by the EU IRU and decided to remove the content voluntarily.

For more information, see the [EU IRU's one-year report](#) on Europol's website.

How has it helped to reduce the threat of terrorist attacks?

The role of the EU IRU is to support online service providers in optimising the current, voluntary referral process. It has, thus, contributed to limiting accessibility to terrorist content online.

Limiting the accessibility of terrorist content serves 2 purposes. Firstly, it lowers the risk of individuals potentially vulnerable to radicalisation being exposed to such content involuntarily. Secondly, it increases opportunities for actors within the civil society to disseminate alternative



views of an increasingly complex reality beyond the simplistic views promoted by terrorist groups.

How important is it to tackle this sort of cybercrime throughout Europe?

Terrorist use of Internet and social media has increased dramatically over recent years. Terrorist groups actively exploit new opportunities for mass communication and direct messaging offered by fast developing technologies. The spread of terrorist propaganda online has been highlighted as an important threat by leaders throughout Europe. Hence the MS request for the establishment of the EU IRU in July 2015. Since then, a wave of terrorist attacks in Europe, several of which inspired by calls for lone actor attacks by the so-called Islamic State, have emphasised the role of online propaganda for the threat from terrorism.

What are the main challenges when effectively trying to counter cyber-crime and terrorist propaganda?

Terrorist online propaganda is based on resilience, speed and agility. Online propaganda has shifted away from the "broadcast model" of communication (one to many) towards a dispersed network of accounts, which constantly reconfigures in a fast and resilient form.

In addition, the new opportunities created by the proliferation of social media platforms have provided the possibility for a persistent and ideologically cohesive presence for terrorist propaganda online (e.g. creation of new apps and automated botnets to boost their numbers of followers, exploiting archiving capability online to make content available to wider audience and for longer period etc.).

How does Europol work together with other organisations and Member States in order to both prevent and investigate terrorism?

The EU IRU works closely with the EU Member States as part of the referral process and can also provide Internet investigation support in the field of Counter-Terrorism. Europol also cooperates closely with online service providers in the framework of the EU Internet Forum, led by the EU Commission. The scope of the forum's activities is about reducing access to terrorist and violent extremist propaganda. ■

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SAFEPOST: Postal security knowledge across supply chains

Dr Antonino Scribellito discusses the SAFEPOST project and its contribution to the development of postal security knowledge for international supply chains...

Drawing to a close in July 2016, SAFEPOST – ‘Reuse and development of security knowledge assets for international postal supply chains’ to give its full title – has been a four year and four months integration project aimed at addressing the European Commission’s FP7 call SEC-2011.2.4-1 International Postal Supply Chains.

Beginning on 1 April 2012, SAFEPOST has since provided a highly innovative solution for postal security to:

- Assist stakeholders involved in postal services to achieve enhanced security without cost penalties;
- Facilitate the sustainable development of increasing levels of postal security across Europe.

Starting from the perspective of the partner postal operators, the project used a cost-benefit method to identify the main security gaps and described security measures to maintain or augment the efficient and secure operation of these posts. After making an inventory of security gaps starting from the perspective of the partner postal operations, the project developed generic postal security models which have been integrated into a Postal Security Target Operating Model.

This enables postal operators, customs and other relevant actors to understand how to securely exchange infor-



SAFEPOST Project presented during the PUASP Plenary in April 2016, Montevideo, Uruguay

mation related not only to security, but also to the optimisation of postal flows.

To support the implementation of the Postal Security Target Operating Model, a Postal Security Platform has been developed which supports, specifically, work packages 3 and 4 and provides a ‘Common Postal Security Space’ with a view to creating a European/World Postal Security standard information sharing system in the future.

One of the most important events in relation to the SAFEPOST project is the live demonstration meetings. The first live demonstration meeting took place on 20 May 2015 in Reykjavik, Iceland, to analyse deeply the process of postal items flow through D-Tube and find room for improvements.

The second live demonstration meeting was held in the Correos sorting

centre in Zaragoza, Spain, on 11 June 2015. The meeting had high-level participation from the European Commission DG Home Affairs, DG TAXUD, PostEurop members, external supply chain stakeholders, customs authorities, and SAFEPOST Project Consortium partners – 70 participants in total. The live demonstration of the SAFEPOST project illustrated the improvements made since the first demonstration took place in Iceland.

The third live Hellenic Post demonstration meeting took place in Athens, Greece, with high-level participation of PostEurop members, customs authorities, law enforcement agencies, UPU and several stakeholders – in total 90 participants.

Seeing the significance of the SAFEPOST project at EU level to supply chain stakeholders, the exploitation plan

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SAFEPOST Project Final Conference held in July 2016, Madrid, Spain

and dissemination phases were also conducted in cooperation with UPU, specifically with UPU Restricted Union (PUASP - Postal Union of the Americas, Spain and Portugal). PUASP is a restricted Union of the UN-Universal Postal Union (UPU). This intergovernmental organisation, with headquarters in Montevideo, Uruguay, gathers (as members) the Postal Authorities of 28 states. PUASP had been running a Postal Security Programme in South America similar to the one undertaken in Europe by the SAFEPOST project, coordinated by PostEurop.

PUASP showed a keen interest in creating a link between Europe and South America. Through the UN-UPU Postal Security Group, PUASP expressed interest in a presentation at their plenary of EU Research & Development (R&D) activities related to security, in particular relating to the (postal) supply chain.

The SAFEPOST project concluded with the final conference, which was held on 5-6 July 2016 in Madrid, Spain. The conference was chaired by Antonino Scribellito, SAFEPOST Project Coordinator, with the high level participation of Dr Javier Cuesta, CEO of Correos, and Botond Szebeny, Secretary General of PostEurop.

The participation and excellent presentations of: David Pilkington, Member of PostEurop Management Board – Royal Mail; Jose Amelibia, Deputy Director Audit and Inspection – Correos y Telégrafos; Paolo Salieri, European Commission – DG Migration and Home Affairs, Principal Policy Officer; and Annegret Rohloff, European Commission – DG TAXUD, Policy Officer, are worth mentioning.

During this final conference the SAFEPOST project partners, postal security and customs supply chain stakeholders, and PostEurop members had an excellent opportunity to gather together in order to present the work developed and carried out to date. This meeting also provided an opportunity to emphasise the necessity of and requirements for a SAFEPOST II project, and to define the next steps.

Presentations from Nordrhein Westphalen Polizei, UK Border Force, UPU, and Conceptivity, among other valuable presentations, were delivered. PostEurop members present at this meeting were: Croatian Post, Czech Post, Estonian Post, La Poste, Hellenic Post, Iceland Post, Poste Italiane, Latvijas Pasts, Posta Romana, Posta Slovenije, Correos y Telégrafos, CTT Correios de Portugal, PostNL, and

Royal Mail – in total 85 participants with 19 EU PostEurop members.

The results of the SAFEPOST project will have a strategic impact as it is designed to make a significant contribution in the following areas:

- Improving the EU's awareness and coordination of activities within and between EU member states in the field of postal security and developments in supply chain security;
- Linking EU projects from DG MOVE, DG TAXUD, DG JLS, and DG ENTR, as well as national efforts, to exploit synergies and created a coordinated approach to security throughout the entire supply chain;
- Encouraging all European post offices and related authorities to assume responsibility in securing their own processes within a Europe-wide cooperative distributed model;
- Creating transparency on the way postal security measures are enforced, and providing benchmarks.

POST EUROPE



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Cyber crime: The threat to your business and how you can avoid it

Rory Clarke, director at J R Rix and Sons, explores the potentially devastating impact of cyber crime and what you can do to protect your business...

In this age of increased connectivity and data sharing, the danger of cyber crime is one of the most insidious threats a company can face. In the Government's [Cyber Security Breaches Survey 2016](#), 65% of large firms reported that they had detected a breach or attack in the last 12 months, and 25% of these firms found that they experienced a breach at least once per month. The widespread and regular nature of these attacks is alarming, which is why it is increasingly important that businesses – both large and small – take the necessary steps to protect themselves.

The internet is a big place, and a threat can appear from any number of potential avenues. The survey mentioned above found that the most common threats to companies were viruses, spyware, and malware, followed by attempts made by an attacker to impersonate the target organisation. Here at J R Rix and Sons, our recent experience of cyber crime began with the latter – fraudsters impersonating the business with the aim of financial gain.

In January 2016, someone got in touch with our phone provider, attempting to pass themselves off as a company director in an effort to get our calls diverted. Thankfully, the security measures that we have in place with our provider prevented this diversion from taking place, which proved to be crucial in the long-run.

The ultimate aim of the scam was to request a payment of £750,000 from our bank by forging the signatures of our managing director and finance director. As soon as the bank flagged this as suspicious they called us to authorise the transaction. Had the call diversion tactic worked, the bank would have reached the criminals and not us, and the theft would have potentially been committed.

From this first-hand experience, it's easy to see the lengths these fraudsters will go to in an effort to get their hands on your money or data. This attempted theft was sophisticated and clearly planned out, which shows that criminals are willing to put the time and effort into learning about your company if there is a chance that they will be successful.

There are a great many tools available to fraudsters, including: distracting DDOS attacks; remote control scams where a legitimate business, like Microsoft or Apple, is impersonated; various forms of phishing; and ever more complex malware and Trojans. Worryingly, these are only a few of the hazards that can be utilised to threaten your security.

Unfortunately, the threat to the most vulnerable businesses – small and medium-sized enterprises (SMEs) – is even greater. While larger firms can easily implement company-wide security measures and provide regular training for staff, SMEs can often struggle due to factors like budget and time restrictions, which make rolling out or reinforcing new security measures difficult. Furthermore, if fraud does take place, larger firms can usually absorb the financial blow, whereas a serious case can put an SME out of business.

The findings in the aforementioned survey seem to draw the same conclusion. When asked if employees had received cyber security training in the last 12 months, only 22% of small enterprises said they had, while medium (38%) and large (62%) companies were more likely to have provided regular training. This lack of preparation is what makes SMEs such an easy target group for fraudsters – they can hold data hostage with a simple attack, often causing business operations to grind to a halt. With the potential loss of revenue, as



well as heavy fines for data loss, it isn't hard to see why cyber crime drives so many enterprises into collapse.

The Government is very aware of this, and has provided support for businesses with their [10 Steps campaign](#), as well as a guide with more tailored [advice for SMEs](#), and wider support through their [Be Cyber Streetwise scheme](#). There are also organisations like [Financial Fraud Action UK](#) and [Action Fraud](#) that provide useful guidance relating to prevention, detection, and what to do in the aftermath.

Here at Rix, we have learned from our experiences and implemented improved security measures. We're using multi-tiered threat analysis across all of our operations, at all levels, which includes firewalls, anti-virus software, anti-malware software, and spam filters. We also keep everything up to date to make sure we are protected against the latest cyber security threats.

Additionally, we've joined the board of the [Humber Business Resilience Forum](#) (HBRF) with the aim of using our experiences to educate the region's businesses about the threats that they face. We suffer phishing, spear phishing, and malware attacks, amongst others, on a regular basis. These attacks change and evolve

and it is critical that we update our software protection and staff training on a regular basis to keep on top of the threat. Part of the reason that we joined the HBRF is to share our experience, but also to keep up to date with the latest information on cyber threats and the best ways to defeat them.

“This attempted theft was sophisticated and clearly planned out, which shows that criminals are willing to put the time and effort into learning about your company if there is a chance that they will be successful.”

I would strongly urge business owners to review any cyber security policies that they have in place, and to read up on some of the measures that can be taken to protect the future of their enterprise. There's plenty of advice out there, it just takes an extra bit of effort to implement it and make your staff aware of the changes. ■

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Rory Clarke
Director

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Cyber crime statistics show we need to defeat the problem

James Kelly, Chief Executive of the British Security Industry Association (BSIA), takes a look at the statistics on cyber crime and how it is affecting society...

In a modern day era where technology is constantly at our fingertips and entwined with our everyday lives, it is no surprise that criminals are targeting cyberspace in order to commit their crimes. These criminals are not discriminatory when choosing their victims and have been targeting a wide range of sectors including businesses, healthcare, education, and individuals too.

The importance of cyber security is becoming more widely recognised within society, particularly with the release of some recent worrying statistics. This year was actually the first time that questions around fraud and cyber offences were asked in the [Crime Survey for England and Wales](#), published in July. Estimates from the survey indicated that in the 12 months prior to interview, there had been 3.9 million fraud offences and 2 million computer misuse offences, emphasising the impact that cyber crime is having on our everyday lives. Following on from that, figures released by fraud prevention service Cifas also revealed that identity theft has dramatically risen, with more than 148,000 victims in the United Kingdom in 2015 – a 57 per cent increase since 2014. As such, it is absolutely essential that we are becoming more cyber savvy on both a personal and professional level in order to mitigate these threats.

Cyber threats can infiltrate our networks in multiple different forms; one common threat in particular is that of phishing, where harmful links or attachments are distributed via email in an attempt to get the recipient to enter personal information, such as passwords or card and bank details. Clicking on such links can also result in harmful malware being downloaded onto the recipients system, consequently allowing criminals to steal information from the computer or spy on the user for long periods of time.



The '[Cyber Security Breaches Survey](#)', published in May by the Department of Media, Culture and Sports, also highlighted that the most common cyber security breach or attack was from a virus, spyware or malware, with 68 per cent of respondents falling victim to it. Impersonation of another organisation was also a main threat, highlighted by 32 per cent of respondents. Such impersonations could include a text or email from a bank requesting the victim to log onto their account via a harmful link that will result in the criminals having access to financial accounts. Therefore, it is absolutely essential for people to be vigilant when clicking links in emails or messages, no matter how familiar the sender may seem.

Defending against these criminals does not necessarily require complex strategies; simple steps such as regularly updating software and malware protection, ensuring that all firewalls are robust and up to date, and restricting access to specific users can all go a long way in



keeping cyber threats at bay. It can be especially useful to configure specialised firewall rules in order to restrict access to the networks, with such firewalls being inaccessible from the internet in order to be less vulnerable to attack. Social media can also be a breeding ground for identity thieves and they do not necessarily have to hack accounts to get the information they need. Often, victims make their own information readily available by publishing personal details on their social media accounts. Phone numbers, addresses and even birthdays should not be mentioned on profiles, with privacy settings being as strict as possible.

One industry in particular that has been suffering at the hands of cybercrime is the business sector. Out of 1008 businesses surveyed in the Cyber Security Breaches Survey, 65 per cent of large firms had detected a cyber security breach or attack in the last year, with 25 per cent of them encountering a breach at least once per month. These breaches can be detrimental to a business, resulting in financial losses and reputational damage. In fact, the average cost of a breach within a large business was found to be £36,500, with the most costly breach being £3 million.

Another very interesting statistic was the fact that while seven in ten businesses did say that cyber security was a high priority for senior management in their organisation, only 51 per cent had actually taken steps to protect themselves against threats. It is very important for organisations of any kind to be aware of the

cyber threats they face and have in place a general cyber policy to which all individuals adhere. Such policies should consider a wide range of staff practices, taking into account remote working, personal devices within the workplace, the use of removable media, and private use of company computers. It can be especially useful to have staff training sessions focused on cyber security to ensure that everyone is vigilant within the workplace.

It can also be wise to enlist the help of a security consultant to help identify any potential weaknesses within a network and develop contingency plans in the event of a breach. A reputable security consultant with a wealth of experience and proven track record in cyber security can carry out penetration testing in order to ensure that the protection already in place is adequate enough to challenge ever-advancing cyber threats. The testing can also identify any weaknesses in the network and address them where necessary. Following that, they can then work closely with the business in order to develop a complete risk register with a comprehensive security strategy and effective cyber policy in order to ensure the business is fully prepared for any potential threats.

If an organisation does choose to enlist the help of a security company to help fight cyber crime, it is essential that quality takes precedence and that products and services are sourced from a reputable company. Members of the [BSIA's Specialist Services Section](#) have a wealth of knowledge and experience in cyber security and can provide a reliable, professional service. ■



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James Kelly
Chief Executive

British Security Industry Association (BSIA)
www.bsia.co.uk

Why study cyber security courses at Warwick University

The cyber security courses on offer at the University of Warwick are your pathway to industry-relevant skills and understanding...

Cyber security is not simply about protecting the internet. As our world becomes ever more dependent upon digital systems, our vehicles, infrastructure, industrial controls, finances, and medical devices all exist within the cyber domain.

Warwick's Cyber Security Centre is based in the Warwick Manufacturing Group (WMG) department and brings together teaching and research excellence in a team highly experienced in intelligence and defence, cyber crime and law enforcement, finance and commercial environments, business strategy, computer science, engineering, digital forensics and security protocols. The Centre's director, Professor Tim Watson, has extensive experience designing and delivering courses for public and private sector organisations, and has acted as a consultant for some of the largest global telecoms, power and oil companies.

"Our focus is on understanding the nature of the evolving cyber environment, and to protect the human experience within it. Our approach is a multi-disciplinary one, combining academics, government and industry experts who bring together both the technical and behavioural (culture, cognition and communication) aspects needed for transformative cyber security solutions," says Professor Watson.

WMG is one of the largest academic departments at Warwick. It is a multi-

disciplinary, research-led department renowned for collaborative R&D with global companies, and for industry-relevant education. We offer a broad portfolio of Masters courses in the key areas of Management, Technology and Innovation, both as full-time 12-month MSc courses and part-time through our Professional and Executive Education route.

"It is this mix of research-led teaching and real-world input from external speakers that helps prepare students not only to work in cyber security, but to be at, and contribute to, the forefront of this field."

Within the Cyber Security Centre at WMG, our MSc in Cyber Security and Management and MSc in Cyber Security Engineering are provisionally GCHQ-certified, and are accredited by the Institute of Engineering and Technology. The courses are designed to give a clear understanding of the cyber security threat landscape, and to develop the skills to build and manage secure systems that will support the strategic deployment of cyber security within a business.

Our expert tutors bring their subjects to life by blending their academic knowledge with their experience in a variety of industry sectors, supporting students in applying what they learn back into the workplace or future career. The course benefits from extensive

support from guest lecturers from companies such as IBM, HP, PwC, and UK government and law enforcement agencies.

Rebecca Faulkner, General Manager at Pharos Group Ltd has recently completed the MSc Cyber Security and Management.

"While other courses focus only on technical elements, the MSc at WMG brings in business and management too," Faulkner explains. "There were a surprising number of experts from industry who came in to talk to us about what they do and the challenges they face. Every one of them was absolutely fascinating to listen to and what they said proved how relevant each module is to business. Having the chance to discuss things with them was one of the biggest positives for me. It helped me to understand exactly how what I was learning is applied in real situations."

It is this mix of research-led teaching and real-world input from external speakers that helps prepare students not only to work in cyber security, but to be at, and contribute to, the forefront of this field.

This year, the Cyber Security Centre have teamed up with IBM to deliver a new module in Enterprise Cyber Security on the MSc programme. Students are trained to undertake key enterprise security functions, such as: persuasively

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articulating cyber security imperatives to key decision makers; critically evaluating the cyber security posture of an organisation; analysing an organisation's identity access management policies; and critically analysing the cyber security consequences of the increasing connectedness of end-point devices and systems.

The team created content to particularly encourage students to look at cyber security from both a technical and a wider organisational perspective. Mark Buckwell, consulting and systems integration practice leader for IBM UK and Ireland, is heavily involved in the teaching.

"The Enterprise Cyber Security module was created to give students the opportunity to engage in architectural thinking in the design of enterprise IT security," Buckwell says. "By understanding how security is designed into core business practice, participants

now have a vital kit bag of practical tools and techniques to apply in the workplace."

With as many as 1.5 million cyber security jobs worldwide expected to be unfilled by 2020, the low availability of professionals with specialised cyber skills is one of the biggest issues facing organisations looking to defend their core business systems against cyber attacks.

Securing your patch of cyberspace is challenging, requiring both technical insight into the security of your digital systems and devices, and also the management of the people who interact with them. The MSc courses at Warwick prepare students and professionals to design these systems, and to manage cyber security within an enterprise – from influencing the risk appetite of the board, to operational issues and managing firewall reconfiguration during a cyber attack.

At WMG, University of Warwick we offer the Masters programmes both as a 12 month full-time course and or as a 3 year part-time option through our Professional and Executive Education track.



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How do you stop falling foul of fraud?

Sundeep Tengur, Banking Fraud Solutions & Financial Crimes Specialist at SAS highlights some key points to help organisations curb the threat from online fraud...

The exponential surge in online fraud and cyber-crime saw almost 6 million offences committed last year, meaning around one in 10 adults in the UK were victims.

According to the latest findings from the [Crime Survey for England and Wales](#), fraud has now become the most prevalent crime in the country with people 10 times more likely to become a fraud victim than they are to suffer a theft.

“With increased government focus and regulatory scrutiny on financial crime, businesses found cutting corners will be exposed and be subject to potential fines. For small to medium organisations, the associated reputational damage may undermine their very ability to exist in the future.”

What is clear is that fraud is an insidious problem that challenges all businesses in the UK and around the globe. For far too long, fraud has been viewed as a victimless crime. On the contrary, it is continually being used by criminals for monetary gain. It is also used to fund a wide spectrum of illegal activities including drug dealing, human trafficking and even the funding of terrorism. Very often, the victims are oblivious to the risks of transacting online and are amongst the more vulnerable members of society.

Keeping pace

Fraud has evolved from simple and opportunistic modus operandi to more complex scenarios. Fraudsters are becoming increasingly sophisticated, making use of techniques ranging from social engineering such as phishing or vishing to cyber-enabled malware attacks. They also often hide within complex networks where



they employ 'mules' to do their bidding. Those networks are often hard to detect as they combine fraudulent activity with legitimate and compliant transactions.

Also contributing to the rising velocity of fraud is the proliferation of online services and the anonymity those digital channels provide to consumers. For example, when making insurance claims it's easy to inflate the value of a damaged or stolen item or to add a few additional items to the claim, therefore resulting in what's often referred to as 'soft fraud'.

No magic recipe

Organisations must be in a constant state of readiness and need a multi-layered and pragmatic strategy to curb this threat. It is critical that organisations adopt a holistic approach that encompasses data management, fraud detection, as well as robust policies and strict internal governance to ensure that their exposure to fraud is brought down to a minimum. The ability to analyse high volumes of data quickly, in real time, is becoming more and more a 'business critical' requirement. Organisations must start with enhancing their data quality, as well as collating and linking different data types coming into the organisation. The use of



data analytics is often understated but could yield significant value for organisations wishing to adopt a superior approach to monitoring and detection.

“Fraud has evolved from simple and opportunistic modus operandi to more complex scenarios.”

Unlocking £290m in value

For businesses, fraud introduces additional costs that impinge on growth, performance and productivity. On a wider scale, it undermines sustained economic progress and the operation of free markets. The onus is therefore on individuals and businesses alike to deter and report instances of fraud. According to our research with the [Centre for Economic and Business Research](#), efficiencies from better fraud detection tools could total £290m from 2015 to 2020. Such tools include advanced analytics which will enable businesses to intervene and prevent fraud before it happens.

Lastly but crucially, people at the head of organisations should lead by example and nurture a culture of zero-tolerance towards fraud and other forms of financial crime within their organisation. There should not only

be policies but enforcement of those policies in the way that day-to-day business is conducted, both internally and with external parties.

With increased government focus and regulatory scrutiny on financial crime, businesses found cutting corners will be exposed and be subject to potential fines. For small to medium organisations, the associated reputational damage may undermine their very ability to exist in the future.

Find out what it takes to develop [effective fraud management](#) to help identify suspicious transactions and networks before the money leaves your premises. ■

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Sundeep Tengur

Banking Fraud Solutions & Financial Crimes Specialist
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Promoting cohesion in Bratislava

Pavol Frešo, President of the Bratislava Self-Governing Region outlines to Adjacent Government why events such as the COR Bratislava event back in July are so important for the city and country of Slovakia...

The summit of regions and cities, held in Bratislava on 8-9 July 2016, was the biggest event in the area of regional and local policy in the last 2 and half years. Its main topics included simplification of the structural funds disbursement process and preparation of the cohesion policy 2020+, which is extremely important because we can hear some voices saying that the cohesion policy may cease to exist or it may be limited to priorities related to dealing with the refugee crisis.

The V4 countries plus Bulgaria and Romania feel that the cohesion policy is extremely important for sustainable regional development, for exercising their competencies at the level of local governments at regional or local levels. It is vital also for the Bratislava region as well as for all other towns and municipalities in the Slovak Republic. Other topics were related to infrastructure, particularly transport infrastructure which connects capitals or economically significant areas in the European Union in order to ensure a long-term economic growth and employment. The third package included topics such as new visions – science, research, innovation and start-ups.

How was the summit received?

The summit as such was very well received mainly in Slovakia. It was a unique event because mayors of towns and municipalities could meet and confront their opinions directly with representatives of the European Commission, individual Directorates General, the European Parliament, or their colleagues from national delegations of the European Committee of the Regions. The event was attended by mayors of towns and municipalities not only from Slovakia but also from neighboring regions – partners from South Moravia, Poland, Hungary and Austria. Naturally, the summit was well received also in Brussels and by our strategic partners who appreciated its organisation, agenda, topics as well as accompanying events.

Continuing topics

For us it is the topic of new assessment of advancement of regions. We dealt with it in more detail and had also several bilateral meetings. A new system, the so-called social index, is going to be introduced, i.e. not only economic indicators will be assessed, but also overall advancement of a region, together with its kind of negative restrictions. This should give us a much more comprehensive picture of the social and economic condition of individual EU regions. The subject of examination should include, for example, structural problems of metropolitan regions – criminality, the issue of traffic, social infrastructure, environmental threats, size of built-up areas, etc. This should turn our position, presented as the 5th most advanced region of the European Union for a long time, into reality.

In the future EU funds should not be disbursed for public areas, reconstruction of municipal houses or local roads, but European resources will be used for social inclusion or to deal with the issue of unemployment – long term unemployment and youth unemployment. We will definitely disburse money to connect schools and practice, i.e. for vocational education, then to develop transport infrastructure, promote engineless transport, public transport., protect the environment, water-retention measures, energy efficiency, particularly the so-called green measures.

These are the new topics based on the social index because they are important for the metropolitan Bratislava region. ■

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Pavol Frešo
President

Bratislava Self-Governing Region
www.region-bsk.sk/en/

The Slovak Presidency: a strong promoter of a positive agenda

Ivan Korčok, State Secretary of the Ministry of Foreign and European Affairs of the Slovak Republic, highlights how the Slovak Presidency aims to help Europe tackle some of its key challenges...

Somewhere between optimism and pessimism, there is ample space for pragmatism. The Slovak Presidency of the Council of the European Union works hard to fill this space with pragmatic solutions bringing tangible results for Europeans. This should help restore their trust if coupled with clear communication of their concrete impact on people's daily lives.

There is no doubt that Slovakia took over the Presidency in uneasy times. Here, I am writing not only about Brexit, but a full set of challenges Europe has been faced with for several years. Crisis became a buzzword. But the answer does not lie in spreading pessimism, embracing fragmentation and accepting radicalisation or extremism. The answer is in common and rational European decisions followed by their speedy implementation.

The informal meeting of the Heads of States or Governments of the EU 27 in Bratislava on 16 September 2016, hosted by the Slovak Presidency, was an important step in the right direction. It marked the start of the strategic reflection process in the EU, hopefully bringing about not only Europe's very survival but its fresh revival. Leaders, with a sense of realism and great honesty, jointly agreed on the diagnosis of the EU's problem in the Bratislava Declaration and outlined suitable treatment in the Bratislava Roadmap. They identified 3 areas, namely migration, internal and external security and economic and social issues. In these, the common aspiration is to achieve concrete results. The summit showed that no topic is taboo for the EU leaders but in the current situation we, first and foremost, need to work on such topics that connect us rather than divide us.

The Bratislava summit was a success. However, it is clear that no single summit can solve all the challenges. A lot of work is ahead of us. The coming months will

be crucial for translating words into actions. This is what European citizens do urgently expect from the Union. Prompt delivery on promises. The 60th anniversary since signing the Treaties of Rome will offer a great occasion for Europe to show its citizens and the rest of the world it still has a common vision for future and is capable of taking joint action, while protecting the real needs of its citizens.

European citizens also are at the heart of the Slovak Presidency programme. With this aim, the Slovak Presidency works hard to achieve progress in 4 main priority areas: economically strong Europe, modernisation of the single market, a sustainable migration and asylum policy and a globally engaged Europe.

What concerns Europeans most? Security in all its forms. Not only internal security or fear of terrorism, but also economic, social and job security. Bearing this in mind, the Slovak Presidency supports the environment favourable to investment, further economic growth and job creation through their focus on a triangle – the European Fund for Strategic Investment (EFSI), the Capital Markets Union and the EU budget. The main aim of the EFSI is to boost investments across Europe. In particular, its goal is to help finance key areas such as infrastructure, research and innovation, education, renewable energy and small and medium enterprises. The Presidency is convinced that the EFSI has the potential to resolve the temporary problem of the investment shortfall in Europe. At the same time, we consider the European Structural and Investment funds the main EU investment tool in the future and the instrument most visible to European citizens.

The Slovak Presidency believes that the mid-term review of the Multiannual Financial Framework and the EU Budget 2017 must better reflect EU priorities and



Ivan Korčok, State Secretary of the Ministry of Foreign and European Affairs of the Slovak Republic

have strengthened capacities to help resolve the latest challenges. Therefore, we hope to adopt budget 2017 in due time, by the end of the year. It looks promising given the fact that the Council has already adopted its position on the EU Draft Budget.

“The coming months will be crucial for translating words into actions. This is what European citizens do urgently expect from the Union.”

It is worth mentioning that the Single Market represents an excellent example of very concrete benefits of the EU for its citizens. But in order to keep up with global technological advancement, it needs to be enriched by 2 new pillars: the Digital Single Market and the Energy Union. The Presidency understands that dismantling regulatory walls in the digital area can significantly contribute to the EU economy and create thousands qualified jobs. At the same time, the Presidency supports successful completion of legislation related to the Energy Union. This bears great potential

of securing supplies of clean energy at affordable prices for industry and citizens.

Europe’s greatest challenge today is deliver on what was agreed upon and use comprehensible language when reminding our citizens of EU’s benefits. It is clear that the European Union is not perfect but it is the best alternative. One should not forget it is the most successful peace project in the history of mankind, a place of well-functioning democracy and an area enabling people to develop and prosper. These things should never be taken for granted. The Slovak Presidency is putting its heart and soul into keeping European story strong. ■

Ivan Korčok
State Secretary

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The six stages of the smart city challenge for local government

Recent research suggests that local government needs to pass through six stages in their journey to smart city status, as John Fox, Managing Director of Lucy Zodion describes...

The concept of smart cities is evolving continuously as technology advances, and as connected, data-driven cities become a reality, improving public services, achieving greater efficiencies and developing better urban spaces for all who use them. In the UK, smart cities are seen as a vital component of our future digital economy, and some initial funding has already been made available to trial technology to explore new initiatives.

However, the task of transitioning our cities into smarter and more connected urban environments lies at local government level. Individual cities are responsible for identifying the right solutions and initiatives to transform their services, yet in a challenging economic climate for councils and local authorities, realising this ambition can be challenging to achieve.

While a number of cities including Manchester, Milton Keynes and Peterborough are leading the way with smart initiatives in situ, others are yet to explore the potential of smart technology. Squeezed budgets, compounded by uncertainty around future funding following the Brexit referendum and further austerity measures, means investment in innovation risks slipping down the list of priorities for many councils across the country.

Lucy Zodion commissioned research on smart cities to explore attitudes, progress and priorities amongst senior representatives from over 180 councils across the UK. While opinions of the potential of smart cities were generally positive, 80% of those surveyed had little to no involvement with smart cities, and very few had named leads or a team to develop and deliver a city-wide smart strategy and coordinate smart projects. Some cities were keen to engage in trials and technology but faced barriers to delivery, and only a small

number were actively involved in initiatives. Those cities who had projects up and running often had a project lead based in planning or economic development, responsible for implementing strategies and building partnerships with third parties and the private sector.

In fact, there were six clear stages identified that councils pass through on their journey to becoming a smart city.

Barriers to delivery

The research also sought to understand barriers to delivery, particularly amongst those with limited involvement. Predictably, a lack of funding was consis-

The smart city journey - six key stages:



Stage 1: In the dark
Minimal awareness of 'Smart Cities'



Stage 2: Ears pricked
Awareness but no involvement



Stage 3: Eyes and ears open
Awareness and partial involvement



Stage 4: Eyes, ears and minds alert
Awareness and involvement



Stage 5: The enlightened
Leader in Smart Cities



Stage 6: The connected city
Delivering smart solutions and engaging citizens at every stage, from design to delivery

Lucy Zodion

tently cited as the biggest barrier; against a backdrop of budget constraints, this often contributed to the fact that smart initiatives were not seen as a priority in their council. Internal collaboration and knowledge sharing was also an issue, with current council structures deemed less conducive to smart projects that often sit above numerous internal departments. Combined with a lack of confidence in smart technology caused by limited proof of return on investments, many respondents felt gaining senior buy-in was a challenge: a catch 22 that means funding, prioritisation and collaboration is often unattainable.

“Squeezed budgets, compounded by uncertainty around future funding following the Brexit referendum and further austerity measures, means investment in innovation risks slipping down the list of priorities for many councils across the country.”

A three-tiered approach to smart cities became apparent during the research: those striding ahead are the early adopters who secured external funding to progress projects. Others are keen to progress but lack the resources to do so. The final tier lack the knowledge or route to delivery to make smart cities a priority – and these are the majority. Devolution of delivery without funding or a clear path to delivery from central government is leading to de-prioritisation.

A toe in the water

So how to achieve more connected cities in a challenging climate?

The resounding message from the research is that strong leadership with a clear, smart vision is the single biggest factor in making smart cities work. Without it, it becomes almost impossible to create an over-arching strategy and mobilise teams from across the council to deliver it.

Building a solid business case can be a challenge, particularly with many projects in pilot phase meaning limited large-scale case studies demonstrating return on investment. But becoming a smart city isn't an

overnight process – it's one of evolution. Finding ways to place the first foot on the ladder is essential, particularly if external funding is hard to come by.

Faced with tightening purse strings, optimising current infrastructure and street furniture rather than replacing it at high cost is an infinitely more palatable strategy for most councils. Smarter street lighting, for example, has proven return on investment and is easy to implement: replacing traditional street lights with LED lighting and remote control management can reduce energy costs by at least 60%, reduce maintenance and pave the way for smarter controls and sensors across the city.

Projects like these, with relatively low expenditure and a strong business case, can help to build confidence within risk-averse councils and pave the way for future initiatives.

Creating a path to delivery

It is clear that smart cities need to become a national strategic priority. This will ensure a consistent and cost-effective approach to future technology roll-out but also prevent cities and regions from being left behind. Until then, local authorities can begin with tried-and-tested projects to begin their smart journey, even with limited resources. The ultimate aim of a connected city is to achieve greater cost efficiencies and better social benefits: it would pay for councils and citizens alike to prioritise a path to delivery. ■

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Varberg takes responsibility – again

For the coastal city of Varberg, Sweden, 2015 was the year when the community united in a joint effort to take responsibility for peace and human rights – just as they did at an international peace summit held there one hundred years before. The municipality has an active role to play and views the project as an extension of the work towards its vision of developing the city of Varberg as the Swedish West Coast’s creative hotspot, with the help of local residents.

As the 100th anniversary of a significant peace summit approached, here in Varberg we chose a different way to celebrate. The result was the VARBERG CALLING for Peace project, with the aim of engaging and involving residents in actively working for peace and a sustainable society. The basic idea is to draw attention to the local and international history of peace, and in doing so combine the forces of Varberg’s administrative bodies, organisations, civil society and local residents to increase awareness of the important perspectives that are vital for peace and a sustainable future. It is also important to encourage participation in order to highlight issues of democracy, human rights, cultural understanding and sustainable environment, and to examine them in greater detail. Also for there to be a legacy once the project has ended, which can be built on and will provide support for future development.

Photo: Mimmi Persson



Greater awareness of the age in which we are living and a common educational perspective on our history provide the conditions for future creativity, innovation and action. We believe that the big, universal human issues can unite many, both organisations and individuals.

Thinking globally and taking into consideration situation analysis and environmental and resource perspectives cannot be restricted to municipal or national borders. VARBERG CALLING for Peace is an opportunity, therefore, for Varberg municipality to take a forward-looking, general approach to sustainable development in a project that involves local residents. Engagement on humanitarian issues and the all-pervading problems we now face in the world around us may also increase interest in important issues at local level. The project therefore represents a step towards the realisation of Varberg’s plan: Vision 2025 “Swedish West Coast’s creative hotspot” and a sustainable future.

Christina Josefsson

Head of the Culture and Leisure department
The City of Varberg

Come to Varberg. Share our vision.

Inspiring people to create everyday peace



**VARBERG
CALLING
for Peace**

The city's local education centre, Campus Varberg, is today the largest vocational college in the Halland region and is one of Sweden's leading providers of vocational education. The core values at Campus Varberg include knowledge, innovation and creativity, and it was not long before it became involved in the VARBERG CALLING for Peace project.

At the college's events and management course a number of students are running their own projects as part of VARBERG CALLING for Peace. Here they tell us about the solid peace work they have done, which has given them valuable experiences.

"We are studying on a three-year events and management course and during February and March we studied a course in 'project-based development work'," explains Lina Rundbom, one of the students.

"During the course, we had the opportunity to choose from a number of assignments to work on and we five chose 'VARBERG CALLING'. We had to examine and communicate the questions 'What do you stand for?' and 'How can you get strangers to talk to one another?' to the general public."

The assignment came from the two process managers for VARBERG CALLING for Peace, Malin Bellman and Jon Liinason.

"They gave us some good advice before we started. 'Don't think – just do it and see what happens!' they said. So we did. We tried out our ideas on people using quick and easy prototype tests, with the results leading to new ideas."

One of the prototype tests involved leaving a bicycle in the entrance to the city's galleria. The girls left the bicycle "right in the way" and stood a few metres away to see how people reacted. Contrary to what you might expect, most people did not seem particularly irritated. It gave some people something to talk about as they wondered why the bicycle was there. Another was the mobile "everyday peace cycle café". Loaded up with coffee and pastries, the bicycle was pushed around to various parts of the city, offering coffee and cakes for free.

They asked the people they met how we can create everyday peace. Smile at someone you don't know, pick up litter, and hold open the door for someone were some of the suggestions.

"It really doesn't need to be any more difficult than that," says Lina. "Everyone can do something. The cool thing was seeing how our own positive energy clearly spread to those people we were talking to."

Annette Wenklo

varberg

varberg.se

What lies ahead for planning and construction regulations after Brexit?

Planning and construction regulations are likely to be a low government priority when it negotiates the UK's eventual Brexit. However, as this article argues, these topics deserve early scrutiny and action as outlined by Simon Randall, Consultant at Winckworth Sherwood LLP...

Planning and construction related legislation is likely to be a low government priority when it negotiates the UK's exit from the European Union. However, as this article argues, these topics deserve early scrutiny and action, so as to adopt some Anglo-Saxon principles of reduced regulation and red tape, which currently significantly increases both the cost to industry and the public purse, as well as handicapping the need to build more homes within the UK.

While land use planning remains largely a national matter, the influence of the European Union is significant, particularly in technical requirements relating to planning and development, such that some of the costliest EU-driven regulations in force in the UK cost many billions of pounds.

Whilst it is, at this stage, possible to predict the extent to which the existing regulations will apply to the UK, as this will largely depend upon the nature of our post-Brexit relationship, the UK could formulate their own attitude to a whole range of existing European directives which have been incorporated in our own regulations. These include the [Environmental Impact Assessment Directive](#), the [Habitats Directive](#), the [Birds Directive](#), the [Energy Performance of Buildings Directive](#) and a whole range of other Directives dealing with health and safety and employment, including the controversial [Working Time Directive](#).

Accordingly, depending upon the Brexit terms, the UK Government may need to review and amend their attitude to the impact of the relevant Regulations and effectively take back decisions on such matters.

Whilst it is likely that, following Brexit, some similar arrangements will continue within the UK, there is, for



example, absolutely no doubt that the bird and habitat regulations involving such matters as the provision of alternative natural green space for particular species, which has the effect of both hindering essential housing development and considerably increasing its cost, may well be watered down. This, coupled with the increasingly expensive energy performance requirements for new buildings, may force the government to relax some of the Regulations so as to reduce both building costs for home buyers and housing associations alike.

“...housing associations should be removed from the EU rules as they are essentially private sector entities competing, as they are, with house builders and private sector landlords with the unnecessary burdens of expensive regulation.”

So far as health and safety legislation is concerned, the introduction of the various directives into the UK has resulted in some absurd interpretations of the rules, restricting the sale of certain light bulbs, banning hanging baskets and cracking down on certain household appliances.

In addition to the unreasonable demands imposed by planning and building control, changes to the complex EU Procurement Regime introduced with the [Public Contracts Regulations 2015](#) merit significant change which would, in particular, benefit building contractors working for the public sector and housing associations.

Last year the government inherited an over-complex EU procurement regime when it introduced the Public Contracts Regulations 2015. A study by the Centre for Economics and Business Research in 2014 found that procurement processes in the UK incur the highest combined costs to public sector bodies looking to attract bids, and private sector suppliers bidding to win contracts. Indeed they calculated that the process costs on average £45,200, with £8,000 of those costs borne by the public sector employer. This compared to an EU average cost of £23,900, making UK procurement processes 90 percent more expensive than the EU mean.

In the housing association sector, its trade body, the National Housing Federation, estimated in late 2011 that EU procurement costs were equivalent to 9,000 affordable homes per annum. Yet housing associations are only public bodies for procurement purposes due to a serious mistranslation from the original French Directive (2014/24/EU) into English. This Directive contains a number of essential criteria to identify public procurement bodies one of which was: “soit sa gestion est soumise à un contrôle de ces autorités [regionals ou locales] ou organismes [de droit public]”.

This was translated into the English version of the Directive and incorporated in the UK Regulations as: “they are subject to the management supervision by those authorities or bodies”. The underlined word “contrôle”, which implies “control” by a state body, is incorrectly translated as “management supervision”. The key regulator for housing associations is the Homes & Communities Agency and “management supervision” by them (if there is any at all) is extremely light touch and undertaken by exception in the unlikely event of an association getting into governance or financial difficulties. Thus housing associations should be removed from the EU rules as they are essentially private sector entities competing, as they are, with house builders and private sector landlords with the unnecessary burdens of expensive regulation.

As an aside, the management supervision regime referred to above, reflects the role of the Charity Commission in its dealings with the 190,000 charities in its care. Adding them to the procurement regime would have a devastating effect on charity costs!

Thus, the EU-inspired regulations which hugely add to the UK building costs should be reviewed early by the government to reduce red tape and ease construction.

The UK, as the most Eurosceptic nation within Europe, must, on its departure from the European Union, devise its own planning, building, construction and procurement rules to more closely reflect the wishes and aspirations of our communities. A start could be made by exempting housing associations from the procurement burden now and making a healthy contribution towards the need to build more homes. ■

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Air quality in working environments

Blanca Beato Arribas, Asset Performance Team Leader at BSRIA sheds light on how indoor air quality can impact working environments...

Indoor environments may feel like a safe haven from external pollution, however, sometimes they can be 8-10 times more polluted than the exterior, according to the World Health Organization (WHO).

Indoor air quality (IAQ) at work is measured when it is obvious that staff may be at risk, following specific Health and Safety Executive (HSE) procedures for special contaminants or industries. In office environments, IAQ is frequently dealt with only when there are complaints about odours or sick building syndrome symptoms. Some employers and building owners tend to be reactive rather than proactive, neglecting the maintenance of the ventilation systems or only carrying out indoor air quality measurements when there are scheme points to be achieved.

For their part, employees tend not to question the indoor air quality of their office, unless there is an unpleasant smell or they suffer from nose irritation, dry throat or headaches. There is also little information available about what contaminants are the most common in the work place and their effect on people's health.

The way to provide good indoor air quality is through ventilation and source control. A design for good, effective ventilation should remove most pollutants and odours in a common office environment.

Measuring indoor air quality is more than measuring temperature, humidity and carbon dioxide (CO₂) in a space, but it's also not cost effective to measure for a long list of contaminants. Unfortunately, not all contaminants are as easy to measure as CO₂, as the market offers a large range of analysers that are small in size and can log for long periods of time. The level of CO₂ in an occupied space is a good indicator of the general IAQ and overall ventilation effectiveness, but is only meaningful if the space is occupied.

The location of the building can give an indication as to what contaminants to look for, for example, if the building is near a busy road, measuring for nitrous oxides (NO, NO₂) and particulates (PM_{2.5} and PM₁₀) should be considered. If the building is in a radon (Rn) area, checking Rn levels in the building and investigating ventilation solutions should be a priority, as exposure to Rn, which is naturally released from the ground, can cause lung cancer.

Isolating the sources of indoor contaminants is not always possible, but there are ways of keeping contaminants under control. For example, printers can produce ozone (O₃) and should be located in a well ventilated area or in an office with local extract ventilation; during cleaning processes the ventilation should be on (or the windows open) to reduce the concentration of Volatile Organic Compounds (VOC); if the office is being repainted or refurbished, selecting materials that do not have a high VOC emission rate and flushing the building should reduce the VOC concentration levels.

“The location of the building can give an indication as to what contaminants to look for: for example, if the building is near a busy road, measuring for nitrous oxides (NO, NO₂) and particulates (PM_{2.5} and PM₁₀) should be considered.”

Good maintenance of the ventilation systems, supply and extract grilles, filters and regular duct cleaning should be the starting point to providing good IAQ. This should reduce the levels of external contaminants, such as PM_{2.5} and PM₁₀, being brought into the space. Controlling humidity levels and the use of UV lights in ventilation ducts should stop bacteria from growing in the ventilation systems. Controlling humidity levels and ensuring the right ventilation in places such as kitchens and bathrooms should also stop mould from growing.

THE BUILT ENVIRONMENT



As employers we should guarantee that the IAQ in our offices is satisfactory, maintain the ventilation systems, measure contaminants regularly and inform our employees.

As employees we should ask for indoor environment checks from our employers. Knowing what contaminants to look for and demanding IAQ from our employers could be the starting point in improving IAQ at work. Regulations and best practices are in place, however, it does not mean IAQ gets tested or is even a priority.

Some employers are looking into a holistic approach to ensure the wellbeing of employees. Indoor environmental quality (or wellbeing) at work does not stop at air quality management. It also includes lighting, acoustic and thermal comfort. Lighting refers to lux levels, reduced glare, providing natural light, etc. Acoustic comfort includes parameters such as speech transmission index, privacy and distraction distances, calculated as per standard ISO 3382-3. Thermal comfort, measured in accordance to BS EN ISO 7730, involves measuring temperature and humidity, but also air speed and

operative temperature, clothing levels and metabolic rate, which are used to calculate the thermal comfort indices: Draught Risk (DR), Predicted Percentage of Dissatisfied (PPD) and Predicted Mean Vote (PMV).

Some wellbeing standards also take into consideration water quality in a building, nourishment, ergonomics, electromagnetic frequency levels and building aesthetics.

More and more studies are beginning to report the increase in employers' productivity and the reduction in sick leave when wellbeing is taken into account, and the subsequent economic benefits this brings. ■

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Smart active house building

Peder Vejsig Pedersen from Cenergia Energy Consultants, looks at how integrated PV solutions can be used for smart house building...

At the same time as the cost of PV panels and related technologies remaining low every year, ongoing work is still taking place in Denmark to develop new low cost mounting and integration systems for both roofs and facades. Here with focus on ultimate solutions where PV panels can actually substitute normal building materials, so the use of nice architecturally integrated BIPV solutions in many cases can be realised, at very competitive costs even based on the new legislation for use of PV in Denmark.

In the ongoing ForskVE projects, BIPV Quality Cities and PV Active Roofs and Facades, Gate 21, Cenergia and other partners with Kuben Management, Technological Institute, AAU, EnergiMidt, Solar City Denmark and FBBB is working respectively with cities and housing associations to support the development of good BIPV solutions, with a view to use so-called "Solar Watch" systems to secure principles for detailed monitoring, follow up and quality control. A number of workshops are organised with the involved stakeholders to support practical implementation work and the full understanding of the new PV rules in Denmark. As well as, how you can still realise cost effective PV projects if you base the design on more limited size projects, where most of the PV electricity can be used in the hour it is produced in.

In connection to this, it has been clear that when you deal with new build and deep renovation projects of the future, quite small PV systems can actually play an important role not only in ensuring that the new low energy class 2020 can be met in practice, but even with a possibility to reach a zero energy or even plus energy building standard. It has now been possible to identify a number of housing associations and cities who are interested in being involved in a dedicated campaign concerning this together with agreements concerning



"Performance Documentation". It is possible to secure a good energy balance in practice, both with respect to the actual energy consumption/ solar PV production, and the total economy for the users. When the results are being disseminated through the national data base for sustainable and energy efficient buildings in Denmark, which is administrated by the Danish Association of Sustainable Cities and Buildings, [FBBB](#), then the proposed project can have a strong impact concerning integration of BIPV, which will actually benefit society.

A Danish Smart Active House demonstration project has been suggested for 50 new build housing units linked to an existing district heating network, here utilising the international [Active House standard](#).

Here, it has been suggested to combine a local low temperature microgrid distribution network for the houses, combined with a solar heated buffer tank and a local heat pump, which secures very low return temperature to the district heating system. As well as this, there is 0.5 kWp local building integrated PV for the houses combined with selected roofs near the common house, where the whole roofs are BIPV

The Active House Radar



The Active House specifications and labelling system is very useful to communicate the Active House quality of a building project, with respect to energy, comfort and sustainability, and it can at the same time be used as a dialogue and performance verification tool. (see also www.activehouse.info)

connected to a local battery system, which also charge the heat pump and local electrical cars. As part of the Active House, design is used as an integrated and web based local performance documentation system including comfort.

“In connection to this, it has been clear that when you deal with new build and deep renovation projects of the future, quite small PV systems can actually play an important role not only in ensuring that the new low energy class 2020 can be met in practice, but even with a possibility to reach a zero energy or even plus energy building standard.”

As well as the ongoing Nordic Built Living in Light project, co-ordinated by Kuben Management, a new concept of urban renewal will be tested at Gammel Jernbanevej in Valby, Copenhagen. Here, a four-storey,

old housing block built around the 1900 will have new rooftop apartments and an extension measuring approximately two metres towards the courtyard. The extension mainly consists of an innovative window structure from Danish company Velfac. This considerably increases the daylight quality of the apartments without compromising comfort and energy use. At the same time, building integrated PV solutions secure an overall CO₂ neutral design for the renovation project. ■

Peder Vejsig Pedersen

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Fig 1. A newly developed "Complete Cover" roof from Komproment in Denmark. It includes a build-in possibility for placing exhaust air armatures, avoiding shadow problems from normal types of exhaust air armatures, and this is with a proven operation quality according to tests at Aalborg University in Denmark

Active Roofs and Facades of the future

Building integrated PV (BIPV) has now been developed into useful substitutes for normal roof and facade materials. Due to continuous reductions of PV costs on a global scale, extra costs for electricity producing roofs and facades is becoming more and more marginal.

In some cases, it is therefore possible to have almost similar m² costs of PV or BIPV to natural slate roof costs or costs of Steni facade or roof plates with an added up to 60 years' durability.

The costs of PV panels have as a mean been reduced by 36% every year since 1991, and

during the last 7-8 years it was reduced by a factor of 10, and a further 50% reduction can be expected before 2020.

This illustrates the importance of ensuring an aggressive development and practical use of BIPV solutions in Europe so a basis for a future supply of Active Roofs and Facades can be secured.

In fig 1-3 examples of recently developed BIPV solutions are illustrated and fig 4 shows how it is possible for builders to support such a development with the help of the international Active House standard.

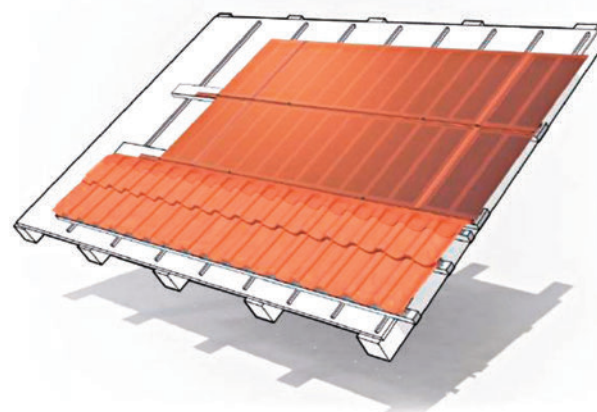


Fig 2. An example of Gaia Solar PV panels which can be incorporated into red tile roofs, here illustrated by Henning Larsen Architects, this solution won an architectural competition in Copenhagen.

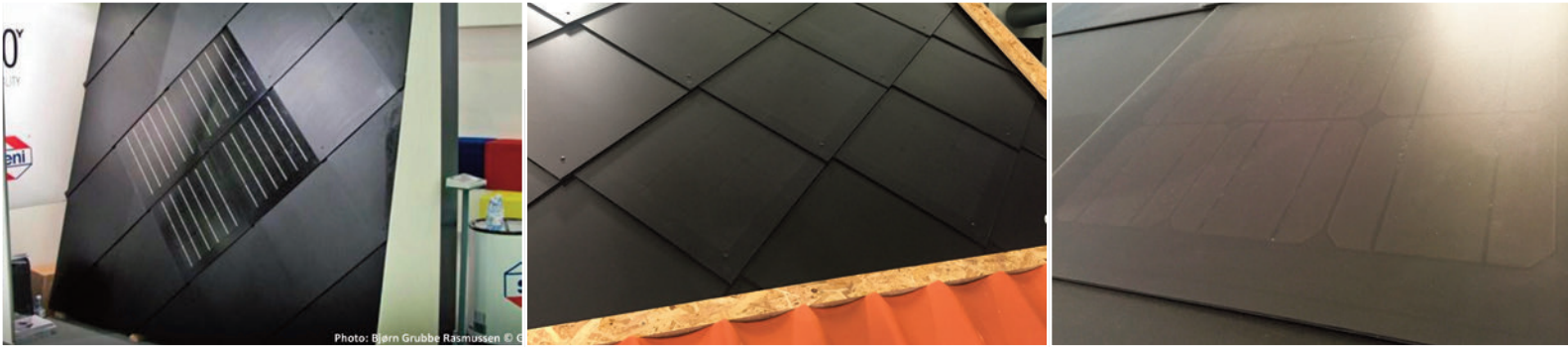


Fig.3 Here is illustrated the impressive development of PV panels from Gaia Solar in Denmark together with Norwegian Steni roof plates. Compared to the 1st generation solution the 2nd generation PV panels have exactly the same appearance as the Steni plates



Fig 4. The Active House specifications and labelling system is very useful to communicate the Active House quality of a building project, with respect to energy, comfort and sustainability, and it can, at the same, time be used as a dialogue and performance verification tool. (see also www.activehouse.info)

Building integrated PV both improves the assessment of CO₂ level, primary energy use and energy supply.

Carbonation induced corrosion of reinforced concrete revisited

The effect of corrosion on reinforced concrete must be addressed both for safety and environmental reasons, say researchers from ETH Zurich...

Carbonation means the progressive neutralisation of the alkaline constituents of concrete by carbon dioxide in the air, forming mainly calcium carbonate. In this neutralised environment, reinforcing steel is no more protected by the alkaline pore solution of fresh concrete. When the carbonated surface zone reaches the depth of reinforcing steel, significant corrosion may be initiated.

“...achieving sustainable reinforced concrete structures clearly requires not only decreasing the environmental footprint of the materials at the time of their production (reducing the clinker content), but to combine this with high durability, thus enabling long and maintenance free service lives of the structures in their actual exposure environments.”

Indeed, corrosion of steel in carbonated concrete was a major concern of research and practice in the years from 1950 to 1980. The research findings lead to the requirement of dense concrete (lower w/c ratio), the control of concrete properties and to a marked increase in the cover depth (from 20 mm to 35 mm) in the codes of practice. The European standard on concrete EN 206-1 published in the year 2000 classified the risk of carbonation-induced corrosion depending on the severity of the environment (XC1 to XC4). With the minimum requirements given in the recommendations (maximum w/c ratio, minimum

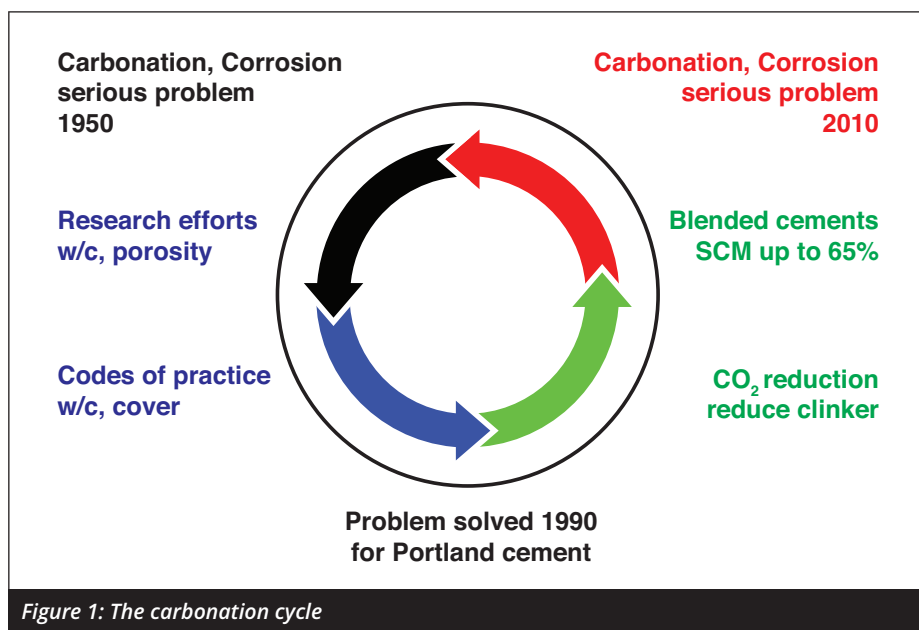


Figure 1: The carbonation cycle

cement content, minimum cover depth) the codes of practice since then give guidance for reinforced concrete made with Portland cement (CEM I) on how to avoid carbonation induced corrosion for structures with expected service life of 50 or 100 years.

The role of carbonation as a factor that contributes to the degradation of reinforced concrete is becoming increasingly important again (Figure 1) for two reasons. First, many old reinforced concrete structures that were built before modern standards were applied are ageing and have to be maintained. Secondly, the need to reduce CO₂ emissions and to obtain materials having a reduced environmental footprint, is leading to a reduction of the clinker content in the cements. Clinker (CEM I) is substituted with supplementary cementitious

materials (SCM) such as limestone, fly-ash, geopolymers etc. In the future blended cements with increasingly lower clinker content and a huge variety of supplementary cementitious materials (SCM) will be used. The introduction of non-Portlandite binders has strongly reduced the pH buffer capacity as a result of the reduction (or elimination) of the calcium hydroxide reserve considered one of the main reasons for the corrosion inhibiting nature of Portland cement systems. The carbonation rate of such modern blended cements is a factor of 2-4 higher than for Portland cement (figure 2), thus the recommendations based on the experience with Portland cement do no more guarantee the required service life.

For service life prediction of concrete structures with new, blended cements,

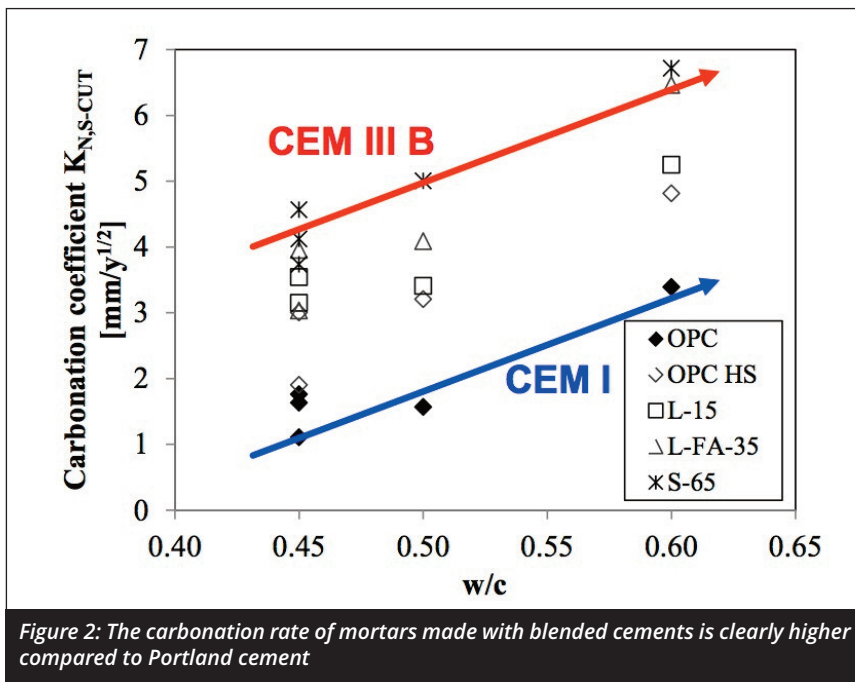


Figure 2: The carbonation rate of mortars made with blended cements is clearly higher compared to Portland cement

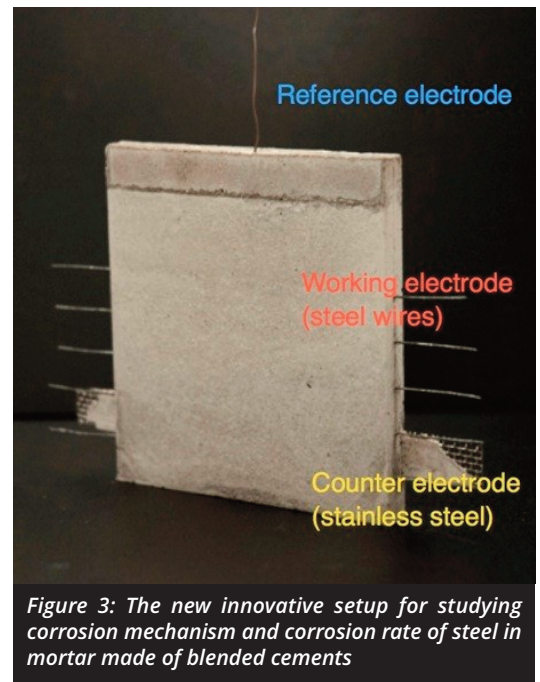


Figure 3: The new innovative setup for studying corrosion mechanism and corrosion rate of steel in mortar made of blended cements

corrosion rate data are urgently needed because the so-called “corrosion propagation stage” might be a significant part of the total service life. Literature data are scarce and refer mainly to Portland cement. To be able to collect data of corrosion rate in a reasonably short time, a new experimental set up has been designed (figure 3). The new test setup consists of small (8 x 8 cm) and thin (6 mm) cement mortar samples instrumented with a reference electrode, 5 steel wire electrodes and a stainless steel grid counter electrode. The thin sample allows rapid full carbonation (max 1 week in 4% CO₂) and rapid equilibration of environmental humidity (checked by the sample weight). Parameters that can be measured are electrical resistivity of the mortar, corrosion potential and corrosion rate (LPR measurements) of the steel wires, oxygen diffusion and consumption rate. From these data the mechanism of steel corrosion in carbonated concrete made of different blended cements can be evaluated.

“The role of carbonation as a factor that contributes to the degradation of reinforced concrete is becoming increasingly important again for two reasons. First, many old reinforced concrete structures that were built before modern standards were applied are ageing and have to be maintained. Secondly, the need to reduce CO₂ emissions and to obtain materials having a reduced environmental footprint, is leading to a reduction of the clinker content in the cements.”

In summary, achieving sustainable reinforced concrete structures clearly requires not only decreasing the environmental footprint of the materials at the time of their production (reducing the clinker content), but to combine this with high durability, thus enabling long and maintenance free service lives of the structures in their actual exposure environments.

1 A. Leemann, P. Nygard, J. Kaufmann, R. Loser, Cement and Concrete Composites 62 (2015) 33 - 43

2 M. Stefanoni, U. Angst, B. Elsener, Innovative sample design for corrosion rate measurement in carbonated concrete, presented at 11th annual International Concrete Sustainability Conference (2016 ICSC) May 15 – 18, 2016, Washington DC (USA)

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BIM for health, safety, and environment (HS&E)

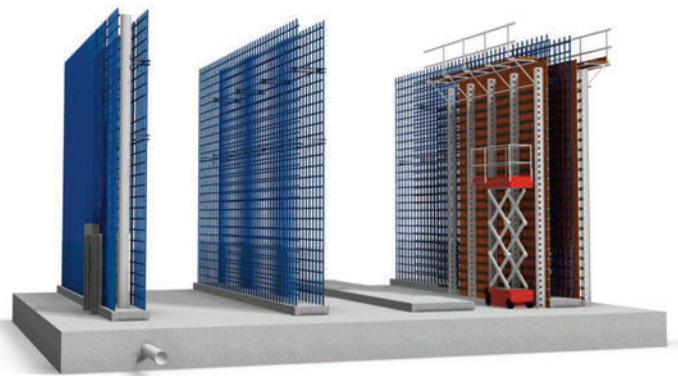
It is possible for BIM to enable the health, safety and environment within the construction industry, as explained here by Andy Radley, Group BIM Director at Kier Group...

Despite the fact that the UK construction sector only accounts for approximately 4% of the UK workforce, 26% of all reported occupational fatalities were from the construction industry (HSE, 2015). In addition, 0.5m working days are lost due to mostly preventable accidents and health related issues.

Kier, like most organisations in this sector, is mindful of these numbers and therefore positions the welfare and wellbeing of its staff, stakeholders and clients high on its strategic and operational agenda. This usually goes hand-in-hand with a robust ethical approach to business which nurtures a culture of respect for the environment that we live and work in. This approach is enabled by multiple initiatives, practices and behaviours which are then underpinned by legislation, governance and guidance. In the context of BIM, there are rumours of the UK BIM central stewardship group issuing a new PAS – PAS 1192 – 6 which is being described as 'BIM for Health and Safety'.

In an organisation that is as diverse and complex as Kier, our BIM offering which forms part of our Digital Construction Dept. is one of those business functions that already transcends the design and build arena. We are constantly looking to embed further and get the best value in the use of BIM from the investment we have made in both our personnel and technologies. In the context of health and safety, we have for some time been advocating the potential of digital construction tools like BIM to further strengthen our health, safety and environment (HS&E) practices across the whole group.

When it comes to HS&E, we probably need to set aside the Bew/Richards 'BIM Wedge' as we are not aiming to achieve any 'Level' of BIM, just the better and expanded utilisation of our digital tools that is appropriate to



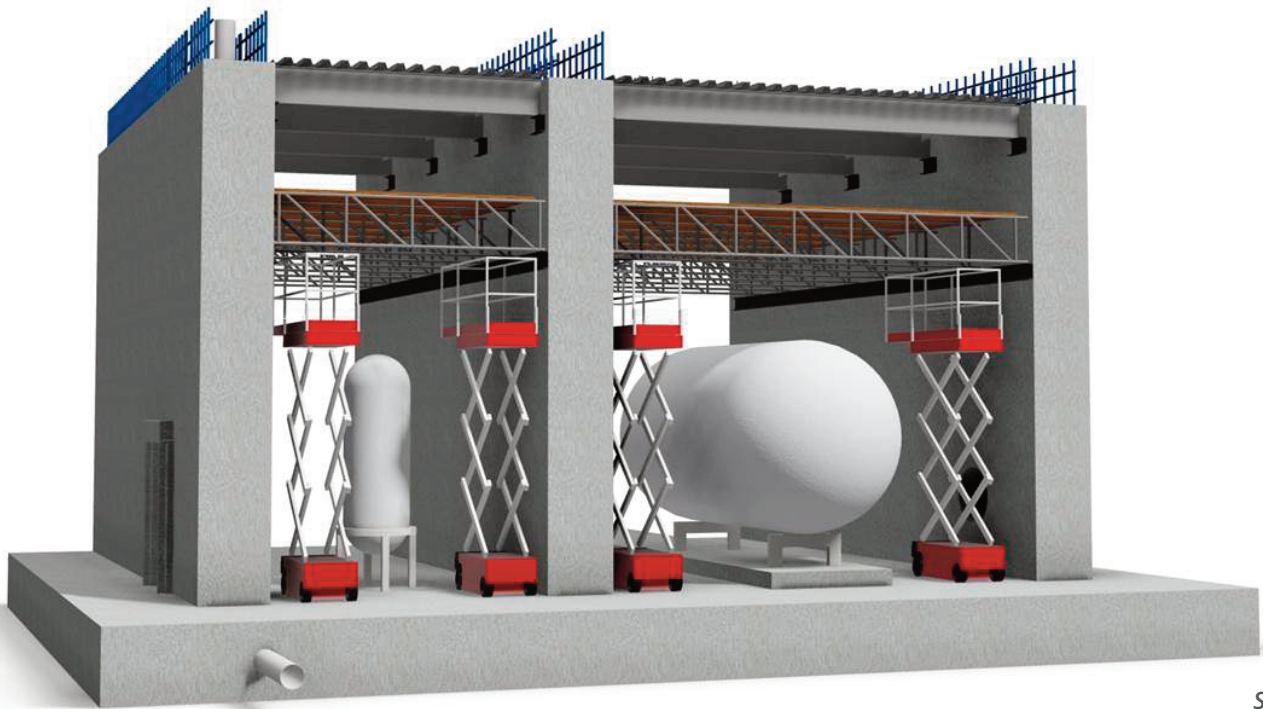
Stage 1

meet the challenges relating to the matters we need to address.

“During construction, we now more or less take for granted that most of the information we are provided with is getting progressively more accurate due to the collaborative BIM processes that are being adopted across the industry.”

At the highest level, we have recognised that we can use our digital tools to keep people safer and protect the environment by the:

- Reduction of site visits;
- Reduction of time spent on site;
- Decreasing the amount of people required on site;
- Better understanding and validation of complex construction processes;
- Better insight and communication of potential hazards (physical and environmental);



Stage 2

- Enhancement of emergency planning.

Pre-Construction

During the early stages of any project, even during the tender stage, the site location, position and layout need to be understood. Issues, if highlighted and practically addressed – in circumstances where there may be unique challenges, restricted access or stakeholder involvement – we would appraise which digital tools would be necessary or appropriate to deploy.

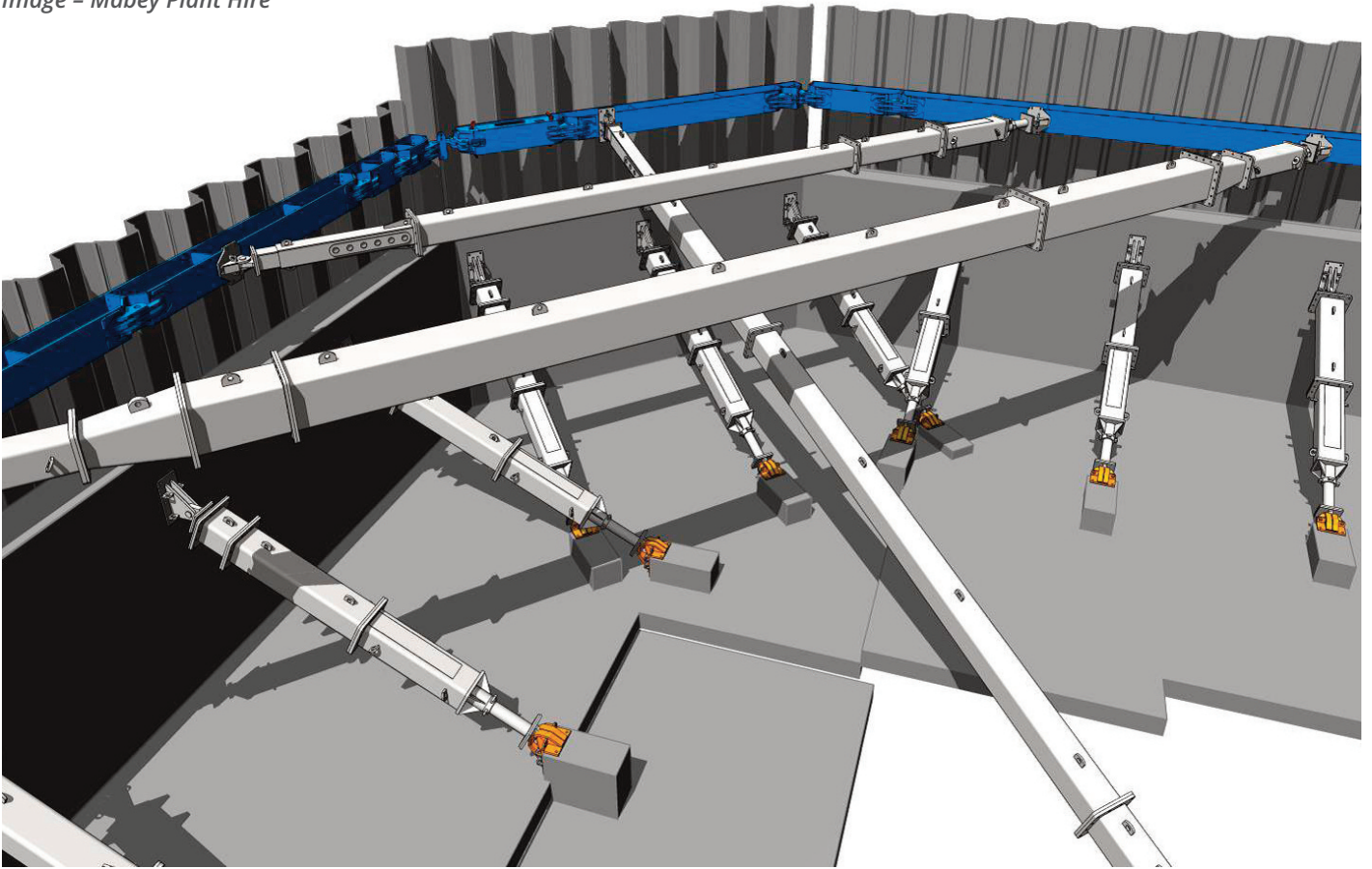
For Kier, it is becoming the norm to carry out a drone survey. If planned and executed correctly, this can provide benefits throughout the entire duration of project mobilisation and handover. The drone footage can reveal features that can focus a remediation survey on areas that may have an impact on the site. This could include, for example, the outlines of a long-demolished building or the location and spread of hazardous waste that may have been deposited or buried on site. We would also try to ensure that we captured adjacent roads and buildings as part of a dilapidation survey to prevent any disputes over the impact of our presence on the site. The added value of this activity is that we could use photo telemetry techniques to convert the images into a realistic and reasonably accurate model,

into which we can place our proposed site boundary, temporary works and new structure. In some instances, we would simply post process some of the film taken and demarcate walkways, laydown areas, COSHH zones, etc. We may sometimes use a combination of models and animations to create a site induction video. In general, the benefits of this approach can be carried on into the construction phase and should enable us to:

- Inform and help develop a better, more realistic construction phase plan;
- Safety/environmental teams can gain an enhanced understanding of activities that may carry a risk on, or immediately around the site;
- Reach a better level of engagement with client and key stakeholders;
- Reduce site visits by providing access to 3D data and visuals via a secure project Common Data Environment (CDE).

During construction, we now more or less take for granted that most of the information we are provided with is getting progressively more accurate due to the

Image – Mabey Plant Hire



collaborative BIM processes that are being adopted across the industry. This has afforded us opportunities to work with, and challenge our supply chain to do more to help us meet our HS&E targets:

- Use of mobile tools for tracking of near misses and logging of real-time hazards;
- Design out risk;
- Design out waste;
- Co-ordination with underground services/interfaces with the general public.

Supply chain

On several projects the structural consultant and contractor were challenged to improve safety during construction. They designed in some permanent edge protection with mid rail, post spacings and toe plates which were compliant with the HSE Guidelines – all of which were built-in and ultimately incorporated into the finished works as the parapet edge.

“When it comes to HS&E, we probably need to set aside the Bew/Richards ‘BIM Wedge’ as we are not aiming to achieve any ‘Level’ of BIM, just the better and expanded utilisation of our digital tools that is appropriate to meet the challenges relating to the matters we need to address.”

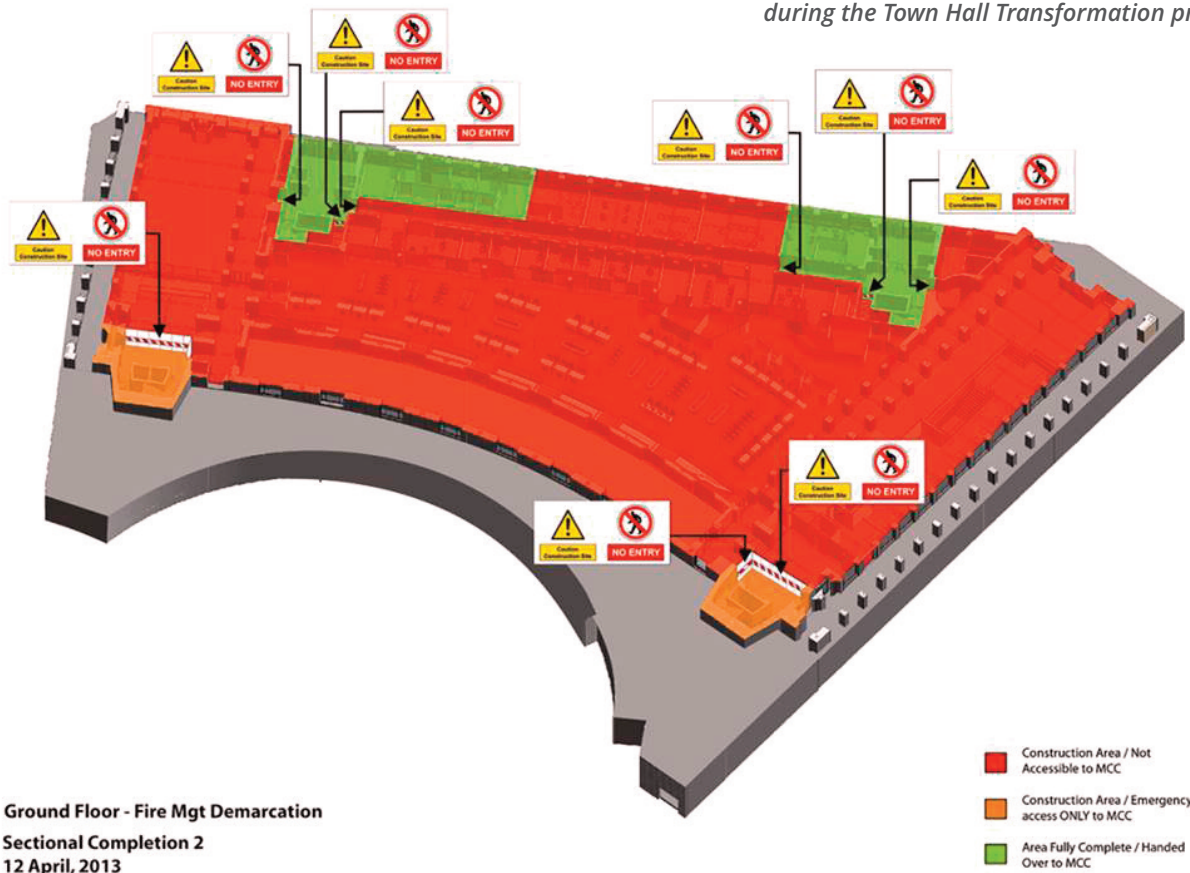
The image above is supplied by Mabey Plant Hire. They have been proactive in embracing BIM, by creating models of their proposed temporary works which allows them to validate their proposed design before going on site, picking up any clashes and coordination issues before we take possession and incorporate them into the master federated BIM model. Having a more complete model ensures we can assess the impact of the temporary works scheme and use as part of H&S briefings and toolbox talks.

Clients

Stakeholder requirements include the ability to demonstrate how to keep the pedestrian flow free, and position hoarding correctly so construction can still

THE BUILT ENVIRONMENT

Model used for emergency planning by Manchester City Council during the Town Hall Transformation programme



progress. The image above shows how to provide overhead cover when accessing the station. It also demonstrates to the client what areas will be closed during construction, and also to co-ordinate site compound with existing underground services and maintenance of emergency access routes.

To engage effectively with clients, it's important to:

- Understand disruption;
- Engage with staff;
- Consider stakeholders and public safety;
- Work with the supply chain and educate them to use the BIM model to understand logistics and access.

The quest for reducing accidents and work-related illnesses is ongoing. BIM will, over time, contribute to a safer and healthier built environment as will the application of emerging technologies. Until the day that all buildings are created in a factory environment

with robots taking over all on site tasks, there will always be an aspiration to improve the welfare of those who do. BIM may not have all the answers; it is, however, part of the continuous improvement process taking us a step closer to zero accidents on site. ■



Andy Radley
Group BIM Director

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Digital Construction: As easy as ordering pizza on your phone

Graeme Forbes, outlines how digital construction has helped Kier achieve greater accuracy and speed of process at Chelsea River Bridge...

For some time now, we've been advocating the move to digital construction. Not solely because of the government's BIM requirements, but also because we believe the construction industry needs to embrace technology in order to catch up with the rest of the business world. With the revolution in Big Data, there is no reason why the construction industry can't capitalise to make itself smarter, more able to predict, in order to streamline its capabilities and avoid unnecessary waste.

"The speed of availability of the information means that it can be quickly and easily circulated to suppliers, sub-contractors and steel work specialists. It also meant that the client could access the information and sign off the work when it was complete, either onsite or at the office."

However, we are always facing challenges about the seismic shift in culture that the industry will have to make, the difficulties in picking up new processes that could slow projects down, and not to mention the expense of initial investment.

However, we truly believe that it will not only simplify processes for users, but also provide a constant, consistent, 360 degree view of a project and enable more efficient use of people's time.

Nowhere has this been more apparent than at a project we worked on at Chelsea River Bridge. The bridge was being surveyed for refurbishment and the team running it was looking for an intelligent solution to make the engineers more accurate and effective in their data gathering, so spoke to us about our BIMXtra product.

Whilst the BIMXtra system was developed and to establish a benchmark, spans 1 and 2 were surveyed using traditional paper-based methods. It took two engineers three weeks to record data, go back to the office and then enter it manually into the database. After the first span, the team had identified that it would need another 8 heads to complete the work on time.

In BIMXtra, historical 2D drawings were drafted into a 3D model, containing some 7,900 uniquely identified structure elements. 2D views from the model were loaded to OnSite, our mobile application, so that individual elements could be selected to allow site survey work to be recorded against each element.

When they got to Span 3, the team used both methods as comparison. Using BIMXtra, it took two engineers just 4 days to complete the survey of the span. Data was recorded and stored within BIMXtra, ensuring



consolidated information could be retrieved by multiple users, either on site or in the office. With the BIM process fully functional, it at least halved the length of time to process.

Thereafter this became the sole methodology and using BIMXtra achieved a saving of 21 programme days and an ROI of 30 times what they invested.

PROFILE



With the tangible benefits clear to see, the team ceased using the old method. But, the more intangible benefits also convinced them that the software was worth its weight in gold.

“...we truly believe that it will not only simplify processes for users, but also provide a constant, consistent, 360 degree view of a project and enable more efficient use of people’s time.”

“BIMXtra allowed us to be much more efficient,” commented Ryan Blunt, civil engineer, Kier Group, “Our engineers could concentrate on the intricate detail, meaning the client received the best possible survey, with all the information they needed on their asset.”

Every site action created, synchronises with the construction summary page within BIMXtra. Thereafter, any further actions such as proposed design solu-

tions, executions of works and sign-offs are logged against these initial uploads and recorded, monitored and managed efficiently.

The speed of availability of the information means that it can be quickly and easily circulated to suppliers, sub-contractors and steel work specialists. It also meant that the client could access the information and sign off the work when it was complete, either onsite or at the office. Kier’s senior project manager, Colin Barnes, said, “Everything flows easier, everyone gets the information they need. It saves a lot of time. I think it’s the best tool we’re going to have to manage delivery of the project.”

So, not only has it saved money, the use of BIMXtra has improved the overall accountability of a process previously executed using more traditional manual and paper based activities.

But, what about the challenge surrounding ease of use and a complete change of culture for the construction industry? Well, yes it is. However, this was summed up nicely by Ryan, “It’s as easy to use as ordering pizza on your phone.”



Graeme Forbes
Managing Director

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The new British Standards for watermist fire protection systems

The new British Standards for watermist fire protection systems are explained here by Bob Whiteley, Chairman, FSH18/5 and FIA/BAFSA Water Mist Working Group...

Why in 2016 do some see watermist as such a contentious issue? For the most part, this has been because there has not been a British Standard which those in the fire safety community can use. The lack of British Standards for watermist fire protection to date had been seen by some to have provided a 'cowboy charter' in the marketplace. However, the publication of BS8458 covering the domestic and residential use of watermist; and the BS8489 series covering the industrial and commercial application of watermist fire protection is seen as a major step forward in this regard.

Why British Standards for mist?

The work in the European standards body, CEN, has only produced a Technical Specification document which cannot be considered a standard. Also, the UK industry took the view that the CEN agenda did not address UK needs and concerns.

The development of BS8489 and BS8458.

The watermist standard began life in 2006 as a Draft for Development – DD8489.

This, as the name implies, created a provisional standard to allow information and experience to be obtained. Two expert groups were then formed to use industry best practice and who, through team efforts, has created BS8458 and the BS8489 series to reflect industry the current knowledge and experience.

The BSI Watermist Working Group

The Working Group, FSH18/5, was formed from representatives from FSH18/2 (sprinklers) and FSH18/6 (gases) fire committees, plus representatives from the Fire Industry Association (FIA), the British Automatic Fire Sprinkler Association (BAFSA), UK Insurers, the Loss Prevention Council (LPC) and Factory Mutual (FM).

FSH18/5 formed three working groups to work on:

- a. BS8458 the domestic and residential standard for watermist;
- b. BS8489 series for industrial and commercial watermist;
- c. Input to CEN TS14972.

This article will now focus on the key elements of BS8489 Part 1, covering system design and installation.

BS8489 – principle requirements – testing

Specific areas within the building can be protected by watermist where relevant fire test protocols exist. The test protocols must be representative of actual conditions, thus:

- Similar fuel;
- Comparable compartment volume;
- Compartment height is comparable;
- Similar ventilation conditions.

In some instances, these have been carried out in-house by watermist suppliers. However, it is highly desirable for independent third parties to carry out the testing and certification. The test facilities are expected to operate a quality system with watermist in their scope of accreditation. The test protocol should be recognised and/or agreed by all interested parties. The laboratory test record should be published showing what equipment and systems have demonstrated performance and listing the equipment and components for their intended application.

STANDARDS

The successful test results/ test report would include details of components and parameters used in tests; maximum and minimum nozzles heights and spacing; and minimum flows and pressures to be met or exceeded. These would then be incorporated into manufacturer's design manual to replicate the system as tested.

These requirements, in themselves, represent a major step forward in providing the information needed for decision makers to make an informed choice regarding the use of watermist and those suppliers with the necessary capabilities.

BS8489 principle requirements – Protection

watermist systems may be engineered to provide either local application or volume protection with design parameters established by representative fire tests.

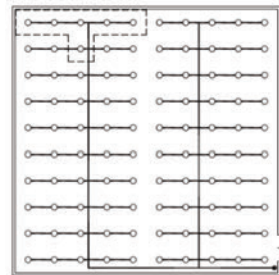
Local Application: extinguishing systems designed for object protection with design parameters established by representative fire tests. This enables protection of discrete hazard objects within a larger, and possibly, unprotected enclosure.

Volume Protection: (either via open nozzles or automatic, frangible bulb operated nozzles) are systems designed for hazards within a volume i.e. creating a protected enclosure. Depending upon the application and testing the systems may be designed to provide fire suppression of ordinary combustibles or fire extinguishment of flammable liquid fires.

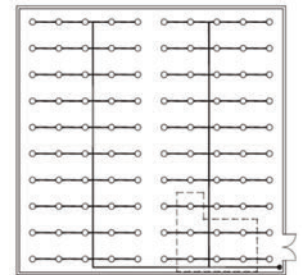
BS8489 principle requirements – duration

Extinguishing systems are required to operate for twice the duration to extinguish and prevent re-ignition as established by the test. For suppression systems the requirements are:

- To suit hazard with 60 minutes minimum;
- For automatic nozzle systems, the maximum flow must be based upon the most favourable 'Assumed Maximum Area of Operation' (AMAO);
- System piping must be fully hydraulically designed.



Most unfavourable AMAO



Most favourable AMAO

BS8489 principle requirements – components

Components should be in accordance with LPS1283/FM5560 or equivalent.

Nozzles should be made of corrosion resistant materials and be permanently marked. Open nozzles should incorporate blockage prevention devices, and automatic nozzles have thermal release elements per BSEN12259-1 quick response.

Piping materials are expected to be stainless steel, copper, or in certain cases galvanised steel with additional protective measures.

BS8489 principle requirements – water supplies

Water supplies must be capable of supplying both the hydraulically most unfavourable AND the most favourable AMAOs with wholesome/demineralised/deionised/ sweet industrial water from:

- Towns main;

THE BUILT ENVIRONMENT

- One or more automatic starting pumpsets;
- One or more pressurised cylinders.

The supplies must provide continuity and reliability of supply. Where other than 100% capacity pump suction tanks are used they must have an effective capacity of at least 30% of full capacity AND the infill rate is sufficient to meet discharge duration requirements, and it can be tested to verify performance.

Dedicated pump houses are required to be constructed with 60-minute fire resistance if forming a separate building, but 120 minutes if adjacent to or within a watermist protected building.

Pump houses need to include:

- Permanent pump flow/pressure test facility;
- Pump driver power 110% of rated power demand;
- Pump continuous flow to prevent overheating;
- Pump suction strainer.

Where multiple pumps are deployed to deliver the required flows and pressures they need to include:

- Common suction;
- Individual pump isolation;
- Sequence starting;
- Starting to ensure sustained system pressure.

Water supplies using dedicated cylinders must have permanent means to check pressure and water content.

BS8489 principle requirements – Annexes

The standard includes four annexes:

- a. Elements of typical watermist systems – shows typical configurations of pump and tank, pump and towns main, cylinders commonly used for watermist fire systems.

- b. Sets out the provisions where enhanced availability is needed for volume protection systems.
- c. Provides informative text and diagrams explaining how assumed maximum areas of operation are determined.
- d. Sets out the testing requirements for water mist nozzles.

Fire test protocols

Four fire test protocols have been included, as part of the BS8489 series as protocols which will be of general interest and value, however, other, third party accredited protocols may be used with this standard. Part 4 – For the protection of local applications; Part 5 – For the protection of combustion turbines and machinery spaces ≤ 80 m³; Part 6 – For the protection of industrial oil cookers; and Part 7 – for the protection of low hazard occupancies.

Summary

BS8489 and its sister standard BS8458 provide, for the first time in the UK marketplace, a series of standards which reflect the best industry practices for watermist fire engineering. They will assist specifiers, users and fire protection companies ensuring that watermist is used effectively and appropriately where the technology is viable and has been validated. ■



Fire Industry Association

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Water Mist Working Group

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www.fia.uk.com

Trying to locate quality
fire protection companies?



Find them at www.bafe.org.uk

BAFE registered companies are certified in specific areas of fire protection by UKAS accredited Certification Bodies using BAFE developed schemes.

Search free to find certified competent fire companies near you at www.bafe.org.uk

Fire Extinguisher Maintenance

Fire Detection and Alarm Systems

Fire Risk Assessments

Emergency Lighting Systems

Fixed Gaseous Fire Suppression Systems

Support for Europe's farmers

Adjacent Government highlights how the European Commission is continually supporting farmers and rural communities...

The agriculture sector is integral to economic development throughout Europe, and even worldwide. As around half of the land within the EU is farmed, this places farming as an integral part of the EU's natural environment. The European Commission has shown continued commitment to supporting agriculture across the member states, and Europe's farmers in particular.

The Common Agricultural Policy (CAP), which implements a system of agricultural subsidies and other programmes, forms the backbone of the European Union's approach. Through the CAP, farmers are encouraged to continue to play a positive role in the maintenance of the countryside and the environment, by:



Phil Hogan

- Targeting aid at rural development measures promoting environmentally sustainable farming practices, like agri-environment schemes;
- Enhancing compliance with environmental laws by sanctioning farmers' non-respect for these laws through a reduction in support payments from the CAP.

The European Commission recently announced a new package of measures worth €500m to support farmers in the face of ongoing market difficulties. The package contains three main elements:

- An EU-wide scheme to incentivise a reduction in milk production (€150m);
- Conditional adjustment aid to be defined and implemented at Member State level out of a menu proposed by the Commission (€350m that Member States will be allowed to match with national funds, potentially doubling the level of support being provided to farmers);
- A range of technical measures to provide flexibility (e.g. on voluntary coupled support), cash-flow relief, and reinforce the safety net instruments.

Speaking about the new measures when they were presented to the Council of EU Agriculture Ministers, Commissioner for Agriculture and Rural Development, Phil Hogan, said: "Coming at a time of significant budgetary pressures, this package provides a further robust response, and means that the Commission has mobilised more than €1bn in new money to support hard-pressed farmers.

"Our ultimate goal is to see the much needed recovery of prices paid to farmers, so that they may make a living from their work and continue to provide safe,



high quality food for citizens, as well as their contribution to rural areas and rural jobs and the provision of public goods.”

In September, Hogan also spoke at the [2.0 Conference on Rural Development](#), in Cork, Ireland, where he highlighted the importance of the Common Agricultural Policy (CAP) and how rural development is an essential element within the policy.

Hogan said: “Agriculture, forestry and their related sectors support 44 million jobs throughout the EU and are essential for the economic, environmental and social development of viable rural areas and communities, both directly and indirectly.

“Though farmers and foresters are the custodians of 85% of the territory of the EU and are by far the largest direct beneficiaries from the CAP in terms of direct payments and rural development payments, the ultimate beneficiaries are the tens of millions of citizens who live in the countryside or those who perhaps live in urban centres but regularly enjoy rural amenities.

“And what about all of us, as citizens, who benefit every day from the contribution that our rural areas make to climate change mitigation?”

“Through the CAP, farmers are encouraged to continue to play a positive role in the maintenance of the countryside and the environment.”

“Everybody benefits from viable farms capable of preserving landscapes and feeding into local economies; we all benefit from climate action and improved environmental management and all of us benefit from thriving rural communities.” ■

.....
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Alternative feed sources for Norwegian sheep

Dr. Vibeke Lind, Senior researcher at the Norwegian Institute of Bioeconomy Research (NIBIO) outlines the work of her research team to develop nutritional alternative feed sources for sheep...

I have my PhD from Norwegian University of Life Sciences, department of animal and aquacultural sciences in animal nutrition. My field of competence is nutrition and the feeding of sheep. I work within all questions related to sheep nutrition and how feeding impact e.g. weight gain, meat quality and nutritious content of lamb meat, enteric methane emission and the impact of grazing on the landscape. Presently my research is related to use of alternative protein sources to soya imported from e.g. Brazil. Seaweed has potential as feed in the diet for sheep and both seaweeds and legumes are possible ingredients rich in protein that can replace parts of the soya protein.

Seaweed as feed for sheep?

The Norwegian funded project, "Legumes and seaweed as alternative protein sources for sheep" are in the third of four years. Results are ticking in and the attention to these are big. The project is funded by the Norwegian Research Council BIONÆR-program. Project leader is Dr. Vibeke Lind from Norwegian Institute of Bioeconomy Research (NIBIO), who works together with other researchers from NIBIO, from Nordland Research Institute also in Norway, Aarhus University in Denmark, Research Institute of Organic Agriculture (FiBL) in Switzerland and Consejo Superior de Investigaciones Científicas (CSIC) in Spain. Together, the 6 researchers cover topics from feed

Image: © Ingrid Bay-Larsen, Nordland Research Institute



digestibility, enteric methane emission, nematodes and farmer's perceptions towards the use of alternative protein sources.

Norwegian meat production is highly dependent on soya, an imported protein source. Isolated, 94% of all protein in Norwegian concentrate is imported and in 2013, as much as 420,000 tons was imported with an expected continued increase. The high import is mainly due to the demand for higher animal milk and meat production. Of all the ingredients in commercial concentrates fed to Norwegian farm animals, 40% are imported. Norwegian cereal production does not meet the demands for increased production. Prohibition of the use of animal and fish protein subsequent to the BSE crisis in the

1990's produced a gap in the supply of protein to ruminants. Additional protein is needed and imported soya seems to be the cheapest and most suitable. In 1996, the Norwegian government forbid import and the use of GMO-ingredients. Due to the increased demand for feed worldwide, the availability of GMO-free soya is decreasing. Therefore, a focus on locally produced concentrates, covering the demand for protein sources in Norway is essential. Legumes and seaweed are interesting products in this context.

Seaweed has traditionally been used in Norway in coastal communities as a supplement in the animal ration especially when there was a shortage of forage. Seaweed production is an important industry in Asia where

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Dr. Vibeke Lind

seaweed is fertilised by waste products from both maritime and agricultural farming. Due to geography, environment and the aquaculture production, conditions along the Norwegian coast are well suited for the production of seaweed. In addition, in relation to climate change, the seaweed culture contributes to bind CO₂. Seaweed is considered to be a source of bioactive compounds as it is able to produce a great variety of primary and secondary metabolites such as, terpenes, phenols and fatty acids and has bioactivities of pharmacological interest.

Anthropogenic emissions of enteric methane (CH₄) are estimated to be responsible for about 30% of the global warming caused by increased GHG concentrations in the atmosphere. Enteric emissions of CH₄ from domesticated ruminants, arising primarily from the fermentation of feed in the rumen, are considered to be one of the three largest sources on a global scale. The emission of methane by cattle and sheep represents a carbon loss pathway that results in reduced productivity. If the energy could be rechannelled into weight gain or milk production, it would increase production efficiency while reducing methane emission to the atmosphere. In Norway, GHG emission

from farming account for 8% of the total national emissions with ruminant production being responsible for about 60%.

Gastro-intestinal nematodes represent a major threat for ruminant husbandry, inducing considerable economical and animal welfare issues. Since the 1960s, GIN has been controlled by broad spectrum anthelmintics. Their prophylactic and therapeutic use has enabled an intensive sheep production that is sustained up to the present. Meanwhile, however, nematode populations resistant to the main anthelmintic families have frequently emerged. Beyond the impairment of animal welfare, the use of partly ineffective anthelmintics reduces the carcass value of lambs about 10 to 14% and considerably extends the time until the lambs reach target live weight. Research has focussed on alternative approaches to control GIN and one promising approach is based on the use of legumes containing condensed tannins.

The agriculture industry and individual farmers are exposed to constant changes in economic, managerial and climatic and environmental conditions. This may have increased the industry's adaptive capacity. At the same time, research shows how farmers vary in their responses and adaptive strategies, and that certain conditions and individual attributes lower the likelihood for using the opportunities from changing circumstances. Further investigations of the perception of new feed components among the farmers is therefore important in order to gain knowledge about constraints and barriers that may meet such an introduction.

The first step in the project was to find different species of seaweeds. Eight

species were handpicked along the coast close to Bodø (67°16'48"N 014°24'18"E). After washing off salt and minerals (e.g. sand) the seaweeds were dried before analyses. Digestibility and protein content were the most important factors to find before deciding which specie to continue with in a feeding trial. At present, lambs of Norwegian white sheep are fed 4 different diets to investigate growth rate. In addition to a control diet, either seaweed, white clover or soya pellets are included as protein source in the 3 experimental diets. In addition, the lambs are tested for enteric methane emission. Another group of lambs are fed a control diet included either soya pellets or seaweed to investigate if diet can reduce the level of nematodes. The project ends in 2017.



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Soil biodiversity

Keeping the Earth alive

Soil condition underpins food security, green growth, bio-economies and aboveground biodiversity; it regulates climate, the hydrological and nutrient cycles, while mitigating climate change. Soils provide resilience against floods and droughts, buffers the effects of pollutants and preserves cultural heritage. Healthy, functional soils underpin several of the UN's Sustainable Development Goals.

What is not widely perceived is that functions, such as soil fertility, carbon sequestration and nitrogen cycling, are actually conditioned by the presence and interactions of soil-dwelling organisms which not only keeps the planet, but also us, alive. Life-saving penicillin, one of the most widely used antibiotics, comes from the soil fungus *Penicillium chrysogenum*, while new types of antibiotics based on culturing bacteria in soil (e.g. Teixobactin) have proved to be very effective against both *Staphylococcus aureus* (respiratory tract infections) and the Koch's bacillus, which causes tuberculosis. There is a growing body of evidence that the human immune system requires activation and exercise in order to function properly and that a lack of contact with soil microorganisms during childhood could be the cause of the epidemic of allergies in developed countries.

In reality, soils are full of life. A single gram of soil may contain millions of individual bacteria and several thousand species. A handful of arable soil



Figure 1. A colourful springtail that lives in the soil

under a temperate climate contains approximately 0.5g of fresh biomass, which is mainly microbial. This equates to around 5 tonnes of animal life in the topsoil of a single hectare – equivalent to 100 sheep or 20 African elephants. Under grasslands, the amount of living organisms can be 20 times greater, which is 2,000 sheep per hectare – orders of magnitude more than the average stocking densities for grazing sheep. In fact, a healthy soil can contain species of vertebrate animals (e.g. moles), several species of earthworms, 20-30 species of mites, 50-100 species of insects, tens of species of nematodes, hundreds of species of fungi and probably thousands of bacteria species. On the other extreme, a single colony of the honey fungus, *Armillaria ostoyae*, can cover an area of about 9 km². Even the smell of wet soil after rain falls on dry ground is due to the release of an organic compound (known as geosmin)

from a type of soil bacteria.

However, our knowledge and understanding of soil as a habitat is limited. While it is thought that 60% of the world's ants have been classified, only 3% of the nematodes, 6.5% of fungi and 1.5% of bacteria, have been identified. Soil biologists estimate that there may be between, 1.5 to 5 million species of fungi on the planet – to date, only 100,000 have been identified.

Apart from a few exceptions (e.g. moles, earthworms and ants), public awareness of life in soil is almost completely lacking. To overcome this deficiency, and help decision makers develop policies to safeguard these organisms and their associated services, the European Commission's Joint Research Centre (JRC), together with the Global Soil Biodiversity Initiative¹, has recently published the first ever Global Atlas of Soil Biodiversity².

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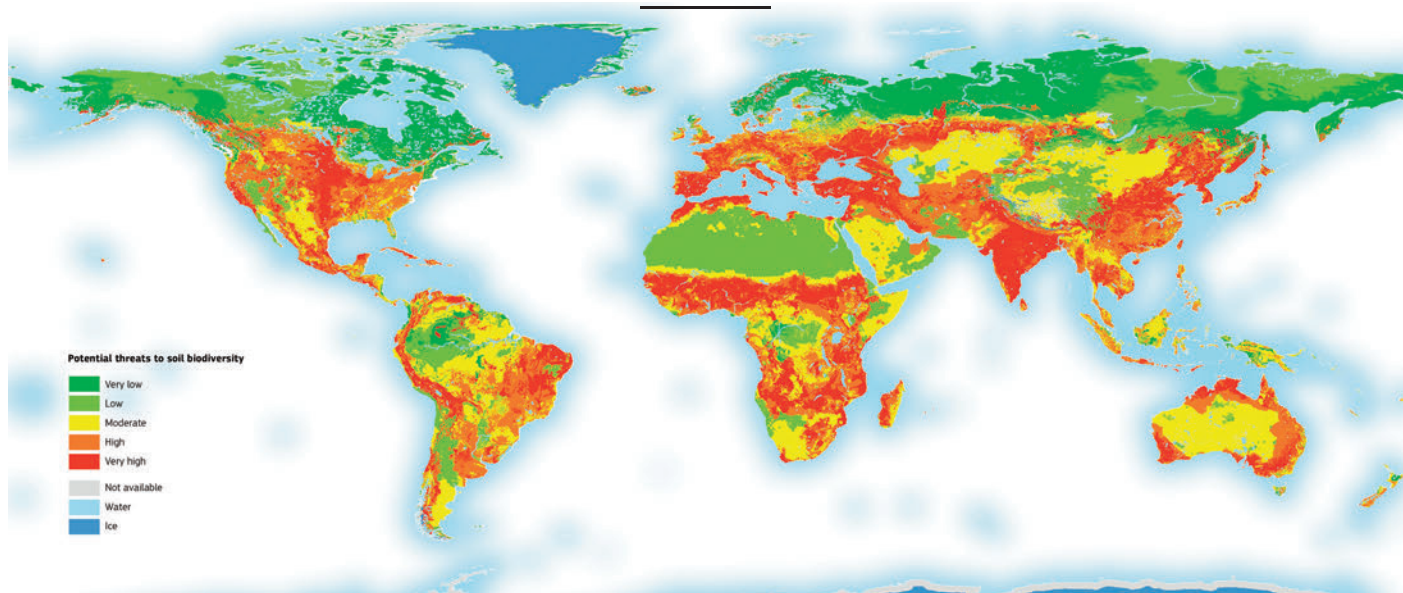


Figure 2. This map is an initial attempt to denote levels of potential risk to soil biodiversity at a global scale. The areas with the lowest level of risk (greens) are generally less subjected to both direct (e.g. agriculture) and indirect (e.g. climate change) anthropogenic effects. At the opposite end of the scale, the areas with highest risk (reds) are those with the greatest exposure to human activities. An important point to highlight is that the map conveys potential rather than the actual level of threat. This means that in the areas with high or very high levels of risk, soil organisms may not necessarily be in real danger. However, these areas present a combination of factors that lead their soils, and thus the organisms living in them, to be more sensitive to risk. This map will require continued effort to improve both its reliability and resolution

Freely available to download from the JRC's website³ (hard copies can be published from the EU Bookshop⁴), the 180 page publication is the result of a global effort between more than 120 researchers. Developed with the non-expert in mind, the Atlas guides readers into the fascinating world of soil biology and explains how soils form and evolve in to specific habitats where physical and chemical soil characteristics condition soil-dwelling communities. A striking element of the Atlas is a group by group guide to soil organisms. Starting with the smallest and working its way to mammals, reptiles and even birds, the reader is presented with a clear and comprehensive description of the diversity of soil organisms, the factors controlling their geographical and temporal distribution, and the ecosystem services and functions that they provide.

A key message of the Atlas is the diverse array of threats to soil biodiversity coming from land use change (e.g. deforestation), the sealing of soils by artificial surfaces, the introduction of invasive species, pollution, acid rain

and nutrient overloading, agricultural practices (including overgrazing), fire, soil erosion and land degradation, desertification and climate change. For the first time, the Atlas presents a global overview of the potential threats to soil diversity based on the previously mentioned factors (Figure 1).

Soil biodiversity is critical for achieving sustainability goals on healthy food, reducing greenhouse gases emissions, lessening desertification and soil erosion, and preventing disease. Gaps in our knowledge of soil biodiversity must be acknowledged. The collection and synthesis of soil biodiversity data globally should be sustained and enhanced in order to better understand and predict the effects of global drivers of land degradation on soil organisms and the functions that they deliver. It is time for people to broaden their view of biodiversity, not just thinking about plants and large mammals, but also the tiny, colourful and fascinating tardigrades and springtails that live in the soil. It is in our interest to understand better life in the soil as our very existence depends on them.

1 <https://globalsoilbiodiversity.org/>

2 Orgiazzi, A., Bardgett, R.D., Barrios, E., Behan-Pelletier, V., Briones, M.J.I., Chotte, J.-L., De Deyn, G.B., Eggleton, P., Fierer, N., Fraser, T., Hedlund, K., Jeffery, S., Johnson, N.C., Jones, A., Kandeler, E., Kaneko, N., Lavelle, P., Lemanceau, P., Miko, L., Montanarella, L., Moreira, F.M.S., Ramirez, K.S., Scheu, S., Singh, B.K., Six, J., van der Putten, W.H., Wall, D.H. (Eds.), 2016, Global Soil Biodiversity Atlas. European Commission, Publications Office of the European Union, Luxembourg. 176 pp

3 <http://esdac.jrc.ec.europa.eu/content/global-soil-biodiversity-atlas>

4 <http://bookshop.europa.eu/en/global-soil-biodiversity-atlas-pbLbNA27236/>



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A Global Perspective on Agriculture Research

The USDA National Soil Dynamics Laboratory (NSDL) has a long history of research on developing sustainable agriculture. Originally founded as the Farm Tillage Machinery Laboratory in 1933 on the Auburn University campus in Auburn, Alabama, USA, it was initially charged with researching tillage, associated traction practices, and machines used in cotton production. The lab was instrumental in the development of engineering principles for modern agricultural equipment design. Currently, NSDL's mission is to develop tools, practices, and products to better manage soil for environmentally sustainable and economically profitable agricultural production systems. While the research is centered around Southeastern USA production systems, implications of findings clearly have a more global prospective, especially in the context of efforts to understand how agriculture influences global change.

The Laboratory solves agricultural problems in three major areas:

- Conservation systems;
- Organic waste management; and
- Global change.

Specific objectives include developing conservation systems that reduce drought risk and sequester soil carbon, developing environmentally sound waste management systems, and determining the effects of atmospheric CO₂ levels on above- and below-ground processes that affect crop



production, soil carbon storage, and trace gas emissions.

Currently, there are many uncertainties concerning agriculture's role in global environmental change including the effects of rising atmospheric CO₂ concentration. Agricultural practices have the potential to increase soil C storage which can positively influence soil quality and help mitigate this rise in atmospheric CO₂. Research at NSDL is examining the effects of atmospheric CO₂ on both biomass production and soil C sequestration.

The concentrations of trace gases (nitrous oxide and methane) in the atmosphere are also increasing with agriculture being a primary contributor. The NSDL has a multi-disciplinary research team investigating ways that agriculture can help reduce greenhouse gas (GHG) loss through improved practices and fertiliser use in cropping and horticulture systems. This work is evaluating new, innovative application techniques that reduce

GHG emissions, including determining fertiliser N use efficiency and fate of fertiliser N in these systems as well as changes in C and N cycling processes. This work showed that soil C storage is sensitive to soil N dynamics and that the decomposition of plant material grown under elevated CO₂ depends on crop species and indigenous soil properties. It has also led to a US patent on the use of microbial inoculations to reduce nitrous oxide emissions from fertiliser N application (US9,266,786 B2).

Research at NSDL develops conservation systems that improve soil quality, conserve natural resources, and increase production efficiency by considering input costs and profitability. A major focus is to evaluate the use of alternative fertiliser sources, such as poultry litter (a poultry manure and bedding material mix), compared to commercial fertiliser in tillage systems designed to enhance soil organic matter accumulation, crop productivity, and grower profitability. Application of

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poultry litter to soil can improve soil conditions and provide nutrients needed for plant production. This seems to be a viable option for South-eastern USA producers due to rising costs of inorganic fertilisers and the fact that the growing poultry industry generates large amounts of manure. Field and laboratory studies are being conducted to develop improved methods to utilise waste products for soil and crop benefits while minimising environmental degradation since improper manure application can increase hypoxia, eutrophication of surface waters, human health

problems, and GHG emissions. Furthermore, using poultry litter in conservation agricultural systems could sequester atmospheric C in soil. Research has shown that the use of poultry litter in long term research plots resulted in increased soil C levels and thus higher atmospheric C sequestration. However, best management practices must be developed for poultry litter application that maximises nutrient uptake and minimises GHG loss.

Tillage and fertilisation practices used in row crop production can alter GHG

emissions from soil. A new prototype implement for applying poultry litter in subsurface bands in the soil was used in studies to determine the impact of management practices and fertiliser source and placement methods on GHG emissions. As part of this effort, a new method was developed for calculating Effective Gas Flux from soil following band application of manure or fertiliser. Banding of fertiliser resulted in the greatest concentration of gaseous loss compared to surface application and conventional tillage resulted in a higher concentration of CO₂ and N₂O loss. These results suggest that poultry litter can be used to sequester soil C, but application by banding has the potential to increase GHG emissions.



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THE EVOLUTION OF YIELD IN CORN

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Why is Corn Yield so Important?

The key to feeding a growing world with less demand on scarce resources and lower environmental impacts lies in increasing yield. Research has shown that increasing corn yield results in better efficiencies in nutrient and water use thanks to the fact that corn plants that yield more also have bigger root systems and more effective leaf area. The challenge for corn producers is to find management practices that allow them to maximize yield given the soil and environmental constraints they are operating with. Among the many management options that corn producers have what practices will provide the best return on investment in terms of increasing yield with the lowest cost and risk. This publication discusses some of the key principles and practices corn growers should consider when seeking to increase yield in corn.

It is All About Intercepting Light

At the most basic level corn is a starch factory that depends in turning light energy into starch. Therefore the most critical practice in managing for higher yield is maximizing light interception. There are three management practices that can be used to increase light interception. These are growing longer season hybrids, increasing seeding rate and plant population, and decreasing row spacing. Of these three the most effective practice is increasing seeding rate and plant population. While growing hybrids that require a longer growing period increases the amount of light intercepted it also increases water requirements and does not improve root mass or leaf efficiency. Using narrow rows only increases light interception for a short period of time. In contrast high plant populations increase light interception across the entire growing period, result in improved efficiency in light interception, and along with other key management practices increase root mass in the field. Figure 1 shows the impact of increasing plant density on the morphology of corn plants. As plant population increases the corn

plant grows taller resulting in more effective placement of leaf area to intercept sunlight. This results in optimum yield potential. However, there is a limit to this response. As plant density increases so does the need for water and nutrients. When the demand for water and nutrients exceeds the ability of the environment to provide these to the plant the corn plant responds by reducing its height and yield potential is reduced. Note that in Figure 1 there is a narrow range of plant densities over which the plant reaches maximum height and productivity. Corn producers must precisely match plant population to the environment of the field.



Figure 1. Change in plant density from 29,343 plants ha⁻¹ on the left to 107,593 plants ha⁻¹ on the right.

Supporting Plant Density with the Right Management Practices

As is apparent in Figure 1 planting at a higher seeding rate is not the only step producers should use to achieve higher yield. Higher plant densities result in individual plants that have smaller root systems and thinner stalks.

These negative effects must be compensated for. There are two key practices that must be used in a systems approach along with higher seeding rates to make higher corn yield possible. These two key practices are starter fertilizer and multiple applications of nitrogen. The root is the first plant part to be developed in the growth cycle of the corn plant. The faster the corn plant grows from germination to flowering the more root mass will be produced. Since the root system is the key to better nutrient and water use efficiency this is a critical component of a high yield corn plant. Starter fertilizer which contains small amounts of nitrogen and phosphorus increases the early growth of the corn plant (Figure 2). Research shows that increasing early growth by using starter fertilizer results in a plant with more root mass and thicker stalks overcoming the negative effects of higher plant populations.



Figure 2. No planting or starter fertilizer was used on the four-row plot on the left while 22.5 L ha⁻¹ of 11-37-0 was applied in a 2 x 2 band at planting to the four-row plot on the right.

Likewise, a corn plant depends on nitrogen to maintain leaf chlorophyll levels and efficient conversion of light into starch. Unfortunately, most growers only apply nitrogen at the beginning of the season or, at most, twice at planting and again at canopy closure. Since nitrogen is mobile in the soil and subject to loss these applications often don't cover the full season nitrogen demands of the plant (Figure 3). Growers often apply more nitrogen than the plant actually needs to cover the fact that some nitrogen will be lost by the time the plant reaches the reproductive stages. A better system for producing high yield corn is to apply small amounts of nitrogen throughout the season. This approach allows growers to just meet the needs of the plant at a given time resulting in little or no waste while ensuring optimum growth and

yield. Furthermore, nitrogen rates can be adjusted as the growing season progresses to match changes in weather (particularly rainfall) resulting in maximum nitrogen use efficiency.



Figure 3. Nitrogen was applied at four different times during the growth cycle of the corn plant to the four-row plot on the right while nitrogen was only applied at planting to the four-row plot on the left.

In Summary – A High Yield Corn System

Capturing more light while increasing root mass and light use efficiency requires a systems approach to corn production. The future of high-yield corn production lies in precisely matching plant population with the environment of the field and then supporting that population with starter fertilizer and regular feeding with small amounts of nitrogen. This approach has the potential to increase yield resulting in less demand on land resources. Research at the Vernon G. James Research and Extension Center at North Carolina State University over the past three years documents that this systems approach consistently produced maximum corn yield ranging from 21.1 to 23.7 mt ha⁻¹. Only by using a systems approach can growers increase water and nutrient use efficiency in corn production resulting in better utilization of scarce resources and improving the amount of carbon fixed in a corn field resulting in less climate impacts.

The hidden cost of air pollution

Urgent action is needed on air pollution, says OECD Environment Director Simon Upton, particularly in coal-reliant economies like China and India...

Air pollution takes years off people's lives. It causes pain and suffering through lung and heart diseases. It harms food crops and suppresses agricultural output in a world with a growing population.

We generally evaluate the cost of air pollution by looking at the economic impact of reduced labour productivity, higher medical expenses and lower farm output. Economic jargon turns the pain of sickness and premature death into the "disutility of illness". But heavy as they are, even the dollar figures do not reflect the totality of what air pollution costs us.

Both outdoor and indoor air pollution matter. For the poorest families, indoor smog from coal or dung-fired cooking stoves can be the more serious problem. As economies develop and start to electrify, motorise and urbanise, outdoor air pollution becomes the bigger issue. Clean technology can help but policy calculations tend to focus myopically on the costs of action, while ignoring the much larger costs of inaction.

Particulate matter particular problem

OECD projections suggest that the costs of inaction will be severe in the coming decades. Economic growth and rising energy demand mean a steady rise in emissions of air pollutants and rapidly rising concentrations of particulate matter (PM) and ozone, especially in China and India.

A new OECD report on [The Economic Consequences of Outdoor Air Pollution](#) estimates that outdoor air pollution will cause 6-9 million premature deaths every year by 2060, up from 3 million in 2010. That is equivalent to a person dying every 4-5 seconds. There will also be more pollution-related sickness. By 2060, 3.75 billion working days a year could be lost due to illness

from dirty air. The direct market impacts of this pollution, in terms of lower worker productivity, higher health spending and lower crop yields, could exceed 1% of GDP annually by 2060, or \$2.6 trillion.

But measuring the impact of air pollution purely in terms of GDP is too limited. Premature deaths from breathing in small particles and toxic gases, and the pain and suffering caused by respiratory and cardiovascular diseases do not have a market price. Nor does foul smelling air or not being able to let your child play outside without a face mask. These burdens weigh far more severely on people than anything we can measure as costs to the economy.

China and India will be badly hit

Our projection for the rise in premature deaths from outdoor air pollution means that, cumulatively, more than 200 million people will die prematurely in the next 45 years. The most affected regions will be those with densely populated areas with high PM concentration levels, especially cities in China and India. In per capita terms, mortality is also set to be very high in Eastern Europe, the Caucasus region and other parts of Asia, such as Korea, where ageing populations mean more people are highly vulnerable to air pollution.

The number of people with acute or chronic illnesses will be a multiple of that. New cases of bronchitis in children aged 6 to 12 are forecast to leap from 12 million today to 36 million a year by 2060. For adults, we predict 10 million new cases a year by 2060, up from 3.5 million today. Children are also being increasingly affected by asthma. All this will translate into more pollution-related hospital admissions, projected to rise to 11 million in 2060 from 3.6 million in 2010.

Not surprisingly, when asked how much they would be



In winter, air pollution is mainly due to the burning of coal in Baoding City, Hebei Province, China

willing to pay in order to reduce these health risks people are very clear in their replies. Examining the myriad studies conducted by economists to put a price tag on this, the OECD has found that on average individuals would be prepared to pay around \$30 to reduce their annual risk of dying prematurely by 1 in 100,000.

Bringing hidden costs into the open

Well-established techniques have been developed to convert these “willingness-to-pay” numbers into an overall value of premature deaths caused by outdoor air pollution, as illustrated for example in the OECD [Mortality Risk Valuation in Environment, Health and Transport Policies](#).

The results are staggering. Based on these “willingness-to-pay” values, the global cost of premature deaths caused by outdoor air pollution would reach \$18-25 trillion a year by 2060. Arguably, this is not “real” money as these costs are not related to any market transactions. But it does reflect the very real value people put

on their lives – and the value they would put on policies that would reduce the risk to their lives from air pollution. To say that only market transactions have value to citizens would be perverse.

Both GDP losses and the reduced quality and length of lives matter. Reducing air pollution can enhance both market and non-market values. The combined case for action is overwhelming. But citizens cannot act alone on a massive problem like air pollution. They need governments to act on their behalf. And that means bringing the hidden costs of air pollution out into the open. ■

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A new comprehensive approach to humanitarian aid

M F Warrender at Adjacent Government, highlights the work of the European Commission, in particular EU Commissioner for Humanitarian Aid and Crisis Management, Christos Stylianides, to provide safety and support to those in need...

August 19 this year marked World Humanitarian Day, reminding the world of the 22 humanitarian workers who lost their lives during the 2003 bombing of the UN headquarters in Baghdad, Iraq. This anniversary prompted a joint statement from High Representative and Vice President of the European Commission Federica Mogherini, and EU Commissioner for Humanitarian Aid and Crisis Management, Christos Stylianides:

“On World Humanitarian Day, we pay special tribute to and honour all humanitarian workers around the globe who are working to help people in need.”

As well as commemorating those who tragically lost their lives, [the statement also](#) reaffirms the European Commission’s commitment to its position as the world’s largest humanitarian donor, highlighting the importance of humanitarian aid in crisis zones all over the world. “We must strengthen our understanding of and respect for International Humanitarian Law (IHL) and the four humanitarian principles: humanity, neutrality, impartiality and independence,” it reads.

Previously serving as Vice Chair of the Committee on Foreign and European Affairs 2011-2013, government spokesperson 2013-2014, and a member of parliament of the Republic of Cyprus, Christos Stylianides has been the European Commissioner for Humanitarian Aid and Crisis Management since 1 November 2014. Some of his responsibilities in this position include:

- Ensuring that the Emergency Response Coordination Centre is always ready to help EU countries in need;
- Enabling authorities in Europe to better fight natural and manmade disasters, by promoting cooperation and joint action;

- Making sure that the EU can finance all commitments made to humanitarian work and that budget rules are respected;
- Building close relationships with the UN, NGOs and civil society to make joint humanitarian work more effective.

Partnerships with non-governmental organisations (NGOs) are vital in order to maintain this level of assistance moving forward, as they allow faster aid to countries in crisis and a greater network of international support. There are many organisations that have signed the Framework Partnership Agreement (FPA) to become humanitarian partners of the EU: Oxfam, Red Cross, International Rescue Committee, and Médecins du Monde, just to name a few, all of which Stylianides and his team endeavour to uphold close relationships with.

Most recently, on 29 September 2016, Stylianides [released a statement on the situation on Aleppo](#), Syria, and the unprecedented attacks that have targeted civilians and humanitarian infrastructures. He stated that the EU “has been constantly working with humanitarian partners like the UN, the International Committee of the Red Cross and international NGOs, to prepare stocks and vital items for Aleppo, including life-saving essentials like food, medical supplies and water.” He also confirmed, “Our humanitarian partners are ready to help people and save lives”.

Considering the current refugee crisis, European Civil Protection and Humanitarian Aid Operations (ECHO), under the mandate of Stylianides, must strive to provide an effective and efficient asylum system able to assure safety for refugees. This unprecedented displacement crisis is impacting not only European member states, but also non-EU countries of transit and major crisis



EU Commissioner for Humanitarian Aid and Crisis Management, Christos Stylianides

zones around the world including Syria, South Sudan, Yemen and Ukraine. Today, more than 65 million people are forcibly displaced as a result of manmade and natural disasters, violent conflicts, or in search of better economic prospects.

In 2015, one million people made their way into the EU, many arriving after perilous journeys, requiring basic humanitarian assistance, for example: provision of clean water, health care, emergency shelter and legal aid.

While the European Commission has taken a new, comprehensive approach to tackling the refugee crisis with its European Agenda on Migration, these are just some of the ways in which ECHO are supporting refugees and their host countries:

Providing emergency support within the EU

This support is made available to member states whose own response capacities are overwhelmed with unexpected circumstances, such as the current influx of refugees from all over the world. A recent case of emergency support being required was in April 2016, when the EU Commission provided humanitarian funding of €83m to assist to 50,000 refugees and migrants in Greece. This provided shelter, food, hygiene, education, child friendly spaces, and family reunification assistance and protection.

Helping transit countries with humanitarian funding

Since the beginning of the Syria crisis in 2011, the commission has provided €455m to support refugees in Turkey, who have fled violence in both Syria and Iraq. This aid, combined with the set-up of the Refugee Facility for Turkey, has offered humanitarian and long-term assistance to more than 800,000 Syrians.

Scaling up humanitarian aid for major crises

In his statement for World Humanitarian Day, Christos Stylianides added: "The EU is proud to be a world leader in humanitarian assistance and to have helped more than 134 million victims of natural and manmade disasters across more than 80 countries in 2015."

The commission continues to step up its targets hoping to increase resources by €300m for 2016. ■

M F Warrender

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The lost opportunity to rebuild refugee law – what next?

Catherine Dauvergne, Dean of the Allard School of Law, University of British Columbia highlights the importance of refugee law to help today's crisis...

On the September 19, 2016, the United Nations General Assembly held a one-day summit on refugees and migrants for the first time in its history. The event was filled with positive rhetoric and feel good sentiments, but on any sensible measure it must be viewed as a failure.

The crisis moment in refugee flows which we have been absorbed in since the summer of 2015, ushered in a moment of opportunity for the global community to reform its approach to refugees. With the failure of the UN Summit to put any substantially new ideas on the table, it appears this moment has passed.

With more than 60 million forcibly displaced people in the world at present, approximately 25 million of whom are known to be refugees, the contemporary system of asylum seeking and occasional resettlement is deeply inadequate. In 2015, the number of refugees resettled around the world reached a new 'high' of 107,000. If the international community committed to a 500% increase in this figure, the human rights needs of today's refugees would be met within 50 years. Helping the entire 60 million would take more than a century.

Clearly a tweaking of the status quo is certain to be utterly ineffective at a global scale. This is an important truth, even while it is important to recognise that resettling even one additional

person or family is a meaningful human contribution.

During the lead up to the summit, a group of leading refugee scholars met in Vancouver, Canada, to consider alternatives. The concluding statement of our workshop, the 'Vancouver Principles' called on the international community to begin a process of rebuilding the promise of international refugee law to provide meaningful human rights protection by accepting as a starting point the principle of responsibility sharing.

The Workshop proceeded on the basis of the following shared understandings:

- The current global system for refugee protection is broken, responsibility is not shared and the vast majority of refugees are not meaningfully protected. There is a moral and practical imperative for change;
- There is no need to renegotiate the Refugee Convention as, properly interpreted, it offers a robust roadmap for protection and solutions. It is the core from which to build;
- Refugee responsibility sharing must be stable in its elements and flexible enough to respond to particular crises;
- Allocating refugee protection burdens and responsibilities based upon accidents of geography is neither sustainable nor ethical;

- Refugee protection must be equally attentive to the needs of all refugees in all places;
- Access to refugee protection must ensure the dignity of refugees;
- The renewal of refugee protection must be conceived in a way that values both refugee autonomy and the legitimate interests of the communities that receive them.

“With more than 60 million forcibly displaced people in the world at present, approximately 25 million of whom are known to be refugees, the contemporary system of asylum seeking and occasional resettlement is deeply inadequate. In 2015, the number of refugees resettled around the world reached a new ‘high’ of 107,000.”

There are seven Vancouver Principles. These set a roadmap for a new international commitment that could alter the hopelessness of the status quo.

1. The current draft proposal for a Global Compact on Responsibility Sharing requires clear principles and mechanisms for a meaningful global system of shared responsibility.
2. A new approach should move towards a generalised and comprehensive model of global shared responsibility, rather than an approach that is simply episodic and ad hoc.



3. Apart from the common duty of all states to enable refugees to have access to international protection, different states may assume different roles in providing protection and solutions.

“Clearly a tweaking of the status quo is certain to be utterly ineffective at a global scale. This is an important truth, even while it is important to recognise that resettling even one additional person or family is a meaningful human contribution.”

4. Both the allocation of roles between states and the distribution of refugees as among states might usefully benefit from preference matching systems.

5. Protection which enables refugee self-reliance and respects socio-economic rights is dignified for refugees and holds the promise of reinvigorating durable solutions.

6. A meaningful system of global responsibility sharing will require 1) substantial innovation in institutional capacity; 2) incentives for rights-respecting conduct by states and other key actors; 3) clear roles not just for states proximate to refugee flows, but also for states outside the region; and 4) hard limits on the amount of time that a refugee can be expected to wait for a durable solution.

7. Responsibility sharing must be accompanied by a system of fiscal burden sharing sufficient to make the granting of asylum by poorer countries viable, and to foster initiatives that link refugees to their host communities.

On the basis of these principle, the Vancouver group recommended the establishment of a working group to develop and refine these principles as part of the follow-up to the September 19th Summit. We are reiterating

this call now in the aftermath of the Summit’s failure in the hope that the moment of opportunity may not be fully passed.



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Why cities and regions matter for Energy Union

European cities and regions are vital to the success of the Energy Union, writes European Commission Vice-President Maroš Šefčovič...

On 4 October, the European Parliament ratified the Paris Agreement – the first-ever universal, legally binding global climate deal. The European Union (EU) is already implementing its own commitments to the Paris Agreement but the EU's swift ratification triggers its implementation in the rest of the world. 2016 is the moment of delivery for the Energy Union. Before the end of the year, we will come forward with our comprehensive legislative proposals. They will be holistic in nature and neatly fit with the Paris Agreement.

“Around nine million Europeans already work in the low carbon energy industry and we expect this number to double by 2030. The shape of cities is already changing as we’re moving into the next industrial revolution. Energy Union is transforming Europe. Nowhere is this as visible as in the regions and cities across the whole continent.”

The EU's Energy Union Strategy consists of mutually reinforcing dimensions which are all very relevant for cities and regions across the European Union. Energy Union means diversifying Europe's sources of energy and making more efficient use of energy produced within the EU.

At the same time, we are increasing energy efficiency: Consuming less energy in order to reduce pollution and preserve domestic energy sources. Energy efficiency also reduces the EU's need for energy imports. In parallel, emission reductions through the renewal of the EU Emissions Trading System and through the globally binding Paris Agreement encourage private investment in new infrastructure and technologies. The main benefits for European cities and regions are

clear: Energy Union offers exciting new investment opportunities!

Those objectives of the Energy Union Strategy are underpinned by concrete, binding numbers: Our climate targets for 2030 adopted in October 2014 – at least 40% cuts in greenhouse gas emissions from 1990 levels, at least 27% share for renewable energy, and at least 27% improvement in energy efficiency – promote the competitiveness of Europe's economy. Only if Europe remains at the forefront of innovation will we be able to retain our European way of life and ultimately our European values in the globalised world.

What's in it for cities and regions?

We unlock investments for infrastructure through the European Fund for Strategic Investments (EFSI), the Connecting Europe Facility (CEF) and the European Structural and Investment Funds (ESIFs). The ESIFs alone invest over €454 billion across the EU in the period 2014-2020. This huge investment package co-finances national projects that invest in growth and jobs. The strict eligibility criteria for co-finance through the ESIFs make sure that investments contribute towards the objectives and binding targets of the Energy Union. Overall, in the preceding financial period 2007-2013, the ESIFs have created 1 million jobs across the whole EU. Each Euro invested through the ESIFs has added €2.47 towards the EU's GDP.

The fast pace of technological change makes it ever more important for cities and regions to constantly learn from each other, and not just in Europe! With 7.4 billion people on the planet, all of us need to continue to reduce our ecological footprint. The biggest population growth occurs in developing countries, and more particularly in megacities such as Lagos, Calcutta or São Paulo. Those

Image: © European Union, 2016/Source: EC - Audiovisual Service/Photo: Georges Boulougouris



European Commission Vice-President Maroš Šefčovič

cities need to transform themselves even faster than the urban centres in the developed world. The innovation necessary to successfully transform cities towards the low-carbon economy can, and should, come from best practices of European cities and regions!

A global initiative of cities and regions

In order to enable European agglomerations to share their innovations with cities around the globe, the world's two primary city-led climate change and energy initiatives, the EU Covenant of Mayors and the Compact of Mayors, have teamed up in June to form a global initiative of cities and local governments leading in the fight against climate change. The European Commission actively participates in and supports this initiative.

Moreover, in the framework of the Energy Union, the EU Urban Agenda enacted in May enables cities to fully contribute to the design of policies so these are better adapted to urban realities. At the heart of the EU Urban Agenda, partnerships on 12 identified urban

challenges – such as air quality, the integration of migrants and housing – will allow cities, Member States, EU institutions and stakeholders, such as NGOs, or business partners, to find joint solutions to improve our lives in urban areas.

Around nine million Europeans already work in the low carbon energy industry and we expect this number to double by 2030. The shape of cities is already changing as we're moving into the next industrial revolution. Energy Union is transforming Europe. Nowhere is this as visible as in the regions and cities across the whole continent. ■

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Maroš Šefčovič
Vice-President for Energy Union

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The IMPACT2C web-atlas: Raising policy awareness on the potential impacts of climate change

Professor Dr Daniela Jacob at the Climate Service Center Germany introduces the IMPACT2C web-atlas, a new tool for raising awareness of the potential impacts of climate change...

The policy discussion of whether we can limit global warming to not more than +2°C was of central importance at the COP21 negotiations in Paris in December, 2015.

In this context, the following scientific questions are of major importance:

- What might be the potential impacts of a +2°C global warming compared to the preindustrial period for various regions of the globe, and economic sectors?
- What might be the difference in the magnitude of climate change between a +2°C and a +3°C global warming?
- Which impacts might be prevented if global warming is limited to +2°C rather than +3°C?

Parts of these questions have been answered in the IMPACT2C project. IMPACT2C was a multi-disciplinary international project coordinated by GERICS, which ran between 2011 and 2015. The project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration activities under grant agreement no. 282746. IMPACT2C has been initiated by the European Commission in order to provide information and evidence on the impacts of a +2°C global warming for Europe and key vulnerable regions of the world. Researchers from 29 different institutions and 16 different countries collaborated and worked together within this project.

One of the project's key tasks was to raise policymakers' and society's awareness of potential climate change impacts under a +2°C global warming compared with preindustrial levels. For this purpose, an "IMPACT2C web-atlas" was developed. The IMPACT2C web-atlas presents the relevant findings of the IMPACT2C project allowing decision-making based on scientific information, which is readily available and easily understandable for a wide range of users.

The IMPACT2C web-atlas depicts the climate change impacts of a +2°C global warming for several key sectors – energy, water, tourism, health, agriculture, ecosystems and forestry, and coastal and low-lying areas – throughout Europe and in some of the most vulnerable regions of the world (see Figure 1). The analysis of a multi-model ensemble of both climate projections and climate impact projections makes possible the definition of impact ranges. This allows to quantify some of the uncertainties concerning future climate projections and climate impact projections.

For each of the sectors and vulnerable regions, the IMPACT2C web-atlas tells stories of potential impacts related to different topics (e.g. change in summer heat waves, electricity demand, water

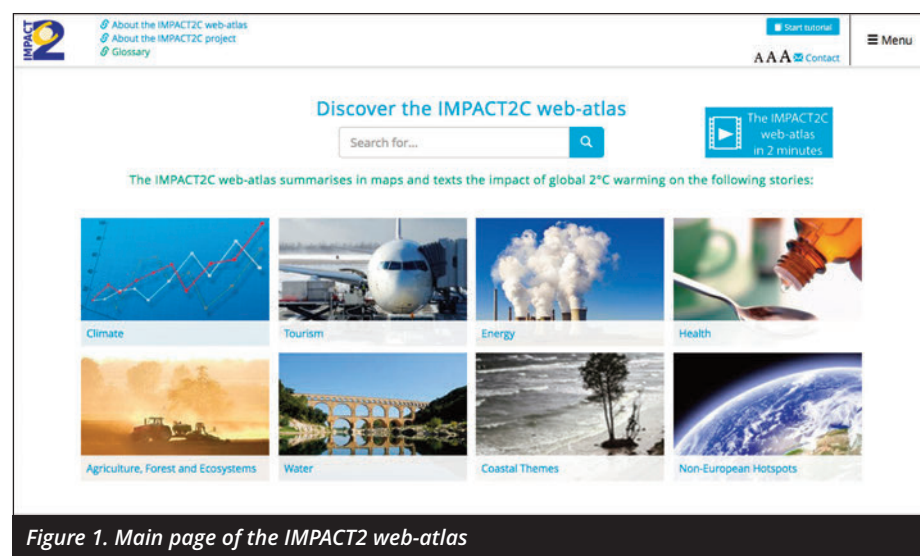


Figure 1. Main page of the IMPACT2C web-atlas

temperature). Within a topic, maps are presenting the recent status, the status under a +2°C global warming and the climate change signal (see Figure 2). All maps and texts in the atlas are structured in the same style in order to improve the accessibility to the various contents. The web-atlas allows the reader to explore the various interlinkages within a specific sector, as well as between different sectors.

By presenting a wide variety of potential climate change impacts, the IMPACT2C web-atlas aims to serve various target audiences in gathering information as a basis for developing recommendations on possible adaptation strategies on national and international levels.

According to the size of the IMPACT2C project and the very detailed cross-sectoral research activities carried out in this project, the IMPACT2C web-atlas provides a huge amount of information for various regions, sectors and applications. Nevertheless, repeating features were identified in the above mentioned stories. Summarized, the key messages related to the potential climate change impacts of a +2°C global warming are:

- A global warming by 2°C substantially affects a wide range of sectors and regions throughout Europe.
- Some regions or sectors will benefit from a future warming, but some will experience disadvantages.
- To assess the impacts of climate change on specific sectors, cross-sectoral relationships have to be included into the analysis.
- In most regions of Europe, the projected regional warming is more pronounced than the global mean warming. Projections for annual mean precipitation show wetter conditions in northern Europe and

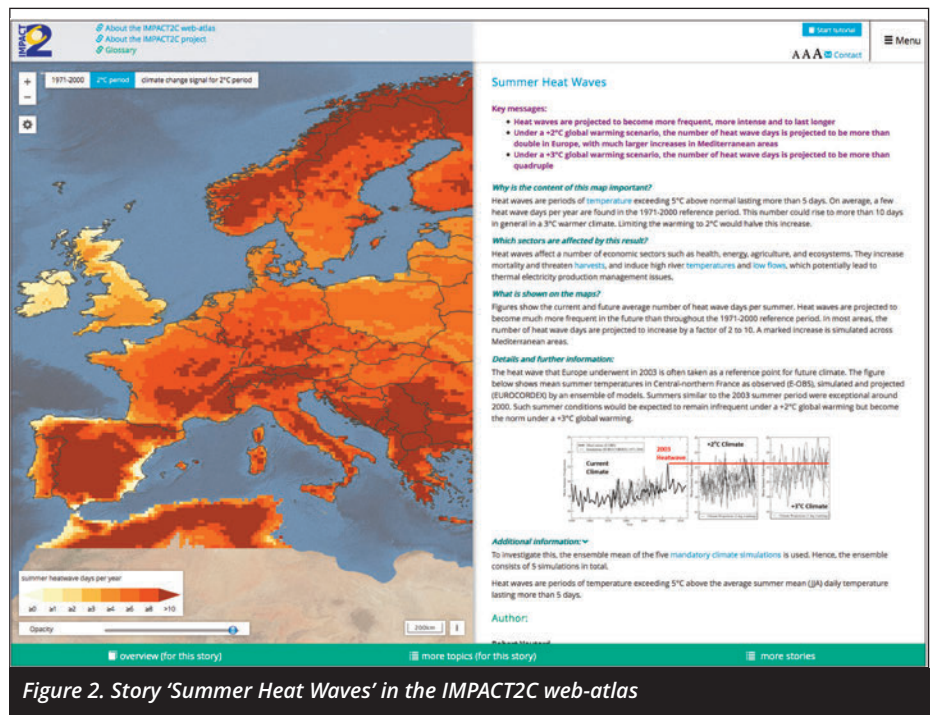


Figure 2. Story 'Summer Heat Waves' in the IMPACT2C web-atlas

drier conditions in southern Europe.

- Under a +2°C global warming, a European-wide increase in the frequency of extreme events is expected. Heat waves are projected to double, while extreme precipitation events tend to become more intense.
- A limitation to +2°C global warming will not stop sea-level rise due to the delayed reaction of the oceans. Therefore, costs due to coastal flooding will incur even with adaptation measures.
- Bangladesh and the low-lying islands like the Maldives are expected to feel the consequences of climate change, due to the continuous rise of sea-levels enhancing the risk for storm surges and flooding.
- For West and East Africa, the warming is above the global temperature increase. West Africa could experience a modest increase in rainfall, whereas for East Africa no clear trend is projected.

Finally it should be mentioned that the IMPACT2C web-atlas is designed to be a living document. It will continue

to develop as further scientific results, e.g. related to potential climate change impacts of a +1.5°C global warming, will be added in the near future. This will be done in a homogenous way, so that the new information can be related directly to the information already present in the atlas.

Climate Service Center Germany (GERICS) offers products, advisory services and decision-relevant knowledge based on sound scientific knowledge in order to support government, administration and business in their efforts to adapt to climate change. GERICS is an institution of Helmholtz-Zentrum Geesthacht and is based in Hamburg.



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The UERRA Reanalyses map the European Climate

UERRA is a FP7 pre-operational Copernicus Climate Change Service (C3S) Project: Uncertainties in Ensembles of Regional Reanalyses...

Weather Forecasting is based on an analysis of the current state of the atmosphere and the surface of land and sea. The forecasts are made with mathematical and physical computer models starting from the analysis. The temperatures, winds, pressure, moisture, cloud contents and other variables are mapped at regular points in space and time. The analysis is using as many observations as possible, but there are often not enough of them or they are not exactly in the right places.

By using the same model of the atmosphere's evolution as is used for forecasting, a prior estimate, a first guess of the analysis can be obtained. That model forecast has in its turn used earlier analysis based on earlier observations and from other places. The process of repeatedly combining such a first guess with observations is called Data Assimilation.

The analysis procedure is updating the First Guess with small corrections.

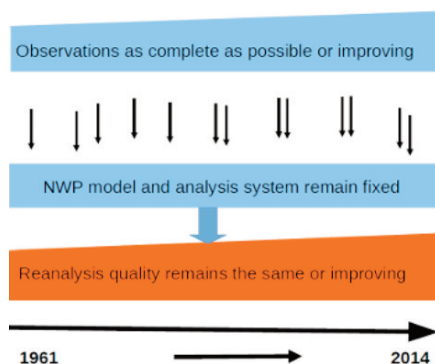


Figure 2

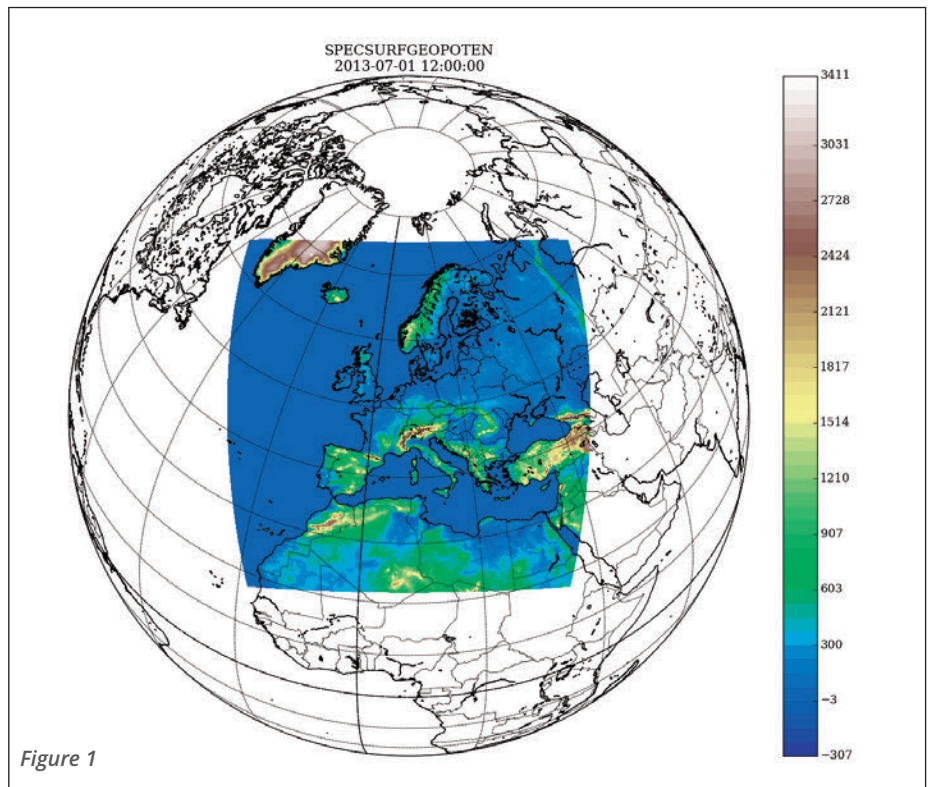


Figure 1

The procedure also uses physical and statistical relationships of the atmosphere when interpreting the observational data. The analyses can in these ways produce values of the atmosphere and the surface away from the observations.

Even though the analyses are made for the purpose of accurate weather forecasting, the mapped variables of the atmosphere have an important value on their own. Many applications and users want to know the best estimate of the atmospheric state at any given time, for assessing past weather events, for statistics of the climate in a location or an area or for running

other fine scale models or validating climate models.

Weather forecasting models and the analysis procedures are improved and enhanced all the time e.g. with increased resolution. The ever increased quality of the resulting analyses makes it difficult to use a long time series over years and decades. Especially for climate monitoring, it is a requirement to have a fixed system for doing the analyses for all the years. The old analyses made a long time ago can be much improved by employing a more recent operational system, both due to improved methodology and higher

PROFILE

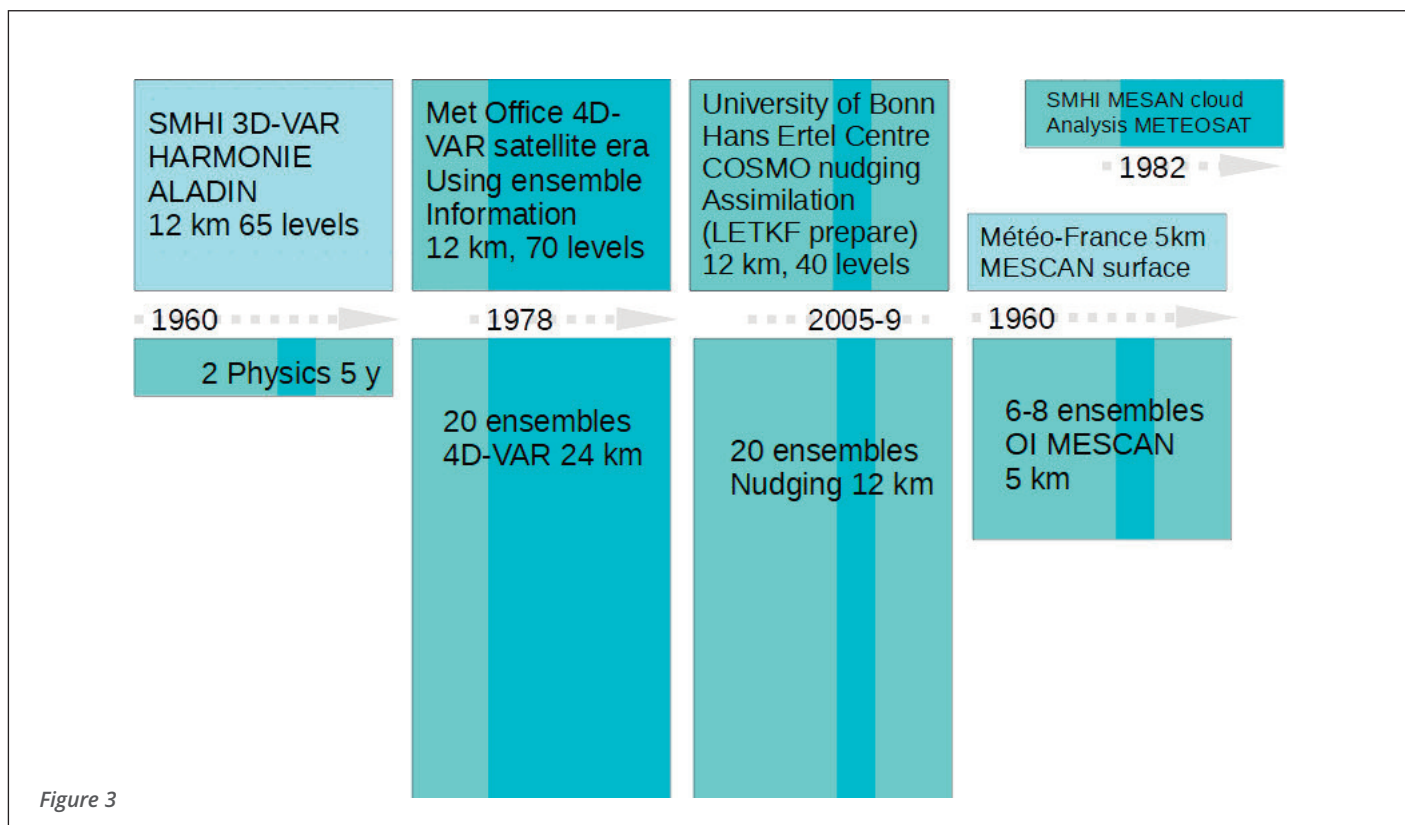


Figure 3

resolution. A number of meteorological centres have re-run their old analyses with their most recent system. This is called Reanalysis. See Figure 2.

Another important reason for doing this is that more observations can be made available after the time of the real time analyses. It is both through receiving late-coming data and especially through data rescue of old observational archives, often on paper. UERRA has a Data Rescue (and Development) activity and over 8M data have been digitised from several countries in and around Europe and on a sub-daily scale.

Global centres have made a number of generations of reanalyses, and there are also a few regional reanalyses covering e.g. North America or Europe, or sometimes only a part of Europe.

Now, the current successor project, UERRA, does much more than the

earlier European reanalysis (EURO4M). The horizontal resolution has doubled from about 20 to 10 km and there are 4 different reanalyses in parallel, spanning 5, 37 or even 55 years. Moreover, there are 8-20 different ensemble members with slightly different values of the analyses due to uncertainties in the atmosphere, observations and methodology. Both the spread between the different models (multi-model) data sets and within the ensemble data sets will be used to gauge the uncertainties. These uncertainties will be quantified and derived from independent data sets using other observations or from very high resolution local data sets. The different models and ensembles and the time periods covered are illustrated above (Figure 3).

Data services including visualisation services have been built and adapted to a common UERRA archive. A common set of meteorological parameters from the Met Office, SMHI, University of Bonn and Météo-France from

the new UERRA reanalyses is just being built at ECMWF and available via the MARS retrieval system.

The different reanalysis streams together with ensembles and subsequent data services are prepared to be able to continue and evolve in an operational Copernicus service and the results stored and disseminated in the Copernicus Climate Data Store.

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An integrated approach to climate change

Floriane Cappelletti and David Donnerer from the Covenant of Mayors Office outline how the organisation will play a key role in achieving the EU's Energy Union...

European cities are home to 360 million people or 72% of Europe's population and account for 70% of the continent's energy consumption. These areas are also particularly vulnerable to the unavoidable impacts of climate change, which makes urban spaces a top target for climate and energy action. They are the ideal place for boosting renewable energy, improving energy efficiency in buildings and increasing green areas, and thereby mitigating and adapting to climate change.

The Covenant of Mayors, launched by the EU Commission back in 2008, was the very first bottom-up movement of European cities' contributing to achieving the EU climate and energy goals. The initiative has recently evolved, adopting a new framework, new objectives and spreading to a global scale. Now called the Covenant of Mayors for Climate & Energy, it promotes a vision for making cities decarbonised and resilient, where citizens have access to secure, sustainable and affordable energy. Cities joining the Covenant of Mayors for Climate and Energy now commit to developing sustainable energy and climate action plans for 2030, with a CO₂-reduction objective of 40% through an integrated approach to climate change mitigation and adaptation.

Amongst the signatories committed to the initial objectives (a 20% reduction in CO₂ emissions by 2020), already over 5,500 have submitted their action plans to the Covenant of Mayors Office. And they are well on track to reach their targets. The European Commission's Joint Research Centre recently conducted an analysis of 122 monitoring reports submitted by Covenant signatories. Four main indicators stand out: greenhouse gas emissions have been reduced by 23%, final energy consumption have decreased by 14%, the share of renewable energy sources in final energy consumption has more than quadrupled (and reached 14%), and local renewable energy production has more

than tripled. Based on the signatories' action plans, estimated levels by 2020 are expected to be:

- Reduction in greenhouse gas emissions of 28%;
- Reduction in final energy consumption of 20%;
- Increase in the share of local energy production in final energy consumption of 18%.

On 22 June 2016, the EU's Covenant of Mayors and the UN's Compact of Mayors announced their merger, creating the Global Covenant of Mayors for Climate and Energy. Mayors from over 7,100 cities in 119 countries are now involved to spearhead the global fight against climate change. "Never before have so many cities joined forces, eager to inspire each other and committed to collectively taking the path to a low-carbon, resilient society", said Vice-President of the European Commission Maroš Šefčovič about the creation of this global initiative.

"The Covenant signatories' Action Plans are a great source of knowledge for the national level, which through them can get acquainted on local/regional needs, policy constraints, and act accordingly with targeted funding streams to boost energy efficiency and renewable energy on their territories, to achieve the GH-emission reduction required by the Paris Agreement."

The Global Covenant of Mayors for Climate Change & Energy will play a key role in achieving one of the most important political goals of the European Commission's Energy Union strategy: a resilient and forward-looking climate policy that supports the transition to a 'low-carbon, secure and competitive economy'.



Indeed, the Covenant of Mayors is fully part of the EU's Energy Union priority of reducing emissions while moderating energy demand and investing in renewable energies and energy efficiency. The Energy Union is about both reinforcing gas and electricity interconnections between Member States in the framework of enhanced regional energy cooperation. As the energy system is moving from a vertical and sectorial system with few players to a horizontal and cross-sector one with a multitude of new key players such as local authorities and citizens, the Energy Union should also be about reinforcing the local dimension of European energy policies.

The EU Member States have to draft – and report on – integrated National Climate and Energy Plans (NECPs) covering the 5 dimensions of the Energy Union: decarbonisation, energy efficiency, energy security, internal market and research and innovation. The role of the Covenant cities' 5,500 action plans in this process is crucial, as they provide Member States with priority actions in the field of renewables and energy efficiency that can

be financed to upscale climate and energy action (e.g. retrofitting of buildings, small-scale renewables, electric mobility, etc.). Including the Covenant of Mayors action plans in the NECPs would also enable Member States to increase overall ambition.

The Covenant signatories' action plans are a great source of knowledge for the national level, which through them can get acquainted on local/regional needs, policy constraints, and act accordingly with targeted funding streams to boost energy efficiency and renewable energy on their territories, to achieve the GH-emission reduction required by the Paris Agreement. ■

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Is Hinkley rethink good or bad for state of UK energy infrastructure?

Oliver Johnson, Policy Executive at Association for Consultancy and Engineering questions whether the decision to postpone approval for Hinkley Point C was the right decision...

The decision to postpone approval for Hinkley Point C taken by the government last month is not a stabilising one. British hesitance on the matter seems to contradict assertions that the country remains 'open for business' despite leaving the European Union. However, there are reasons to be positive about the new government's likely approach to infrastructure in general and an early nuclear hiccup should not result in foreign investor panic – yet.

In [an article](#) written before the Brexit referendum, ACE's Chief Executive Officer, Nelson Ogunshakin suggested that infrastructure decisions shape the way the outside world perceives us. He pointed out specifically that initiatives in our energy sector, such as Hinkley Point C, have instrumental and symbolic benefits in equal measure. His conclusion was that the decisions we make on power generating infrastructure build our national identity, not just our energy security.

If committing to projects such as Hinkley Point C gave the UK 'an opportunity to embrace our stated values of openness and internationalism', as Ogunshakin said previously, what does apparent reluctance towards fulfilling such commitments symbolise? If whole-heartedly (and perhaps uncritically) launching ourselves into these projects sent one message, then May government's approach is beginning to articulate a slightly different side of the British psyche that has its own strengths.

The decision on whether or not to go ahead with the reactor had been yo-yoing for quite some time. Hinkley's construction would have involved the cooperation of the British, French and Chinese governments, with the only barrier supposedly remaining being the formal sign off from the French government backed energy giant EDF. In the context of protest by unions, a CFO resigning over the project and serious concern from



Hinkley Point Nuclear Power Station Somerset, UK. Proposed construction site of new nuclear power station project (Hinkley Point C).

shareholders, EDF decided to take a risk and push on with the project. Then, having emerged from the meeting triumphant, EDF's executives had their faithful investment in Britain dashed by a government press release signalling a decision in the early autumn.

Although the Hinkley delay is a disappointment, we should not make a pessimistic mountain of a frustrating – albeit nuclear – molehill. First, it is important to understand this decision (or the postponing of a decision) in its context. Hinkley Point has taken over a decade to get this far – in 2007, Vincent de Rivas, then EDF's top man in the UK said that Christmas turkeys would be roasted in ovens powered by Hinkley as soon as 2017.

By contrast, the current government has been in power for under a month. It could be argued that an expectation for the government to push ahead with an £18bn project even before ministers' feet are comfortably under desks is somewhat unreasonable.

Second, the government is systemically building institutions that should be capable of making these kinds



Oliver Johnson, Policy Executive at Environmental Industries Commission

of decisions more efficiently and effectively. This change in focus is marked by the inception of a new Department for Business, Energy and Industrial Strategy, as well as a cabinet committee focused on industrial strategy that will be attended by 10 secretaries of state. Indeed, the previous government set up the National Infrastructure Commission, which will independently audit existing assets and recommend improvements over the long term. Clearly the government is pushing an emphasis on 'industrial strategy', as well as infrastructure provision as a part of that strategy.

Most notably, the measures above seem to eclipse the previous government's rhetorical commitment to a 'long-term economic plan', characterised in large part by an unwavering vow that government must target a surplus in budgets instead of running a deficit. This policy culminated in a strengthening of the 'fiscal charter' to make what was previously a principle into a legal requirement.

However, the new Chancellor has hinted that the Autumn Statement will reveal a loosening of govern-

ment purse strings and that an increase in the budget deficit to pay for infrastructure improvements would be acceptable. The majority of commentators characterised the fiscal charter as both a public relations master stroke and an irresponsible economic straight-jacket. Though it is difficult to know how the change will register with the public, the recent change in direction will likely make for more comfortable economic garb.

Finally, more than simply a general interest in 'spending more', the government does seem to be honouring most of the specific projects that the previous administration was committed to. An important first test came in late June, when the government needed to pass the recommendations made by the Committee on Climate Change's fifth carbon budget, which it did without protest. Ministers with portfolios directly tied to infrastructure programmes have been maintained – with one minister, Andrew Percy of the Department of Communities and Local Government, even having 'Northern Powerhouse' in his job title. Continuing assurance on HS2 is also encouraging.

In sum, despite the temptation to see the Hinkley indecision as indicative of a Britain closed for business, the correct interpretation of recent events is that of a considered and hard-headed government unwilling to be shackled by previous government decrees but keen to give certainty where possible.

Perhaps this new vision of Britain is not one of assumed foreign investment and openness by default, but one characterised by stability and a confidently pragmatic core. ■

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Canada's oil and gas sector in a clean energy world

Canada's transition to clean energy is already well under way, with help from the oil and gas sector, as Minister of Natural Resources Jim Carr explains...

It has been said that the best way to predict the future is to create it. That is sound advice for a world that stands at a pivotal moment in its history; a time when climate change is the greatest challenge of our generation and a lower-carbon economy is today's imperative. We should be emboldened by these challenges, and not shy away from them.

It is also helpful for nations such as Canada and the United Kingdom to compare notes through opportunities such as this article. We will not succeed as individual nations unless we recognise the value and importance of working together.

That's why Canada and the United Kingdom were among the 21 members of Mission Innovation last year. The goal of this ambitious new global partnership is to double government investment in clean energy research and development, spur new private-sector spending in clean technology, and enhance international collaboration.

Oil and gas sector leading the way

As Canada's Minister of Natural Resources, I'm proud to say that Canadians across our country are rising to this challenge. And among those helping to lead the way is Canada's oil and gas sector, which is embracing tomorrow's clean-energy world. There are many examples.

First, major Canadian oil and gas companies are making large investments in clean technologies, as well as renewable energy sources such as solar, wind and geothermal, because they realize there is a role – and real opportunity – for them in the fight against global warming.

This is fundamental to our collective future. We are at the crossroads between a global reliance on the fossil

fuels of the past and the renewable energy of tomorrow. But, as our Prime Minister, the Right Honourable Justin Trudeau, has said, "the choice between pipelines and wind turbines is a false one. We need both to reach our goals."

That is why our government is leveraging the fossil fuel resources we have today to support clean-energy solutions for tomorrow. It starts by investing in the clean technologies and innovations that will transform our traditional resource sectors and open up entire new industries. We know that new technologies and innovations will strengthen our economy, ensure our energy security and preserve our planet.

Essential investment in innovation

Second, many people forget that it was innovation that led to the development of Canada's oil sands in the first place. Nobody had figured out how to get oil out of sand until we created the technology.

Canada's oil companies are now working together to develop the next generation of breakthroughs that will significantly improve their environmental performance. For example, through a formal partnership called the Canadian Oil Sands Innovation Alliance, 13 member companies have put aside competitive pressures and, to date, invested more than CAD\$1.3 billion to share more than 800 distinct technologies and innovations.

Our natural gas sector is demonstrating similar foresight and promise. Canada has some of the world's largest known reserves of natural gas and, as its third-largest producer, we are in position to be a major global supplier of liquefied natural gas (LNG). In addition, we have the technology and know-how – in producing, processing and transporting natural gas – to capitalise on its value as a transitional fuel: cleaner than coal or oil and currently more accessible than many renewables.



Image: © City of Medicine Hat, Alberta

Our government is doing its part to support a more sustainable role for oil and gas in the clean energy world. We are funding research and development to green the industry's practices as well as modernising our regulatory and review systems to ensure all voices and perspectives are heard and considered in evaluating major new resource projects. This is the only way we can build the right infrastructure to get our resources to global markets and then use the revenues to fund Canada's transition to cleaner forms of energy.

That transition, by the way, is already well-established in Canada.

The time is now

Our clean-tech sector has been consistently outpacing the annual growth rate in the rest of the Canadian economy – and by a significant margin. Our government is determined to maintain that advantage.

That is why we are also investing billions of dollars in the clean technologies and innovations that will increase our supply of renewable energy from solar power, wind energy and nuclear, as well as new and emerging sources such as wave, in-stream tidal, geothermal and biomass.

At the same time, we're building on Canada's enviable reputation as one of the best places to invest and do business. We're committed to maintaining investor certainty; ensuring our tax structure remains among the most competitive; and promoting the benefits of partnering with Canadian companies that have world-class experience and expertise in clean energy and technology.

This may be a time of transition and significant challenges, but it's also a time of unprecedented opportunity – for both our traditional sources of energy and tomorrow's clean energy solutions. This is our chance to shape the future, because the potential is tremendous, the opportunities are clear, and the time is now. ■

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Minister of Natural Resources
Government of Canada
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Measuring the fever of the glaciers' firn and ice

The firn and ice of glaciers can be at temperatures far below freezing point, writes Professor Martin Hoelzle

Glacial ice acts as a natural climate and environmental archive and is able to preserve important information about the past atmosphere. Measurements of firn and ice temperatures, however, show substantial warming since the 1990s, even for high-altitude and latitude locations. The expected continued climate change raises concerns that this natural archive will become erased.

The firn and ice of high alpine glaciers in different mountain regions or from ice caps and ice sheets at high latitudes is mostly cold. The term "cold" has a very specific meaning among glaciologists: Cold means that the glacier has a temperature below freezing over the entire year, as opposed to

"temperate" ice which refers to ice that is at the pressure melting point (about 0°C). In the Alps, for example, most glaciers are temperate and there are no glaciers which are entirely cold. Often, one finds cold and temperate ice coexisting in accumulation or ablation areas of the same glacier. Such glaciers are then called polythermal. The largest polythermal glacier in the European Alps is the Grenzgletscher in the Monte Rosa area. Large parts of the Greenland ice sheet, virtually the entire Antarctic ice sheet, and many glaciers and smaller ice caps of high mountain Asia consist of cold or polythermal ice.

Cold accumulation areas are very important for ice core research focusing on the reconstruction of environ-

mental and climate history. They allow analysis of climate evolution in areas where there are no direct instrumental observations. Cold thermal conditions ensure that practically no meltwater can arise and percolate through the porous firn layers, so that the information stored in the snow/ice crystals, and in the trace gases within air bubbles cannot be displaced or washed out.

The first ice temperature profiles were measured in the 1950s at Camp Century in north-west Greenland and they revealed temperatures of -24°C at the surface and -13°C at 1,400m depth at the interface between ice and bedrock. In recent years, firn and ice temperatures have been measured in the Alps within several tens of boreholes.

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According to these studies, cold firn can occur between 3800-4800m above sea level. The measured average firn temperature in the Mont Blanc summit area reaches down to about -15°C and down to around -12°C on the Monte Rosa. What is surprising is the large spatial variability of temperatures observed on the glaciers: Actual 'cold spots' on shady slopes or flat saddles with little snow accumulation alternate with almost temperate parts in exposed southern slopes with high amounts of solar radiation.

Measured englacial temperature profiles also reflect the surface temperature history and can thus be interpreted as a climate archive. However, this applies only if the conditions on the surface (snow accumulation, melt energy input, etc.) have not changed too dramatically over the reconstruction period. In Greenland, for instance, a reconstruction of the surface temperature over a period of several thousands of years back in time was possible. The Last Ice Age (around 110,000 to 12,000 BP) showed a temperature decrease of around -23°C, the Climatic Optimum (around 9,000 to 5,000 BP) showed an increase of about +2.5°C and the Little Ice Age (around 15th to 19th century) about -1°C in comparison of today.

However, as the increase in air temperatures today is very fast, we have to better understand the microclimatic influences on the formation of cold firn and ice. Therefore, the energy fluxes between the atmosphere and cold snow and firn were investigated in detail. Measurements

have shown that short but sometimes intense snowmelt events are a major factor in quickly increasing englacial temperatures. The latent heat released by refreezing of percolating meltwater causes a rapid increase in temperature within the firn/ice body and creates ice layers several centimetres to metres thick. This effect is of great importance, because it could warm large firn areas in cold environments like Greenland and the high mountains of Asia.

“The first ice temperature profiles were measured in the 1950s at Camp Century in north-west Greenland and they revealed temperatures of -24°C at the surface and -13°C at 1,400m depth at the interface between ice and bedrock.”

However, recent studies from Greenland show that the production of ice layers can also have impacts counteracting the direct warming of deeper layers in the firn. The meltwater created during the recent series of warm years has refrozen in near-surface ice lenses so thick that they now act as an aquiclude (an impermeable layer of water). These ice layers of several metres in thickness prevent the percolation of further meltwater and force meltwater to run off along the surface. Therefore, the deeper firn layers cannot be warmed by percolating meltwater through the effect of latent heat release by refreezing any more. The increased meltwater production has serious implications, among which is the increased runoff of glaciers, ice caps and ice sheets leading to an enhanced sea level rise

and the erasure of the valuable historical and environmental information stored in cold firn and ice. Ice cores therefore need to be drilled soon in sensitive warming areas to avoid losing the climate records stored in these unique archives.

Furthermore, stability of steep hanging glaciers frozen to bedrock can be weakened due to increased meltwater running along the bedrock, resulting in large ice avalanches endangering the valleys below. For these reasons, it would be considered a strong asset to install a world-wide firn and ice temperature monitoring system embedded in the already existing international monitoring strategies of glaciers, ice caps and ice sheets of the Global Terrestrial Network on Glaciers (GTN-G) within the Global Climate Observing System (GCOS).



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Can shale gas help meet the UK's future energy demands?

Government and industry must work to change public perceptions of shale gas and its role in meeting the UK's energy demands, contends IMechE's Dr Jenifer Baxter...

To date, the extraction of shale gas as an energy source across Europe has been slow; this is due to a myriad of reasons including public opinion, concerns over the environmental impact of hydraulic fracking, and difficulties gaining planning permission in relatively densely populated countries such as the UK.

Increasing demand for energy worldwide means that there is a constant search for new secure energy sources, in terms of both geographical locations and exploitation methods. One such source is shale gas, which has had a significant impact on the energy sector in the USA.

Domestic gas production from the UK Continental Shelf (UKCS) is insufficient to meet UK demand, currently supplying around 48% of demand. The UK is therefore reliant on imported gas to meet the majority of the demand. Approximately 38% of UK gas is supplied through pipelines from continental Europe and

Scandinavia, with the remaining 14% of demand being met by Liquefied Natural Gas (LNG) supplied by ship, primarily from the Middle East.

Imported gas is less secure than domestic gas, has commercial risks associated with currency exchange rates, has a negative impact on the UK balance of payments, and does not contribute the revenue associated with gas production into the UK economy.

A diverse and balanced energy portfolio

Shale gas is not the solution to meeting the UK's future energy demands, but could have a role to play in a diverse and balanced energy portfolio that also includes nuclear, renewables, demand side management and energy storage. UK shale could make a helpful contribution and help protect the UK from the volatility of the global energy markets particularly in the short term. There is a need for the government to create momentum in this industry as there is still a



*Dr Jenifer Baxter
Head of Energy and Environment*



long way to go before UK shale gas extraction is at a level to supply power stations or the gas grid.

The UK shale gas industry has the potential to contribute to securing energy supplies and creating much-needed jobs in regions such as Lancashire and Yorkshire, particularly in a time of uncertainty around markets, investment and supply. Shale gas could provide opportunities for localised UK supply that replaces imports.

The UK Government has issued licences to enable companies to undertake exploration work to determine if UK shale gas and oil can be developed economically. The first dedicated shale gas well was drilled at Preese Hall in Lancashire in 2010. During the initial stages of high volume fracturing of the well, low level earth tremors were recorded and the operation was shut down. There was significant media interest and the UK government imposed a moratorium on further activity. The moratorium was lifted following evaluation and agreement on guidelines for future activity.

Fracking faces significant resistance

Proposed onshore UK shale gas and oil exploration has continued to attract significant attention from the media, politicians, environmental groups, protest groups, business groups and the public at large. Local councillors turned down an application for further

shale gas exploration activity in Lancashire and there is significant resistance to an application for fracking in North Yorkshire.

The information often used to oppose shale gas extraction through hydraulic fracturing often includes anecdotes from the US, where the regulatory framework is completely different to the UK and more environmentally damaging activities have been allowed.

Government and industry must now work to help change public perceptions of shale gas to convince the public that hydraulic fracturing of rock for shale gas extraction is safe, as well as improving the understanding of the role gas plays in our everyday lives. There is a long way to go before shale gas provides significant amounts of gas in the UK. If local authorities and communities are to make informed decisions on whether to allow fracking to take place in their locality they need to understand all the issues and have an opportunity to discuss them sensibly. ■

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The connected lighting networks driving smart city adoption

Simon Newcombe, Business Development Manager, Schröder talks about the role of connected lighting networks in saving energy and reducing emissions...

The global population is growing by approximately 83 million people annually, and the United Nations (UN) World Urbanization Prospects report predicts that 60% of the world's population will live in cities by 2050. For urban planners, architects and designers of public spaces the key challenge is offering citizens a sense of safety and wellbeing while balancing increasingly stringent financial and environmental restrictions.

It is for this reason that local authorities around the world are investing in new technology to connect key infrastructure via the internet. This will offer a range of new data streams and enable better management of the cities of the future. According to business consultancy firm Gartner, there will be 26 billion devices networked together in the Internet of Things (IoT) by 2020. While many of these connected devices will be used by consumers – from washing machines and fridges to cars and motorbikes – the majority will be utilised in public infrastructure – the smart city.

What do we connect already?

Connected infrastructure gives local authorities more control and visibility over public services. Take lighting; central management systems (CMS) – where a city's lighting is networked together and controlled remotely from a central location – gives significant levels of control and enables energy savings and reductions in carbon emissions.

When energy-efficient LED luminaires – which alone can enable energy reductions of 60% against traditional technology – are connected to a CMS, energy consumption can be optimised through dimming schemes and variable lighting levels. Streetlights can be dimmed, for example, to 40% between the hours of 01:00 and 05:00. Different areas of a city or town can

be divided into zones, and each zone can have a unique dimming profile based on the type of road, time of day, or what the area is used for.

One for all and all for one

Connected lighting networks using CMS are seen by many as the foundation for the smart city movement, but new multi-functional lighting products also have the potential to become even more central to their wider development.

“Multi-functional luminaires offering internet connectivity in public spaces also provides a valuable hub for the collection, storage and distribution of information. The applications of this touch on all aspects of public life, from health and safety to crime prevention and social interaction.”

Connected, interactive and multi-functional lighting columns declutter public spaces by providing multiple requirements in a single installation. Installing one luminaire for multiple purposes removes the need for other street furniture and significantly lowers the carbon footprint of what would have been a number of installations.

Multi-functional lighting columns can include a variety of 'enabling' services – pieces of technology that interact with and extend the range of other systems. Loudspeakers, CCTV, night vision, wireless internet (Wi-Fi) routers, electric vehicle (EV) charging and visual guidance tools can all be integrated into a single lighting column thanks to advances in energy supply technology. Multi-functional lighting columns are flexible and offer quick and inexpensive on-site installation, very low maintenance and a low total cost of ownership for local authorities. Indeed, lighting columns are the



natural choice to house new technology as they are already evenly distributed throughout urban areas.

Commercial implications of increased connectivity

Multi-functional installations provide additional cost saving opportunities for local authorities through affiliated maintenance contracts and managed services. Why employ 4 engineers to service 4 separate installations when one engineer can service the whole product in a fraction of the time and for a fraction of the cost?

The benefits also extend to retailers and local businesses. For 'brick and mortar' high street retailers, the internet has had a serious impact on sales as increasing numbers of consumers choose to do their shopping online. Offering internet access in public places, however, can have a positive impact for high street retailers, shopping centres and other commercial spaces. 62% of people spend more time in public areas when they can use their laptops and tablets via Wi-Fi, and surrounding shops and facilities report an additional 50% more spending when this occurs. Providing ubiquitous connectivity in commercial spaces through lighting columns can have a positive impact on footfall for local businesses.

Multi-functional luminaires offering internet connectivity in public spaces also provides a valuable hub for the collection, storage and distribution of information. The applications of this touch on all aspects of public life, from health and safety to crime prevention and social interaction. This connectivity between local businesses and potential customers also provides valuable opportunities for retailers to interact with customers with exclusive offers and enables them to provide better, more targeted and rewarding services.

“Connected, interactive and multi-functional lighting columns declutter public spaces by providing multiple requirements in a single installation. Installing one luminaire for multiple purposes removes the need for other street furniture and significantly lowers the carbon footprint of what would have been a number of installations.”

The cutting edge equipment making its way into integrated lighting products is already making cities safer, healthier and more profitable. As smart cities begin to come into their own, the possibilities of future integration can be harnessed by local authorities, businesses of all sizes, and the increasing number of citizens moving into urban areas. ■

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Power On Connections

Self-service – making it happen

It has been just over a year since the new Electricity Market Competition in Connections Code of Practice was formally approved by Ofgem. Customers and ICPs (Independent Connection Providers) are now starting to reap the benefits brought about by the Code.

The Code mandates that DNOs, (the successors to the pre-privatisation regional electricity companies) must as far as reasonably practicable, minimise their involvement in the provision of new connections by Independent Connection Providers (ICP's) to their customers.

DNOs are required to provide as high a standard of service to ICPs, as it would to its own connections business.



Finally, DNOs must work to harmonise their processes and procedures relating to Competition in Connections, in line with industry best practice allowing

ICPs to freely and easily operate across DNO boundaries.

Leading the way...

Power on Connections founded in 2003, continues to be amongst the first to take the next steps by carrying out works that, until now, had been exclusively completed by the DNO and its contractors. In all of the DNO regions in which Power On operate, the company has the ability to:

- Identify the location on the DNO's network that the new connection is to be made;
- Self-Approve the design of any network extension;
- Complete all of the necessary operational switching activity on the DNO network to facilitate the connection of the newly constructed assets;



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- Complete the final joints to the existing DNO Distribution System.

Power On is driving the change forward and has achieved NER's accreditation for self-assessment, self-design, self-operation and self-connection across many of the DNO regions.

Other ICPs are following in their path, all of which is great news for customers, as further competition will drive up standards and drive down prices.



More to do...

There is still significant room for improvement. The scope of works that ICPs can undertake in each DNO region varies, as a failure of some DNOs to embrace the spirit of the Code of Practice in its entirety.

Power On will continue to push the boundaries, to minimise the touch points between themselves and the DNO during the process of a customer making their original enquiry to Power On, and the electricity infrastructure works energised and handed over for adoption.

Power On is focused on delivering an exceptional level of customer service and would like to have full control over that process and be fully accountable to its client, thereby being able to deliver against our commitment to provide Programme and Cost Certainty.

Next Steps....

DNOs must work to harmonise their processes and procedures relating to Competition in Connections, allowing ICPs to work across DNO boundaries.

The Code of Practice is a living document and changes will be made through the governance process to address the lack of a harmonised approach amongst DNOs. Further process improvements will be implemented through the experience obtained by ICPs as they complete these Self Service Activities.

POWER ON
connections

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Investing in urban mobility

Benedicte Swennen, urban mobility and cities policy officer at the European Cyclists' Federation outlines how mobility habits are shifting throughout Europe...

The growth of cars in the past 50 years and the adaptation of the infrastructure to this dominant mode of transport have transformed our cities into urban areas with a low quality of life: air pollution, noise exposure, car crashes, congestion are examples. And the growth of cars comes at huge social, economic and environmental costs.

However, a turning point may be possible. More and more local governments are investing in more liveable, people-oriented cities and cycling and walking are part of the most cost-efficient solutions for that transformation. Mobility habits are shifting as well; if we take millennials as an example, we see an aversion in private car ownership and a preference in sharing solutions paired with the development in mobile technology. Public bike schemes are popping up all around Europe

showing that this sharing perception of economy is much more than a trend.

ECF provides fact based evidence of the benefits of cycling to help our members convince local decision makers of the win-win situation that cycling can provide for cities. To improve mobility in cities, ECF works with 80 national cyclists' organisation members, representing over half a million individual citizens in 40 countries worldwide, and with our ambitious Cities for Cyclists Network, which counts 26 cities in 16 countries, mostly in Europe but also some cities outside (Rio de Janeiro, Taipei). These cities for cyclists have the ambition to improve cycling for their citizens. It is a mix of beginner, climber and forerunner cycling cities and the main goal of the network is to exchange with each other and take cycling forward.



Benedicte Swennen, Urban Mobility and Cities Policy Officer

Every year, ECF publishes new studies and this fact based evidence also serves to lobby on behalf of our members on the European and global level. One of our interesting recent studies for cities is about how cycling can benefit the local economy: Currently, more than 650,000 jobs in the EU are linked to the sector. If cycling modal share was doubled, more than 400,000 extra jobs could be created. ECF collected evidence from several towns in Europe, from the North to the South and [including some UK examples on how local shop owners](#) profit from cycling customers.

The reverse is true too: Take for example Padova (Padua), a city in Northern Italy, where the mayor decided to prohibit cyclists to ride in the city centre on Saturday afternoons. The result was clear: [Shop owners](#) suffered a 50% loss in income during this time.

This is an exception though – many cities are currently reaching their limits in terms of congestion and pollution, so they are restricting or limiting motorised transport in their city centre, school environments or residential areas. The role of cycling in this new, accessible and more human-centric concept of mobility is prominent. In addition thanks to the electric revolution

in cycling, bicycles can now take citizens further – up to 20km – to their work or activities, and they can carry more weight of passengers or goods to be transported. The ECF study [Recommendations on Cyclelogistics](#) show the potential of cargo-e-bikes and how cities can start introducing to make their city more liveable.

“ECF provides fact based evidence of the benefits of cycling to help our members convince local decision makers of the win-win situation that cycling can provide for cities. To improve mobility in cities, ECF works with 80 national cyclists’ organisation members, representing over half a million individual citizens in 40 countries worldwide, and with our ambitious Cities for Cyclists Network, which counts 26 cities in 16 countries, mostly in Europe but also some cities outside.”

We also pilot the implementation of new innovative concepts such as cargo-bikes and [cycle highways](#) through European funded projects such as CHIPS (cycle highways), FLOW (congestion & transport modelling), EuroVelo (long distance cycle routes) etc.

These topics and many more are explained in depth at [the annual Velo-city conference](#), run by ECF and widely respected as the world’s premier international cycling planning conference series, which seeks to encourage cycling as a part of daily transport and recreation. ■



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Towards cleaner and smarter mobility

Hans Bruyninckx, Executive Director at the European Environment Agency explains how cleaner and smarter transport can meet Europe's need for mobility...

Transport connects people, cultures, cities, countries and continents. It is one of the main pillars of the modern society and economy, allowing producers to sell their products across the world and travellers to discover new places. Transport networks also ensure access to key public services, such as education and health, contributing to a better quality of life. Connecting to transport helps boost the economy in remote areas, create jobs and spread wealth.

Transport also plays a decisive role in shaping the way we live: our food, clothes and household waste all need to be transported; it influences what products are on offer and what we consume; and we use transport systems to go to work, school, the theatre and on holiday. Today high-speed train connections make long daily commutes possible, allowing people to live hundreds of kilometres away from their work.

There is, however, a downside to our current transport model. The transport sector causes substantial negative impacts on the environment and human health. Transport is responsible for a quarter of the EU's greenhouse gas (GHG) emissions, and causes air pollution, noise pollution and habitat fragmentation. More concretely, it is the only major economic sector in Europe where GHGs have increased since 1990 and is also the largest contributor to nitrogen oxides emissions, which harm health and the environment. Similarly, road transport is one of the main sources of environmental noise pollution in Europe.

Transport demand to rise further

Today the demand for transport in Europe is significantly higher than in 2000 and is expected to continue growing. According to European Commission estimates, by 2050 passenger transport is projected to grow by more than 50% and freight transport by 80% compared to 2013 levels.

Other challenges lie ahead. Europe's transport depends heavily on oil. Oil consumption not only releases GHGs and air pollutants into the atmosphere and contributes to climate change, but also makes the European economy more vulnerable towards fluctuations in global energy supplies and prices.

Moreover, despite transport's central importance to our economy and quality of life, not enough attention is paid to preparing Europe's transport infrastructure to the challenges posed by climate change. Can Europe's rail and road infrastructure cope with higher temperatures? Disruptions in transport services – volcano ash in the air, flooded roads or damaged rail tracks due to extreme weather – can have serious consequences for travellers, daily commuters and businesses, well beyond the affected area.

The transport system also needs to adapt to changes in Europe's demographics. How can public transport be adapted to the mobility needs of an increasingly older population?

Technological improvements are not enough

In recent years, new cars and vans sold in Europe have become more and more energy efficient. For each kilometre travelled, they consume less fuel and release fewer pollutants than older models. Stricter policy measures have been instrumental in achieving these gains. Nevertheless, the number of vehicles on the road and the distances they travel continue to grow. Similarly, aircraft engines have become more efficient, but more passengers are flying and travelling further.

Incremental efficiency gains through technological improvements will fail to break the sector's dependence on fossil fuels and negate its environmental impacts. Even after recent efficiency improvements in car engines, only up to a quarter of the fuel burnt is

EU targets to reduce greenhouse gas emissions

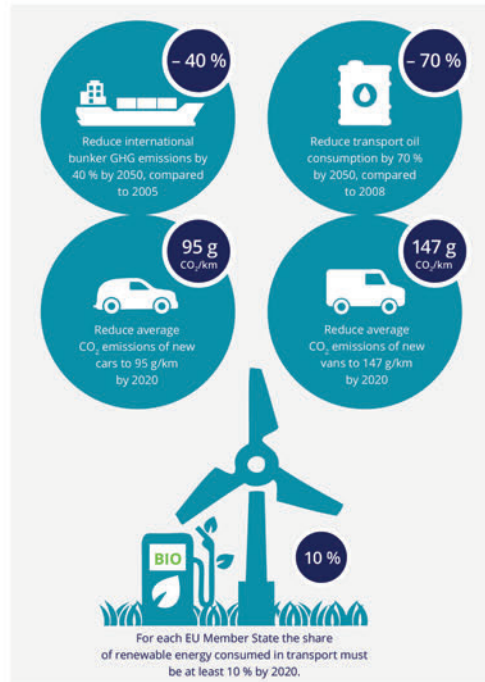
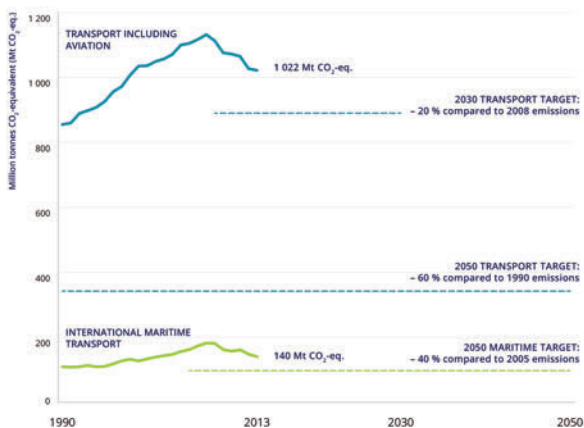
Several EU targets have been set to reduce the environmental impacts of transport in Europe, including its greenhouse gas. The transport sector's targets are part of the EU's overall goal to reduce greenhouse gas emissions by 80-95 % by 2050.

The EU's transport sector depends on oil for 94 % of its fuel, 90 % of which is imported. This makes it particularly vulnerable to instability and changes in the global energy market. A disruption in the energy supply could severely undermine the economy and hamper the quality of life in the EU.

Key targets to be reached by 2050:

Reduce transport (excluding international maritime) greenhouse gas (GHG) emissions by 60 % compared to 1990 levels and reduce international maritime transport emissions by 40 %, compared to 2005.

Transport's total share of EU GHG emissions in 2014



Sources: EEA Report No 15/2016 Annual European Union greenhouse gas inventory 1990-2014 and inventory report 2016; EEA Report No 7/2015 Evaluating 15 years of transport and environmental policy integration — TERM 2015. EEA GHG data viewer

Source: EEA Report No 7/2015 Evaluating 15 years of transport and environmental policy integration — TERM 2015

actually used for moving the vehicle. The rest is lost as heat, mechanical inefficiencies or is used for accessories. Moreover, recent improvements in official fuel efficiency statistics have been questioned. There are significant discrepancies between fuel consumption observed in real-world driving and testing under laboratory conditions.

Ultimately, the issue is not just about cars, planes, roads, ships or fuels – the different components of the transport system – but about the need to move people and goods from one place to another in an easy, safe and efficient way. We must build a clean, smart and comprehensive 'mobility' system that caters to mobility needs by offering a service tailored to user requirements.

Defining the mobility need: essential or a treat
The need may vary depending on the way we live. People living in compact cities where everything can be

accessed on foot are less likely to rely on private cars. Fuel prices, housing and job markets, income levels and low interest rates on bank loans can all influence how much and how we travel, or how the goods we consume are brought to us. Even topography can influence our choice of transport.

Globalisation of markets (e.g. global trade and travel) would not have been possible without extensive transport networks. The world economy grew along with transport demand, each fuelling the growth of the other. In today's globalised world, consumers can buy products that only a few decades ago were not on offer, and which are now delivered to their doorsteps. Our lifestyles and consumption aspirations have changed accordingly. We expect to find cheap tomatoes on supermarket shelves and to take affordable vacations all year round. Ultimately, we should not be afraid of asking whether we actually need all this transport.

The mobility need can be assessed in different ways. First, is the journey essential or just a pleasant treat? Can it be avoided? Second, can the journey be shifted to a more environment-friendly transport mode, such as opting for train travel instead of flying, or for public transport instead of driving? And last, can the transport mode be improved?

The European Union's transport policies build on these 'avoid, shift and improve' principles, among others. Many measures in use to help curb the negative impacts of the transport sector, including fuel taxes, tolls or other road charges, are based on the 'user/polluter pays' principle. Such measures usually aim to reduce environmental impacts. Higher taxes and tolls, for example, might increase the price of using the vehicle, which in turn can lower the demand.

Unfortunately, the prices users currently pay for transport services do not reflect the full cost on the environment and public health. Carbon prices, global oil prices and passenger car prices tend to be too low to send a strong signal to users and investors.

Furthermore, the price signal can be distorted by transport subsidies, the use of which remains widespread in Europe. In some cases, subsidies are designed to promote cleaner modes, e.g. those provided to public transport. In other cases, such as tax breaks for company cars, tax exemptions on international aviation or shipping fuels and differential tax treatment for diesel and petrol, subsidies can have adverse impacts on the environment and lock the transport system in to an unsustainable path.

Mobilising ideas, policy and funds

The current mix of transport modes and fuels is simply not sustainable. The choice is ours: we can choose to build a clean, accessible, coherent, climate-resilient mobility system that greatly contributes to our quality of life and well-being.

Cleaner and smarter transport can actually meet Europe's need for mobility, and at the same time

deliver many public health benefits, including cleaner air, fewer accidents, less congestion and less noise pollution. Where feasible, encouraging a switch to active mobility modes, such as walking and cycling, can also help improve other health problems such as cardiovascular diseases and obesity.

It is clear that decarbonising Europe's transport sector will take time. It requires a combination of measures, including better urban planning, technological improvements, a wider use of alternative fuels, stronger price signals, innovative research, continuous adoption of cutting-edge technology and stricter enforcement of existing rules. It also requires all investments in infrastructure and policy measures to be designed to this end.

Turning Europe's carbon-dependent transport sector into a clean and smart mobility system might seem like a colossal task. It can be done and we know how we can make it happen. It is also a must, given the current transport system's impacts on the environment and public health. I personally see it as an exciting opportunity for us to build a better and cleaner future. ■

<http://www.eea.europa.eu/signals/signals-2016/articles/towards-cleaner-and-smarter-mobility>

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The Internet of Trains: For safety, efficiency and comfort

Particularly for bogies with flattened wheels, the Internet of Trains can bring all-round benefits, writes ZNAPZ CEO Marcel Van Velthoven...

The Internet of Things is entering our world more than we realise. Many pieces of equipment today have sensors, supplying us with all kinds of information. Obviously we have internet access on mobile devices such as smart phones, and our mobile devices can make use of this data to tell us, for example, what movements we made today and how that may affect our health. With the growing popularity of health apps, we are rapidly getting used to this.

That a similar “health device” also exists in trains – in bogies, to be very precise – is probably not known to

most people. However, with the huge number of passengers using rail transport today (1.65 billion on franchised rail services in the UK in 2015, according to the UK Office of Rail Regulation, and well over 547 million in the Netherlands), we all experience the result of the improved technology.

As I wrote in [an earlier article](#), trains are equipped with many devices, giving us a lot of information about the train’s health and performance. Sensors inside doors indicate their level of wear and tear, and whether they are still able to close safely within the expected amount of time. Sensors

in the water basins of toilets indicate if they can still be flushed and hence are clean to be used. This goes on and on.

An important part of the train is the bogie, containing amongst other components the wheels that are in contact with the tracks. It is because of the wheels on the track that trains have a lower resistance and run more efficiently than any other form of transport. However, the wheels of rail vehicles are exposed to high wear and tear. This leads to “flattened wheels”. One can imagine that even the smallest flat surface on a wheel can lead to problems. First it causes the wheel to

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hit the track instead of rolling across the track, causing track and wheel to endure a higher force and resulting in damage to both elements. But where is this happening, at what speed, with what force, and what are the consequences, short and longer term?

Rail infrastructure companies have extended the track with sensors. These sensors indicate the temperature and pressure of the wheels passing by. This is combined with the load of the train and the temperature of the air. With this set of data, it is possible to identify which wheel on which bogie of which train is flattened and relatively how much. The combination of this data supports the maintenance of the trains and the tracks.

Automatically, via the 'Internet of Trains', a signal can be sent to the train operator, informing them that a specific train has wheels that have a deviation (roundness) that is beyond an acceptable tolerance. This information can be fed back to the maintenance department who can

now quickly plan and execute a wheel correction. This prevents further deterioration of the wheels, and because the deviation is detected early, the wheel repair effort is significantly less than if the flattened area had increased. If for any reason a wheel or wheels flatten quickly the train operator can be informed to reduce the speed of this train, lessening further damage to the wheels and the track.

Wheel flattening is identified earlier than it would be with regular inspections, and this leads to longer life for the track. Also, in severe cases with limited inspection routines, flat wheels can lead to the track breaking, which could ultimately lead to a train derailment with very severe consequences.

An additional benefit is increased comfort for passengers. A flat wheel leads to an uncomfortable ride. There are also lower noise levels for the environment as flat wheels cause significantly more noise than round wheels. This is all because with the

Internet of Trains we are able to assess the asset health of the train in real time and take corrective actions early.

Identifying asset behaviour and what is required to make assets behave the optimal way is one of the core competences of ZNAPZ. Identifying which data is required to perform optimal Asset Management and making this data and the required analysis and models available to the asset owner and/or operator is our core business, in which we support rail organisations across the world.



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Cycling in Brussels, Rue De La Loi

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EU Cycling Strategy: Putting the EU on the cycle track

With the EU Cycling Strategy, the European Cyclists' Federation hopes to get all member states on the right track, as Fabian Küster explains...

To put the EU on the cycle track' is the goal of the [EU Cycling Strategy Campaign](#) that was launched this September by a coalition of stakeholders under the leadership of the European Cyclists' Federation (ECF). The main output of this campaign will be the delivery of a blueprint document that for the first time will discuss in a systematic way all policy fields related to cycling at European level. This 11-chapter blueprint will be presented at the [Velo-city conference](#) in Arnhem-Nijmegen on 13-16 June 2017, set to be attended by European Commissioner for Transport Violeta Bulc. The development of the EU Cycling Strategy has already received an endorsement from the Member States and other European institutions including the Parliament which called upon the Commission to bring forward an EU Cycling Strategy.

The Committee of the Regions, the EU's Assembly of Regional and Local Representatives, has recently adopted an opinion which forges some important recommendations. These include minimum quality standards for infrastructure projects co-financed by the EU, as well as the recommendation to widely introduce a 30km/h speed limit in urban built-up areas, and the collection of better and comparable data across the EU.

The introduction of the EU Cycling Strategy will strengthen these calls and, the ECF anticipates, greatly contribute to a doubling of cycling over the next 10 years, boosting employment in the cycling economy and halving the rates of people killed and/or seriously injured in road accidents per km cycled. It will also give



Fabian Küster, Senior Policy Officer

a political recognition to cycling as a mode of transportation in its own right. Furthermore, at the moment there are at least nine directorates (DG MOVE, DG SANTE, DG REGIO, etc.) of the European Commission whose activities are linked to cycling, thus the Strategy will also provide a convergence of the work areas related to cycling into a coherent EU-wide policy. Last but not least, as most cycle trips are of a local nature, recommendations for Member States as well as regional and local authorities will be included, too.

Growing popularity of cycling: Why is it important?

In turn, the increasing number of people using bicycles on a daily basis brings various socio-economic, environmental and health benefits. The ECF has estimated that [economic benefits of cycling](#) amount to €205.2-217.3bn per year. It includes the benefits of cycling on citizens' health (reducing risk of obesity and cardiovascular diseases), creation of stronger communities and growing interaction among local residents, boosting vitality of town centres, better accessibility affordable to most residents, and so on.

Furthermore, the ECF research has proven that cycling saves between 11 and 25 million tons of CO₂ emissions (depending on what mode of transportation it substitutes). Additionally, the bike industry and related

sectors create around [655,000 jobs](#) in Europe: A doubling of cycling would lead to the creation of a further 400,000 jobs. Also, due to the fact that bicycles occupy less road space, cycling scales down the social cost of congestion, which normally results in big losses experienced by business. Finally, [cyclists tend to spend more money](#) as they shop more frequently than car drivers, on average. Thus, doubling the cycling modal share would add another €27bn to retailers' turnover.

EU Cycling Strategy and local/regional governance

In addition to the socio-economic benefits of cycling, local and regional governments would also benefit from the EU Cycling Strategy as it would provide a more comprehensive guidance on cycling policies and actions to be taken, and facilitate a better exchange of good practices. Most importantly, it would attract more European funds to support the development of cycling infrastructures and to integrate cycling into the multi-modal transport system.

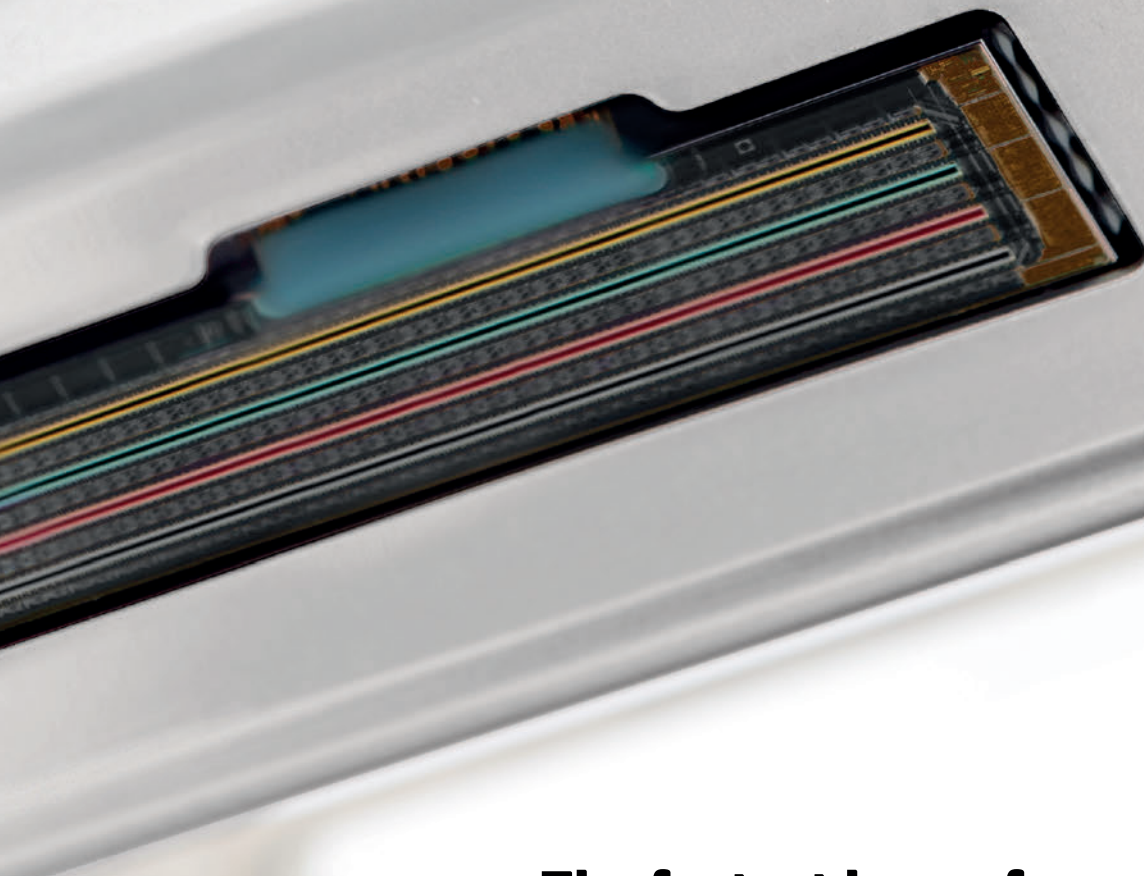
However, in order to achieve a full use of these benefits, involvement of all the actors is necessary. Therefore, local and regional governments should also provide [active support for the EU Cycling Strategy](#); during the process of developing the blueprint for an EU Cycling Strategy, there will be numerous possibilities to get involved and contribute. All stakeholders are also invited to [participate in the campaign's survey](#). Or [show your political support](#) by having your logo displayed at the campaign website.

About 40% of all car journeys in the EU are shorter than 5km. This simple figure illustrates the potential for growth in cycling, thereby helping to address some of the most urgent challenges we face: Climate change, poor air quality, lack of high-quality public space in urban centres due to the dominance of private car use. An EU Cycling Strategy would be an important milestone in delivering a better transport system that caters for the mobility needs of everyone, including children and elderly. ■

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Fabian Küster
Senior Policy Officer
European Cyclists' Federation

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