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It would seem that certain people have little knowledge of themselves, or of others. Unless some secret plan has passed me by, I wonder at any rate whether these people are reasonable: 2016 saw two of Europe's prime ministers resign the day after failure in a referendum which they themselves had recklessly launched.

In the first case – the United Kingdom – I did not risk predicting the result itself, but I did dare to predict the damage it would do in perpetuating a divide in the population, particularly in regional terms, rather than seeking to repair it. I'm still wondering how one can venture to ask the people's opinion without knowing what could happen, or what the legal consequences could be, if their response proved not to be what one hoped.

“I do not want to make any predictions for 2017, but I do hope that the European Union will finally start to regain a sense of its values as laid down in the first articles of its Treaty, that men and women will come forward to defend those values in tangible ways, and that citizens will have reasons to regain hope in something solid, intelligent, generous, peaceful and reasonable.”

In the second case – Italy – the people were asked a set of questions whose ultimate aim was to reduce the number of instruments of representative democracy, including participatory democracy, since the intention was to abolish the National Council for Economics and Labour. Paradoxically, we then saw populists amongst those defending the institutions of the good old constitution, established by democratic parties from all sides in the wake of the horrors of fascism and war.

What I find deeply troubling is the ever-increasing legitimisation of excesses, attitudes lacking in nuance, verbal provocations, absurd promises and the impression of chaos which all this creates. I fear that the various forms which demagoguery can take will leave their mark over everything, causing confusion in the population and leading to the most odious exploits.

The year 2016 also saw – in France, Belgium and Germany – crimes committed by a handful of fanatics who murdered and tortured at random in “civil society”, the society represented by the Committee of which I am

FOREWORD

Georges Dassis

President

European Economic and Social Committee (EESC)

Once upon a time those wishing to know the future could consult the Oracle of Delphi. This High Priestess must have disappointed or baffled her “customers” on more than one occasion: sometimes she did not reply at all, or her answer was rather – cryptic. But the customer had been warned: inscribed on the Temple of Apollo was not “Here stands the god of whom you may ask all you would like to know”, but rather “Γινώθι σεαυτόν”. Know thyself. Socrates ultimately saw this as a way of saying “try to be reasonable” (σωφρονεῖν).



president. There are not many individuals capable of committing this type of atrocity, but they are horrifyingly dangerous. I especially want them not to win in any way. Any way at all. We must track them down, but we must not taint our own lives with permanent fear nor aspire to turn our society into one of mass control. Nor can I accept that the contemptible acts of a few madmen should legitimise the rejection of hundreds of thousands of innocent and peaceful people. It makes me furious to hear the desperate, cynical and nihilistic arguments of future extreme-right voters: "When they're in power, I will suffer. My situation, my own rights, especially social entitlements, will deteriorate, and I know it. But immigrants and refugees, who are taking advantage of welfare, will suffer even more, and that's what counts".

Humankind's worst enemy, the thing holding us back, is jealousy. And yet there is a way to overcome this vice: first of all we can welcome the happiness of others and be happy about it ourselves. Next, solidarity, the core principle of trade unionism and the EU – to name but

two things particularly close to my heart – is not unpleasant or even overly expensive in relation to the benefits it brings.

I do not want to make any predictions for 2017, but I do hope that the European Union will finally start to regain a sense of its values as laid down in the first articles of its Treaty, that men and women will come forward to defend those values in tangible ways, and that citizens will have reasons to regain hope in something solid, intelligent, generous, peaceful and reasonable. The key to our progress can be found in the mottoes of the three neighbouring countries recently hit by terrorism: liberty, equality, fraternity, unity and justice. ■



European Economic and Social Committee



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WELCOME

Welcome to the February edition of Adjacent Government. As it is the first one of 2017, I would like to wish all our readers and contributors a very Happy New Year. 2017 has started with a bang, with the inauguration of Donald Trump in the US and the Supreme Court ruling that the UK government must consult Parliament before triggering Article 50. Change is also afoot in the European Parliament, where Antonio Tajani has been named as the new President.

This issue starts with a foreword from President of the European Economic and Social Committee (EESC), Georges Dassis. In his opening article, Dassis gives thought to events of last year and looks forward to how we can progress this year.

The health section starts by highlighting World Cancer Day 2017, with a special focus headed up by EU Commissioner for Health, Vytenis Andriukaitis. The Commissioner's article stresses the need for prevention and joint efforts to tackle rare forms of cancer. Adjacent Government also interviews Dr Percy Ivy from the National Cancer Institute at the National Institutes of Health in the US. She sheds light on clinical trials and their integral role in cancer research. The focus also features articles from SIOPE, Cancon and Cancer Research UK.

Our extensive health section highlights a number of key healthcare challenges, including obesity, with articles from RCPCH, WHO Europe and the Canadian Institute of Health Research. HIV/Aids in Sweden, low vision, innovative medicines, and smart hospitals are also discussed.

Another area we give focus to in the February edition is wildlife crime prevention in the environment section. EU Commissioner for Environment Karmenu Vella and MEP Catherine Bearder both highlight this problem. "We need tougher action on wildlife trafficking", states Bearder in her informative piece, and Commissioner Vella highlights the EU Action Plan against Wildlife Trafficking.

In the environment section we also look at polar research, in the Arctic regions of Canada, as well as Antarctica. An article from Polar Knowledge Canada outlines how they bring together indigenous and scientific expertise to look at issues faced by Arctic communities today.

Other topics within the publication include: Erasmus+, Hungarian rail infrastructure, renewable energy sources in Canada, Digital Society, and cyber security in healthcare.

Elsewhere in this winter issue, we shine the light on a number of key HR topics, including women in leadership, HR compliance and retaining talent. Articles come from such key organisations as CIPD, Acas and PPMA to outline these areas.

As always I hope you find the February edition informative and useful, and I welcome any feedback you may have.

.....
Laura Evans
Editor

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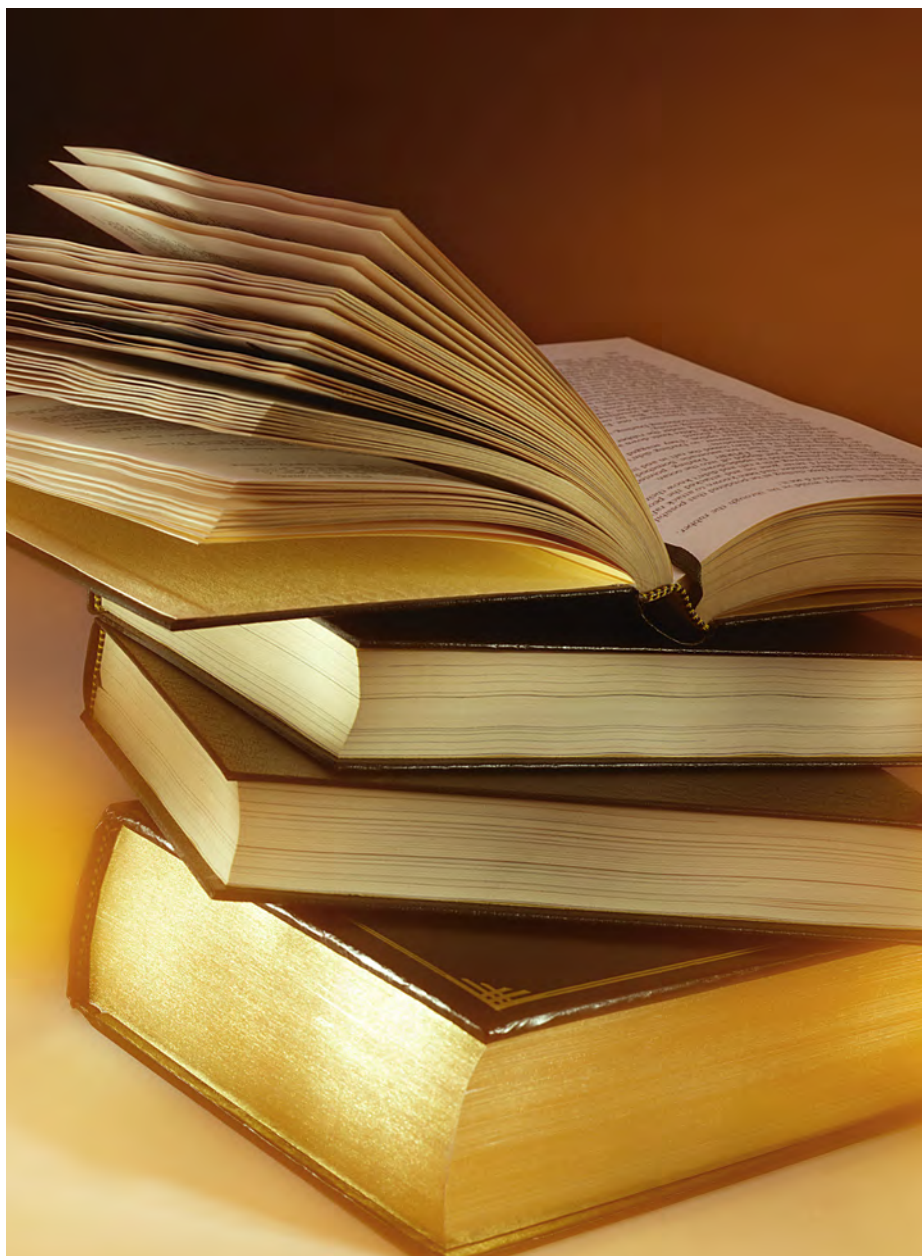
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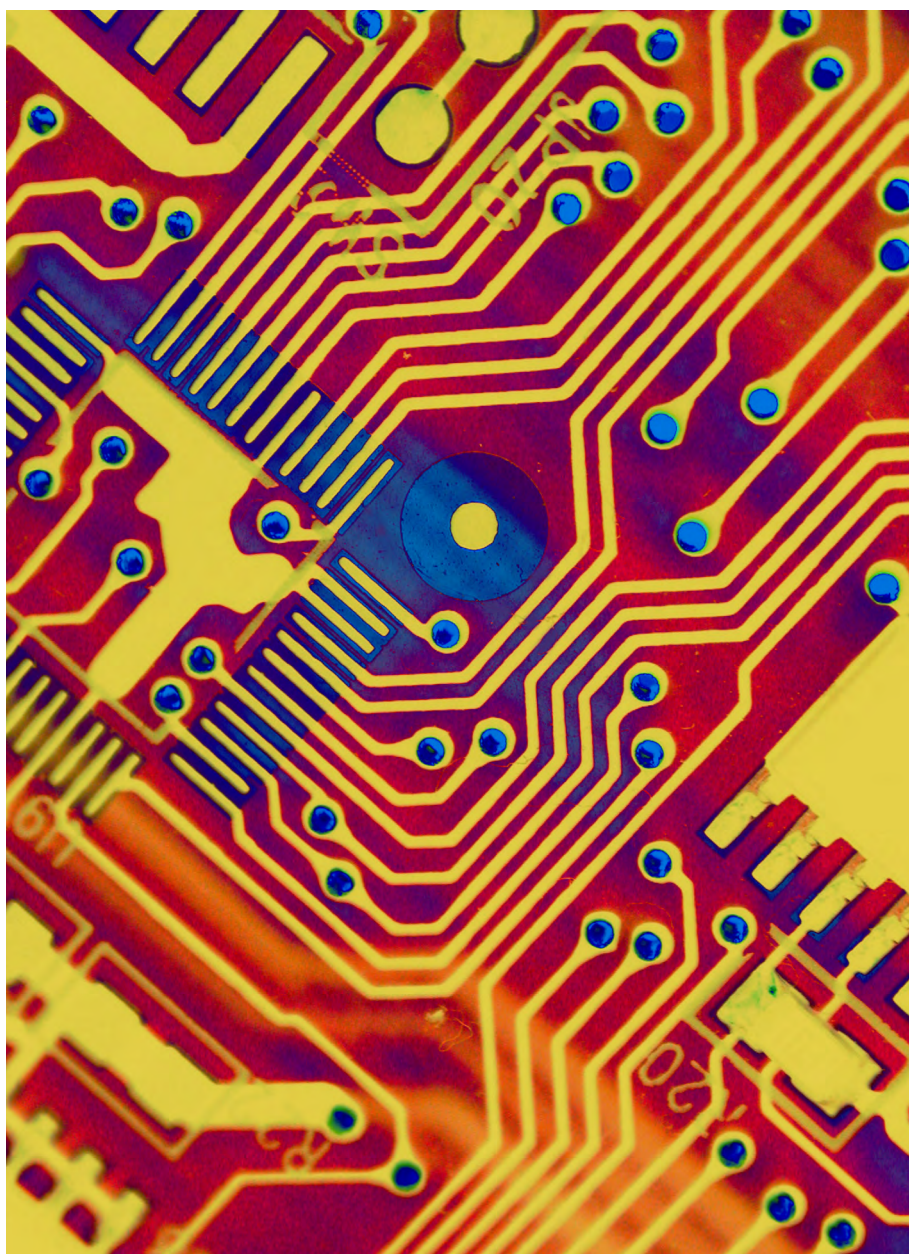
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We are joining the dots on rare forms of cancer, EU health commissioner says

Vytenis Andriukaitis, EU Commissioner for Health and Food Safety, stresses the need for prevention and spotlights joint efforts to tackle rare forms of cancer...

The EU vs. cancer battle has been underway for 32 years – more than half of my lifetime. Since the Heads of State of the European Community countries gathered in 1985 and committed to launching the first “Europe against Cancer” programme, actions taken at EU-level have helped to extend and save lives. Indeed, the past three decades have seen rising cancer control standards in all 28 Member States, and earlier diagnosis and more effective treatments have led to a significant increase in cancer survivorship in most EU countries.

Despite our success, this is no time to rest on our laurels. In 2012, in the EU, 1.4 million men and 1.2 million women were diagnosed with cancer. Given today’s incidence rates, it is estimated that one in three men and one in four women in the EU will be affected by cancer before the age of 75. We must not forget that, despite more people surviving cancer, it remains the second most common cause of death in the EU.

A new iteration of the European Code Against Cancer

The EU takes a multi-pronged approach to cancer, focusing on prevention by addressing the risk factors and producing guidelines for quality screening; providing nearly €1 billion for collaborative research; and supporting Member States’ efforts to improve diagnosis and treatment, raise standards of care, improve patients’ quality of life and support survivors.

We know that some cancers can be avoided by adopting healthier lifestyles, and that outcomes can be greatly improved if cancer is detected early on. This is the premise behind the “European Code Against Cancer” – co-financed by the EU Health Programme. The Code, which was first published in 1987, and has undergone several updates to keep up with the evidence, aims to arm

people with information on how they can lower their risk of cancer.

The fourth edition of the Code continues to emphasise the importance of avoiding tobacco, alcohol, and excessive sun exposure, as well as the benefits of maintaining a healthy body weight, being physically active, and being screened for certain types of cancer. It also includes important new recommendations to reduce cancer risk, such as vaccination against human papillomavirus, breastfeeding, and limiting the use of hormone replacement therapy.

At least one in three cancers is preventable, so heeding all 12 recommendations would go a long way in decreasing the burden of cancer in Europe.

European Reference Networks join the dots on rare forms of cancer

However, we cannot attribute all cancers to unhealthy lifestyle choices. Many cancers cannot be prevented no matter how healthy our choices and behaviours are. I am sure that every one of us can think of such an example in our family or circle of friends.

There are some rare, genetic forms of cancer which are extremely difficult to diagnose and treat and, sadly, many of them affect children. Such rare forms of cancer represent a particular challenge as specialist knowledge is often scarce, and patients and parents are sometimes left to scour the internet to find doctors and centres with the required expertise.

With knowledge and resources scattered across individual countries, the EU can provide significant added value by connecting the dots, bringing together expertise and maximising synergies between Member States.



“The EU takes a multi-pronged approach to cancer, focusing on prevention by addressing the risk factors and producing guidelines for quality screening; providing nearly €1billion for collaborative research; and supporting Member States’ efforts to improve diagnosis and treatment, raise standards of care, improve patients’ quality of life and support survivors.”

Vytenis Andriukaitis, EU Commissioner for Health and Food Safety

This is precisely the aim of the European Reference Networks (ERNs) – unique and innovative cross-border networks that will help diagnose and treat rare and complex diseases, including rare forms of cancer. I am pleased to be launching the first 24 ERNs in Vilnius on 9-10 March 2017.

EU Joint Action on Rare Cancers

To complement and support these developments, the Commission, together with Member States, has recently launched the EU Joint Action on Rare Cancers. This provides a framework for stakeholders to work together not only to ensure the implementation of ERNs, but also to establish national cancer plans and clinical practice guidelines, and fund research.

No country alone has the knowledge and capacity to treat all forms of rare cancer, but by cooperating and exchanging life-saving knowledge at European level through ERNs, patients across the EU will have access to the best expertise available.

Prevention and more prevention, continues to be my message on this year’s World Cancer Day and, in this

respect, the European Code Against Cancer remains our guide. Addressing the risk factors is the Commission’s first line of attack for reducing the burden of cancer.

Lastly, I am optimistic about the potential of ERNs. Ensuring that they reach their full potential is one of my key priorities for 2017, and we are developing European cross-border telemedicine tools to this end. We will also ensure that ERNs receive support via a range of EU funding mechanisms such as the EU Health Programme, the programme notably for infrastructure financing (the Connecting Europe Facility), and the EU research programme Horizon 2020. ■

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Vytenis Andriukaitis
Commissioner for Health and Food Safety

European Commission

http://ec.europa.eu/commission/2014-2019/andriukaitis_en

How far have we come on treating gynaecological cancer?

New avenues are opening up for treatment of gynaecological cancer, as Professor Gunnar Kristensen of Oslo University Hospital outlines to Adjacent Government

Surgery remains an important step in the treatment of ovarian cancer. Two earlier randomised studies revealed the same survival rates for patients who had surgery as the first step of treatment, as for patients who received 3 courses of chemotherapy before surgery.

The primary goal of surgery is to remove all visible tumours. Unfortunately, the main group of patients in the 2 former studies did not obtain this goal. In recent years we have seen considerable improvements in pre- and post-operative care, as well as in surgical skills. A new randomised study is now starting to test whether the old findings still hold. In the new study, the demands on surgical skill are high in order to achieve the maximal benefit from surgery.

For ovarian cancer, the traditional point of view has been that it originates from the epithelial surface of the ovaries. In recent years it has become evident that the site of origin often is the fimbrial end of the fallopian tubes. This may have considerable importance for preventative measures; patients with a high risk of developing ovarian cancer could potentially have their fallopian tubes removed after bearing children (if they wish) and spare the ovaries until menopause.

The most important recent finding

For medical treatment of gynaecological

cancer, the most important recent finding is from a phase 3 study on maintenance treatment with niraparib in patients with a late relapse of ovarian cancer. Niraparib is a PARP inhibitor, and it has been known for a long time that maintenance treatment with olaparib (another PARP inhibitor) after successful chemotherapy for relapse of ovarian cancer considerably prolongs the time to next relapse in patients with a BRCA mutation.

In the niraparib study, the time to next relapse was substantially prolonged for these patients, but also considerably prolonged for patients without such a mutation. Other PARP inhibitors have also shown promising results. We are awaiting a decision from the European Medicines Agency (EMA) to see whether niraparib will be allowed to be used for patients without a BRCA mutation. The results from the niraparib study indicate a possible use of PARP inhibitors for other patient groups, not just ovarian cancer patients with BRCA mutations.

Immunotherapy for gynaecological cancer

Immunotherapy has gained much interest, especially treatment with immune checkpoint inhibitors. Response rates for ovarian cancer are around 20% with stabilisation of the disease at about 40-50%. It seems that this kind of treatment has the potential to improve long term survival, which is very important. The testing of check-

point inhibitors began in patients whose tumours did not respond to chemotherapy any longer. After having established the value of this kind of treatment, new studies will test this at an earlier time in the treatment. The value of treatment with immune checkpoint inhibitors is also being tested in other types of gynaecological cancer.

Low grade serous ovarian cancers are relatively indolent. At the time of diagnosis they are often restricted to one ovary and can be managed by surgery alone. For advanced cases it has been shown that maintenance with oestrogen blocking therapy can prolong survival substantially.



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Obesity, liver cancer, metastasis: Future consequences for Europe

Mathias Heikenwälder at the German Cancer Research Center warns of the impact of modern lifestyles and the obesity epidemic on liver cancer and metastasis....

Alterations in lifestyles over the last decades, including high caloric diets combined with sedentarism, have increased the world-wide incidence of overweight and metabolic syndrome, characterised by abdominal obesity, insulin resistance and type 2 diabetes, as well as hypertension and dyslipidaemia. This trend is not only observed in countries such as the US and Europe, but also developing countries. It is believed that approximately 90 million Americans and 40 million Europeans suffer from fatty liver disease.

We know that overweight and metabolic syndrome can lead to several diseases, including coronary heart disease and type 2 diabetes, as well as cancer (e.g. liver cancer, colorectal cancer). This is also underlined by the statement from Vytenis Andriukaitis, EU Commissioner for Health and Food Safety, that prevention and information on how individuals can lower the risk of cancer triggered by lifestyle choices should be intensified and focused on in the future.

Epidemiological data clearly indicate that overweight and metabolic syndrome are reaching pandemic dimensions in industrialised countries. In the past 15 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, and this trend will accelerate and steepen.

The liver – which is the most important metabolic organ – is strongly affected by a chronic state of overweight and metabolic syndrome.

A range of associated health problems

Non-alcoholic fatty liver disease (NAFLD), which is 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 macrovascular steatosis of the liver. Although the prevalence of NAFLD is increasing globally, epidemiology and demographic characteristics of NAFLD vary worldwide.

A significant number of NAFLD patients develop non-alcoholic steatohepatitis (NASH), fibrosis and, consequently, hepatocellular carcinoma (HCC). HCC cannot currently be treated, it is the second most common cause for cancer related death in humans and it is one of the few cancers that strongly rise in percentage.

It is becoming increasingly clear that a number of pathways are involved in the pathogenesis of NASH, and its progression to the advanced stages of liver disease. These pathways may be diverse in different cohorts of patients with NASH. Understanding which pathways play a role in the development of NASH will be critical before launching treatment modalities.

In recent years, obesity leading to metabolic syndrome, steatosis and steatohepatitis has attracted increased attention due to an increased HCC incidence in the USA and Europe. 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, while treatment options for late stage HCC are limited and can only prolong the lifespan of patients from 3 to 6 months.

In laboratory mice, NASH can be induced by several different diets such as methionine/choline-deficient diet (MCD) or choline-deficient diet (CD) but not by high-fat (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. Thus, 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 thus far been lacking.

Choline deficiency is the key

Deficiency in the essential nutrient choline is described in NAFLD patients as exacerbating 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 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, fibrosis, hepatic mitochondrial damage, dyslipidemia and NASH as observed in human patients. HCC developed 12 months post CD-HFD start and histologically, genetically and morphologically resembled human HCC. Interestingly, by using this model we could investigate the cellular and molecular mechanisms that drive NASH, as well as NASH to HCC transition. Results of our work 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 and affect the degree of liver damage, as well as the degree of lipid uptake in hepatocytes, thus

priming the liver to develop from a fatty liver to one with NASH pathology. Moreover, we could show that some of those immune cells expressed and secreted several inflammatory cytokines that appeared to be the underlying effector molecules to drive pathology. We also found similar cytokines expressed in the livers of NASH patients as we had found in our mouse model to be causally linked to NASH and HCC disease development.

Changing the way we live

We thus believe that our mouse model recapitulates several pathophysiological aspects of human NASH and provides a model to the study of development of NASH as well as, NASH to HCC transition. In the future the link between activated T-cells in the liver and their crosstalk to hepatocytes could give us important insights in how we can generate novel therapeutics for treating NASH, as well as NASH induced HCC, in industrialised countries.

The foreseeable development of NASH into a pandemic disease in Europe will further force health authorities to act. To some extent first measures have been taken but the wave of cases that is expected to come will not be prevented with the current political initiatives, or current attempts to support education and research. It will need strong political efforts to change our thinking about living, about nutrition, and about preventive measures people can take to lead a more healthy life. Moreover, research has to be strongly supported to find – besides a European wide political strategy of prevention – therapeutic measures to prevent, to diagnose early, and to treat NASH as well as liver cancer.

It is important to note that today more than 90% of all patients who die

of cancer do so because of metastasising cancers and not because of the primary tumours. This is why I believe that, besides working on educating people on how to reduce the risk of lifestyle triggered cancers, a lot of effort has to be taken to pre-screen, diagnose and treat metastatic cancer patients. The clock is ticking and it is important that European political decision makers do not wait until the problem is more evident than it already is.

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Metabolic activation of intrahepatic CD8⁺ T cells and NKT cells causes nonalcoholic steatohepatitis and liver cancer via cross-talk with hepatocytes.

Cancer Cell. 2014 Oct 13;26(4):549-64. doi: 10.1016/j.ccell.2014.09.003



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Regional organisation and the Orkdal model of cancer care

The Orkdal model of cancer care rests on collaboration between specialist oncology and community care in palliative treatment, as Anne Kari Knudsen explains...

The Norwegian Orkdal model of cancer care has been called “the future of cancer care”. The aim is to develop and implement a model for optimal cancer care, and according to Oslo University Hospital consultant Anne Kari Knudsen, the integration of treatment approaches is the key.

In general, the aim is to achieve a situation where different cancer treatments are integrated with palliative care. This is the case at a few hospitals in Norway, says Knudsen, who additionally works as a researcher at the European Palliative Care Research Centre (PRC) of the Norwegian University of Science and Technology.

Cancon WP 7, Community-level cancer care, examines community cancer care, and how it could be improved. The Orkdal model of cancer care is a good example of a regional organisational model of after care.

In Norway, the national guidelines for example on breast or prostate cancer, include guidelines on surgery, chemotherapy, hormone treatment, and radiation therapy given both with curative and palliative treatment intention. Furthermore, there are national guidelines specifically for palliative care.

Oncology and palliative care separated

According to Knudsen, there are differences between the health regions in Norway, but there is still a distinct separation between oncology and palliative care. The patients are traditionally referred to the palliative care team when palliative systemic tumour-directed treatment is stopped.

“Palliative care should be integrated into cancer care during the whole disease trajectory, focusing on systematic assessment of symptoms and needs including the patient’s physical, social and psychological issues,



Anne Kari Knudsen

their family and how to collaborate with community care,” Knudsen explains.

There is a strong evidence-base behind this approach: Several studies have demonstrated that palliative care improves the quality of life for patients with cancer and their families. According to results, for example, patients receive better symptom management throughout the disease trajectory and family members may experience the care and bereavement process as less burdensome when palliative care is integrated with oncology.

The GP’s important role

“General practitioners, cancer nurses, and resource nurses coordinate the treatment process in the municipalities in close collaboration with physicians and nurses in specialist care. This is a good example of how community level cancer care and the patient pathway are taken care of in palliative cancer care,” says Knudsen.



For example, the Norwegian Cancer Society provides financial support for 128 cancer coordinator positions in 206 municipalities/city districts across the country, positions mostly held by cancer nurses.

According to Knudsen, general practitioners have an important role as medical coordinators and as contributors to the creation of integrated and effective patient care within the community health and care services. They also serve as coordinators and contributors between the municipal health and care services, and the specialist health service.

Reform ensures improved health and cancer care

The Coordination Reform in Norway envisages a greater municipal responsibility for health and care services. At the same time, the specialist health service shall be reorganised by decentralising services wherever this is possible, placing more focus on mobile organisations that support municipal services, and centralising highly-specialised functions where this provides the best quality.

Knudsen emphasises that the reform will help to ensure an improved and more integrated treatment process for all patients, including the ones with cancer. The objective is to increase competence within the

municipalities for all processes relating to cancer diagnoses. This should increase the quality of treatment and follow-up.

“In general, the aim is to achieve a situation where different cancer treatments are integrated with palliative care. That is the case at a few hospitals in Norway, says Knudsen...”

“In order to achieve this, it is important that general practitioners, to a greater extent than previously, are able to utilise other municipal services in order to offer patients the best medical follow-up,” Knudsen says. ■

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Cancer research and training take centre stage in NCI's work

Adjacent Government spoke to the US National Cancer Institute's Dr S Percy Ivy about the importance of clinical trials and the agency's role in cancer research and training...

The National Cancer Institute (NCI) is one of 27 institutes that make up the National Institutes of Health (NIH). The NCI is the US federal government's primary agency for cancer research and training, and coordinates with the National Cancer Program, which supports research, training, health information dissemination, and other programmes with respect to the cause.

Cancer is a term that everyone worldwide is aware of, with new research suggesting that 1 in 2 people will be diagnosed with cancer in their lifetime. The NCI estimated that in 2016 1,685,210 new cases of cancer would be diagnosed in the US and that 595,690 people would die from the disease. However, the number of people living beyond cancer diagnosis reached nearly 14.5 million in 2014 and is expected to rise to almost 19 million by 2024.

Research is an integral (but not the only) part of the work conducted at the NCI. Research helps to learn more about various forms of cancer and how to treat and prevent the disease. Clinical trials are research that involves people, in order to help find to find new ways to improve treatments and the quality of life for people living with the disease.

Adjacent Government Editor Laura Evans speaks to Dr S Percy Ivy at the NCI about the role of clinical trials and how cancer research has evolved over the years.

"Cancer clinical trials are essential for advancing the treatment of patients. These trials are a controlled framework in which selected populations of patients with cancer can be treated in a clinical research setting, based on results of earlier studies," explains Dr Ivy. "Essentially, for patients the goal is to prolong their life and, hopefully, be cured of the disease.

"The trial accomplishes several objectives from a medical and scientific point of view; we hope it changes the standard of care and improves the care and management of cancer patients. Patients are looking for response, slowing of their disease and improvement in their overall quality of life, and in some instances even remission and cure.

"I believe that clinical trials are essential for the advancement of cancer treatment. Networks of clinical investigators allow clinical researchers to evaluate large cohorts of patients, and more efficiently evaluate new treatments together across the country," Dr Ivy adds.

Developing new cancer treatments

The Cancer Therapy Evaluation Programme is one of the many programmes within the NCI and is focused on developing new cancer treatments. The clinical trials are made up of different phases which are used to detect how cancer responds to specific treatments.

As Dr Ivy outlines further: "Within the Cancer Therapy Evaluation Programme there are 2 very large programmes. The first is the Experimental Therapeutics Clinical Trials Network, made up of academic investigators across the US and Canada, who perform early phase clinical trials. The goal of those trials is to determine how to use a drug, what the drug properties are, and how it should be used in humans, as well as developing preliminary information on how the cancer responds to specific therapeutic interventions.

"The other large group in the US is the National Clinical Trials Network," she adds. "This is a group of more than 3,000 investigators who perform much larger randomised phase 2 and phase 3 trials. They are looking for signs of activity, efficacy and survival or response to a treatment or combination treatment that will lead

to a pivotal trial. The goal is to move to phase 3 trials that may result in licensing the treatment for a specific disease indication.”

Orphan diseases and rare types of cancer

The NCI is aiming to find treatments for all types of cancer; however, they also focus on rare forms of the disease besides what are known as the big 4 – colon cancer, breast cancer, lung cancer and prostate cancer. The rare forms are ones that are not as actively studied or used in clinical trials by pharmaceutical companies and have less than 200,000 cases per year, although this landscape is changing.

“I believe that clinical trials are essential for the advancement of cancer treatment. Networks of clinical investigators allow clinical researchers to evaluate large cohorts of patients, and more efficiently evaluate new treatments together across the country.”

“Orphan diseases, are defined as affecting fewer than 200,000 cases a year, and have not been as actively studied,” says Dr Ivy. “In the past these orphan cancers have been much less attractive targets for pharmaceutical companies, so the NCI has filled this niche as an unmet medical need. Pharma is also changing and starting to work more in niche diseases. As we find that cancers, for example breast cancer, are really made up of a group of biologically distinct diseases that require different treatments, the challenge is to provide effective treatments for all different kinds of cancer and the challenge for pharma is to define a sustainable niche market.

“The goal of the NCI is to provide those treatment opportunities to the U.S public. The US Congress recently passed a bill called the ‘21st Century Cures Act’ that will fund \$4.8bn in medical research with approximately \$1.8bn cancer related research. This means that we are able to develop synergies between programmes and initiatives that can effectively use that money in service of the public. We will do that collaboratively with researchers, organisations and companies and with our academic co- investigators, with the primary goal to make treatment for cancer widely available and accessible no matter how rare your disease is.”

A revolution in cancer research and training

As our knowledge of cancer evolves, new ways to treat the disease are also established. Along with new technology and key innovations, research and clinical trials are able to understand the best treatment for a specific type of cancer. Dr Ivy explains that cancer research is in the middle of a revolution, with new therapies such as precision medicine and immunotherapy coming to the forefront.

“With the exception of immunohistochemistry for PDL1, there are no biomarkers to select patients to receive anti PD-1/PDL-1 immunotherapy,” she says. “The tumours that have responded to these so-called checkpoint inhibitors have been those that were treated in the past with other immunotherapy agents, especially melanoma and renal cell carcinoma.

“However, there are areas in immunotherapy treatment that clearly stand out for the favourable response rates that have been seen, including lung cancers and Hodgkin’s lymphoma, as well as some rare diseases, such as Merkel cell tumours. However, the utility of the PD-1 biomarker to identify patients who are likely to respond is limited, and more work is needed to develop more robust biomarkers. What is becoming very clear with immunotherapy, as is the case for most effective cancer treatments, is that it needs to be combined with other therapies, including chemotherapy, molecular therapies and radiation therapy.

“Cancer treatment globally will be changing. In addition to the scientific challenges, the high cost of treating cancer patients with immunotherapies and other therapies remain an issue. We must ensure that academic clinical research in the public interest is available widely and not simply to those who can afford it.” ■

Dr S Percy Ivy

Program Director, NCI Experimental Therapeutics Clinical Trials Network (ETCTN)

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Treatments for prostate cancer: Pros and cons

Dr. Sumith A Kularatne, vice-president of R&D at On Target Laboratories, explores the pros and cons of various existing treatments for prostate cancer...

Prostate cancer (PCa) is the second leading cause of cancer related deaths in men, with about 1.1 million new cases and approximately 307,000 fatalities per year globally. This high mortality rate is partly due to the lack of sensitive methods for early stage of the disease and absence of better treatments for metastatic tumours. Metastatic disease also significantly impacts the quality of life due to extreme pain, bone erosion, muscle wasting, obstruction of urination and erectile dysfunction. Development of safe diagnostic and therapeutic modalities thus remains a major hurdle in PCa.

Current diagnosis of PCa is accomplished via a digital rectal exam (DRE), prostate-specific antigen (PSA)-blood test, punch biopsy, targeted-biopsy, a transrectal ultrasound (TRUS), magnetic resonance imaging (MRI), computed tomography (CT), and positron emission tomography (PET). Only advanced stages of the disease can be detected by a DRE and the reliability of PSA tests has been questioned due to its elevation during benign prostatic hyperplasia (BPH) and depression whilst taking medication for BPH, or hair loss.

While prostate biopsies can be expensive and painful, they can lead to incorrect diagnosis due to miss-sampling. In fact, it is not uncommon for patients to



undergo five sets of prostate biopsies and still to miss signs of PCa. Manual alignment systems, such as the Artemis biopsy tracking system that uses previously taken MRI images in combination with TRUS images, has shown that MRI-guided biopsies increased the accuracy of diagnosis of PCa. However, this strategy does not provide real-time data.

While CT, MRI, and PET are preferred methods to detect localised PCa, these non-invasive techniques often do not accurately detect or stage lymph nodal metastatic tumours and may not provide real time information during surgery. Thus sensitive and specific detection methods are needed to assess the primary and metastatic disease.

The range of treatments for prostate cancer

Treatments for prostate cancer range from “watchful waiting” to surgery, radiation therapy, hormonal therapy, chemotherapy, immunotherapy, cryotherapy and/or combination therapy. For optimal surgical resection of the cancerous tissue, it is important for surgeons to locate and remove the primary PCa mass with entirely negative margins with minimal damage to nerves in the prostate, that non-cancerous tissue be left intact, and that all lymph nodes harbouring metastatic cancer cells are removed.

Localised PCa, therefore, is commonly treated with radical prostatectomy either by partial or complete removal of prostate glands using, either open

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surgery or Da Vinci Robotic Surgery (Intuitive Surgical, Sunnyvale, CA) system. Radiation therapy and hormonal therapy, commonly in combination with surgery, have also been used to treat localised PCa. Consequently, palliative hormonal therapies are often preferred in lieu of above strategies.

Hormonal therapies involve chemical castration by exogenous administration of specific hormones, such as analogues of gonadotropin-releasing hormone and luteinising hormone-releasing hormone, to inhibit either the activity or production of testosterone. The production of testosterone can also be inhibited by androgen receptor blockers such as flutamide and bicalutamide. Unfortunately, advanced stage of PCa is androgen-independent; thus most of these cancers may be nonresponsive to hormonal therapy. Additionally, hormonal therapy may lead to liver damage, cardiovascular disease, weight gain, and osteoporosis. Treatment of metastatic PCa is then limited to chemotherapy that destroys rapidly dividing cancerous cells by inhibiting cell division and inducing apoptosis. Use of cytotoxic chemotherapeutics remains controversial due to their lack of tumour cell specificity, marginal efficacy, rapid clearance, poor aqueous solubility, etc. Moreover, collateral damage to healthy tissues by chemotherapeutic agents can lead to bone marrow suppression, hair loss, nausea, etc.

Improving diagnosis and therapeutics

To improve current diagnostic and therapeutic modalities for PCa, over 90 biomarkers related to the origin of PCa and disease progression have been evaluated. Even though its physiological function in PCa remains unclear,

Prostate-Specific Membrane Antigen (PSMA) is over-expressed on the cell surface of most PCa when compared to other PCa biomarkers, such as PSA and prostatic acid phosphatase. PSMA is also referenced as glutamate carboxypeptidase II, N-acetyl-L-aspartyl-L-glutamate peptidase I, or folate hydrolase 1 due to its expression in the central nervous system and small intestine. In the central nervous system, PSMA cleaves the neurodi-peptide, N-acetyl-aspartyl-glutamate, into glutamate and N-acetyl-aspartate. In the small intestine, PSMA cleaves the poly-γ-glutamate folate into glutamates and pterate.

Expression levels of PSMA markedly increase in the advanced stages of cancer and tumours that have metastasised to lymph nodes, bone, rectum and lungs. Recent findings demonstrate that PSMA is expressed in the tumour-associated neovasculature of several other solid tumours such as liver cancer, lung cancer, colon cancer, brain cancer, and kidney cancer. Several high resolution crystal structures of PSMA have been reported, with the active site occupied by either a ligand or unbound. As a therapeutic target, perhaps the most important characteristic of PSMA is that it undergoes internalisation through clathrin-coated pits and rapidly recycles to the cell surface for additional rounds of internalisation.

Due to its higher expression levels on PCa cells as well as in many other solid tumours, its ability to deliver drugs inside the cancer cells, and availability of its high resolution crystal structure, PSMA has gained attention as an attractive biomarker for targeted drug delivery. Therefore, PSMA-targeted antibodies, proteins, and small molecular ligands have developed to deliver therapeutic or imaging payloads to primary and



Sumith A. Kularatne, PhD, is the Vice President of Research & Development at OTL. He has pioneer experience in drug designing on both small molecule ligands – and antibody-targeted drugs under the guidance of Philip S. Low at Purdue University, West Lafayette, IN and Peter G. Schultz at The Scripps Research Institute, San Diego, CA. Dr. Kularatne's scientific efforts have resulted in 6 drug candidate in human clinical trials, over 50 US and foreign issued/pending patents and over 30 peer-reviewed publications. He has given multiple invited seminars/lectures in prestigious conferences as well as in multiple institutes and has received several international and national awards.

metastatic PCa and are currently evaluating in different stage of clinical trials.

ProstaScint (111In-CYT-356), anti-PSMA-monomethylauristatin E, EC0652 (DUPA-99mTc), YC-27 (Ligand-IR800CW), G-202 (Mipsagargin), EC1169 (DUPA-tubulysin B), DUPA-Hapten, and DUPA-antiCD3 Fab are some of the PSMA-targeted drug conjugated under clinical development.



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Tissue-scale factors in predicting cancer treatment outcome

Zhihui Wang and Vittorio Cristini provide evidence that could improve the success of treatment plans and make predicting cancer treatment outcomes easier

Current processes for creating cancer treatment plans are primarily based on empirical data from clinical trials, consensus expert panel guidelines, and limited laboratory-based testing. Physicians still face major challenges in successful prediction of the effectiveness of any particular treatment plan for any given patient, prior to actual treatment. Physical oncology is an integrated approach that focuses on developing mechanistic models to provide predictions of treatment outcomes based on biophysical and biological parameters that can be gained from individual tumours in specific patients. This approach can not only help improve treatment outcomes, but it could also benefit many cancer patients if incorporated into the creation of treatment plans.

Here, we provide evidence for improving cancer treatment plan efficacy, through the inclusion of mathematical modelling techniques, based on our capability to consider the multiple scales of the human body, (i.e., cellular, tissue, and organ) when predicting patient-specific treatment outcomes. We developed a mathematical model that accounts for diffusion on a tissue-scale, in addition to cellular and genetic influences, in order to bridge a gap in understanding and predicting tumour response to anticancer therapies¹. We extended a time-dependent model² by incorporating spatial dependence to describe perfusion and diffusion heterogeneities.

$$f_{\text{kill}}(t) = 1 - \frac{\frac{2}{\phi_0 L^2} \int_{r_b/L}^{r_b/(L\sqrt{\text{BVF}})} \phi(r, t) r dr}{\left(\frac{1}{\text{BVF}} - 1 \right) \frac{r_b^2}{L^2}}$$

By integrating the viable tumour volume fraction (BVF), at each time point over the cylindrical tissue domain surrounding a blood vessel and affected by the drug diffusion, we calculate f_{kill} as the ratio of the killed tumour volume to the total initial tumour volume:

As a function of parameters: r_b (blood vessel radius), BVF, and $L = \sqrt{D/(\phi_0 \lambda_u)}$ (the effective diffusion penetration length of the drug).

We performed a set of simulations with the time and space dependent model in a cylindrically symmetric domain surrounding a blood vessel. Model parameter values were set as follows: $L = 155.06 \mu\text{m}$ and $r_b = 15.83 \mu\text{m}$ – based on experimentally measured values in resected patient colorectal metastasis to liver tumours³ – giving $r_b/L = 0.102$; we also set $\text{BVF} = 10^{-2}$ as the reference value for the simulations, as measured BVF values ranged approximately from 10^{-3} to 10^{-1} .

To examine the impact of each parameter on f_{kill} , we simulated nine parameter-variation combinations, using three r_b/L values, i.e., 0.05, 0.1, 0.5, paired with three BVF values, i.e., 0.005, 0.01, 0.05. Figure 1 shows the numerical results of the model. In the presence of a boundary condition σ_0 at the vessel wall ($r = r_b$), successive cell layers next to the blood vessel die out (Fig. 1A) due to cell-death induced enhancement of drug penetration (Fig. 1B), in turn leading to accelerated cell kill (Fig. 1C). As cell kill occurs, tumour volume fraction ϕ decreases, leading to an increase in local drug concentration σ (because dead cells no longer uptake drugs), and thus accelerating cell kill in the locations further away from the vessel and deeper into the tumour.

As evidenced in this modelling study, we have shown that tissue-scale factors significantly affect a drug's ability to kill cancer. Focusing on this scale allowed us to observe the tumour microenvi-

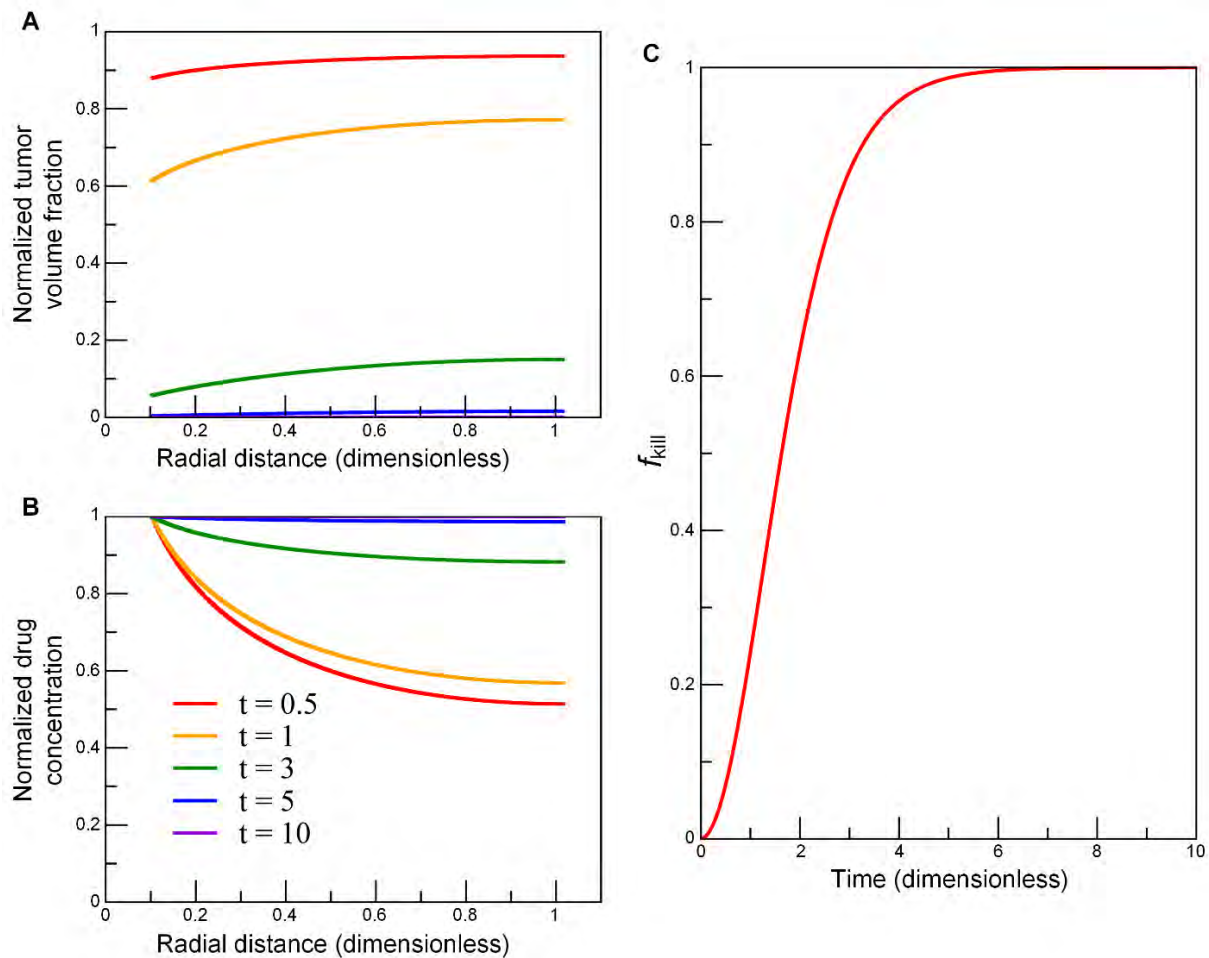


Figure 1: Numerical simulations of the model in a cylindrically symmetric domain. As cell kill ensues over several cell cycles, (A) successive cell layers next to the blood vessel ($r = r_b$) die out, i.e., tumour volume fraction ϕ decreases (top to bottom: $t = 0.5, 1, 3, 5, 10$); (B), local drug concentration σ increases due to an enhancement of drug penetration (bottom to top: $t = 0.5, 1, 3, 5, 10$); and (C) cell kill accelerates further from the vessel and deep into the tumour. Input parameters: $r_b/L = 0.102$ and $BVF = 0.01$. The duration of the entire simulation was $10 (\lambda_k \lambda_u \phi_0 \sigma_0)^{-1/2}$, where time unit is a characteristic cell apoptosis time. Drug concentration and tumour volume fraction were normalised by their initial values, and radial distance by the diffusion penetration distance L . The fraction of tumour kill f_{kill} is calculated from Eq. 1⁴.

ronment's impact on drug delivery, which revealed the presence of diffusion barriers, which prevent adequate concentrations of drug from reaching the tumour cells. Not only did we find that tissue-scale barriers impact drug delivery and effectiveness, but that diffusion barriers may be a main cause for drug resistance in many tumours. If the sources of drug resistance can be determined, it is our hope that researchers and physicians can create strategies to overcome them, thus drastically improving treatment outcomes.

1 Wang et al., PLoS Comput Biol 2016, PMC4902302

2 Pascal et al., ACS Nano 2013, PMC3891887

3 Pascal et al., PNAS 2013, PMC3761643

4 Reproduced from (Wang et al., PLoS Comput Biol 2016, PMC4902302).

Additional resources:

<http://physics.cancer.gov/>

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

<http://www.jci.org/articles/view/73455>

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

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

Diagnostic services for cancer under growing pressure

Improving cancer survival relies on earlier diagnosis, but diagnostic services are under growing pressure, as Cancer Research UK Policy Manager Sara Bainbridge explains...

There are more than 200 different types of cancer, so when someone sees their doctor with possible symptoms, getting the right diagnosis can be complicated. Diagnosing cancer early can make a huge difference – in some cases, survival rates are three times higher when the disease is diagnosed early.

So, to improve cancer survival, we need to make sure people get the tests they need at the right time.

Pathology plays a crucial role in cancer diagnosis and staging, helping to determine the best way to treat someone. Some types of pathology are more relevant to cancer, as they look at the biopsies of tumours (cellular pathology), blood samples (haematology) and the genetics of the cancer (molecular pathology).

But pathology – and other services providing diagnostic tests – are under pressure.

“Ensuring diagnostic services can cope with future demand is essential if we are to improve outcomes for patients through early diagnosis.”

Can we cope with the growing demand for pathology services?

Whilst cancer survival is at its highest ever level, our health services are under considerable pressure. Increasing cancer incidence, an ageing population, and efforts to improve outcomes mean that the demand for cancer diagnostics has never been higher. There were around 357,000 new cancer diagnoses in the UK in 2014 and this is set to increase considerably as we live longer – around half of us will be diagnosed with cancer in our lifetime.

Previous research has shown that endoscopy and

imaging services are performing more scans and tests than ever before, but they are struggling to meet demand. We’re hitting a diagnostic bottleneck with thousands of patients waiting too long for tests, results and to start treatment.

Ensuring diagnostic services can cope with future demand is essential if we are to improve outcomes for patients through early diagnosis.

Diagnostic services are all experiencing difficulties in staffing their services.

Our latest study has revealed that we face a severe crisis in pathology capacity within the next 5 to 10 years. There aren’t enough new pathologists in training to replace an ageing workforce. Immediate action is needed to avert a crisis in pathology capacity and ensure we have a service that is fit for the future. Without it waiting times are likely to increase as it takes longer to process and report all requests. This means more people will be left in limbo when they require tests, and it may delay a patients’ diagnosis and treatment.

What more could be done?

New approaches to diagnostic services, including pathology, need to be explored. This might mean different team-working, so that biomedical scientists or more junior doctors take on new tasks. There should also be efforts to network and consolidate services – which could improve efficiency by sharing test results and resources to reduce duplication.

We also want to ensure that pathologists still have time to take part in teaching and research. The discoveries of the future can only be achieved with the input of pathologists – people working in the NHS need the time and flexibility to undertake clinical research.



It is important to look ahead at the growing demand for cancer diagnosis, and changes to the types of tests we need, and plan the workforce accordingly. It takes over 10 years to fully train doctors to consultant level, so making sure our cancer services can deliver world-class outcomes in the future will need a long term strategy.

“Whilst cancer survival is at its highest ever level, our health services are under considerable pressure. Increasing cancer incidence, an ageing population and efforts to improve outcomes means that the demand for cancer diagnostics has never been higher.”

By 2020, over 750,000 extra endoscopies will need to be performed every year – that’s the equivalent of the population of Leeds. This rising demand has led to the government pledging more funding and starting a training scheme for 200 more non-medical endoscopists in the

next couple of years. But we need similar action to be taken for those involved in imaging and pathology, so that there are enough staff in the short term. Without enough workforce, we will be letting down patients who deserve the best chance of survival through getting the tests and treatment they need, on time. ■

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Sara Bainbridge
Policy Manager

Cancer Research UK
www.cancerresearchuk.org
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Innovative oncology drug development: Why not children?

SIOPE asks why therapies made available for adults are not extended to children with cancer, and why paediatric oncology drug development is lagging behind...

Thanks to the increasing introduction of molecular targeting and personalised medicine strategies, innovative medicines and treatments are nowadays available for adults with cancer. Widespread access to these therapies could also treat children and adolescents diagnosed with this disease, and even reduce the long-term side effects of current treatments.

However, despite the potential of these therapies to target paediatric malignancies, innovation in the research and development of new cancer medicines for children and adolescents has not been sufficient. Today, fewer than 1 in 10 children in relapse with a terminal cancer have access to these therapies. At the same time, cancer is still the leading cause of death by disease among children over 1 year of age, with 6,000 young people dying of cancer every year in Europe. Why is it that children do not have access to these innovative therapies?

“In December 2013 SIOPE, Innovative Therapies for Children with Cancer (ITCC) and the Cancer Drug Development Forum (CDDF) launched the multi-stakeholder platform ‘ACCELERATE – Innovation for Children with Cancer’, to facilitate a sustained interaction and support the stakeholders’ joint efforts to analyse the current situation, identify bottlenecks and design solutions to improve new oncology drug development for children and adolescents.”

Paediatric drug development in Europe is currently regulated by the EU Regulation on Paediatric Medicines (EC No 1901/2006), and in 2017 it will be 10 years since it came into force. Although the regulation helped to speed up paediatric drug development, the European



Instant from the ACCELERATE Paediatric Oncology Conference 2016

Society for Paediatric Oncology (SIOPE) observes that medicines, options and investments to cure childhood cancers have not been sufficient so far.

Oncology drug development targeted at adult cancers

During these years, pharmaceutical companies made insufficient efforts to investigate and develop drugs for the paediatric population, and oncology drug development is still mainly driven by the adult cancer “market”. More specifically, companies often obtained waivers from the obligation to investigate the potential benefit of a drug in a child, if the cancer for which the drug was originally developed in adults does not exist in children. In practice, however, such drugs can still be used to treat other childhood cancer types (for example, a new drug for adult lung cancer can benefit children with neuroblastoma).

Significant changes and meaningful incentives are therefore urgently needed to give children and adolescents suffering from this disease better chances to survive and thrive. Interestingly, the past 10 years

Continued on page 28 →

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INNOVATION FOR CHILDREN AND ADOLESCENTS WITH CANCER

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Anyone interested in developing new life-saving medicines for children and adolescents with cancer should attend the conference :

- To discuss successes and failures in paediatric development, and share new initiatives in clinical development
- To discuss the strategies to accelerate new oncology drug development
- To share and discuss the 10 years' report and changes in the regulatory environment
- To share and harmonize with the US, Canada, Japan, and Australia
- To further strengthen the collaboration between all stakeholders at international level (Parents, Academia, Regulators, Pharmaceutical Industry)

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← Continued from page 26



MEP Elena Gentile (S&D, IT) and MEP Renata Briano (S&D, IT) supporting the SIOPE plea for a revision of the Paediatric Medicines Regulation



Instant from the last edition of the ACCELERATE Paediatric Oncology Conference

were also marked by a close interaction between all the stakeholders who wanted to improve the regulation in this direction: Academic researchers and health-care professionals; pharmaceutical representatives; officers from the drug regulatory agencies in Europe; and patient/parent advocates.

“Today, fewer than 1 in 10 children in relapse with a terminal cancer have access to these therapies. At the same time, cancer is still the leading cause of death by disease among children over 1 year of age, with 6,000 young people dying of cancer every year in Europe. Why is it that children do not have access to these innovative therapies?”

In December 2013 SIOPE, Innovative Therapies for Children with Cancer (ITCC) and the Cancer Drug Development Forum (CDDF) launched the multi-stakeholder platform ‘ACCELERATE – Innovation for Children with Cancer’, to facilitate a sustained interaction and support the stakeholders’ joint efforts to analyse the current situation, identify bottlenecks and design solutions to improve new oncology drug development for children and adolescents.

Improvements to the EU regulation on paediatric medicines

After an intensive advocacy campaign, on 15th December 2016 SIOPE together with the ACCELERATE partners and Cancer Research UK welcomed the adoption of a new European Parliament resolution seeking to improve the current EU Regulation on Paediatric Medicines. This

resolution aims to limit waivers to the obligation to investigate drugs for children and calls upon the European Commission to modernise the current legislation and facilitate a rapid and better prioritised development of innovative therapies, ensuring that it goes as far as it can for children with cancer across Europe.

All these recent developments, as well as the next steps to be taken will be discussed at the upcoming ACCELERATE Paediatric Oncology Conference, which will take place on 2-3 March 2017 in Brussels.

Formerly known as the CDDF-ITCC-SIOPE Paediatric Conference, it represents the occasion for high-level experts to reflect upon successes and failures in paediatric development, share new initiatives in clinical development, discuss proposals on how to accelerate paediatric oncology drug development, and comprehensively review the 10 years’ report on the EU Paediatric Regulation. Everyone with a sheer interest in this topic is very welcome to attend this event, which will potentially make a breakthrough in public awareness on this important issue. ■



SIOPE – the European Society for Paediatric Oncology
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The obesity epidemic and cancer: A disaster in the making?

IARC's Véronique Terrasse highlights the link between the growing obesity epidemic and cancer in countries around the world, with some alarming statistics...

The obesity¹ epidemic is reaching alarming proportions in many countries and has become a major public health concern in both developed and low and middle-income countries (LMICs).

Indeed, the prevalence of obesity worldwide has more than doubled since 1980. In 2014, more than 1.9 billion adults were overweight, and of these, over 600 million were obese.

Obesity is an important risk factor for non-communicable diseases, such as cardiovascular diseases and diabetes, but its impact on cancer is also particularly concerning. Unless the obesity epidemic is curbed, the public health repercussions may be severe, as the growing number of obesity cases is most likely to translate into a steep increase of obesity-related cancers.

Proportion of cancers attributable to obesity

The latest available data show that nearly half a million cancers worldwide are due to overweight/obesity, representing an estimated 3.6% of all new cancer cases in 2012. Women are disproportionately affected by obesity-related cancer, and cancers of the endometrium, colon, and postmenopausal breast account for almost three quarters (73%) of all cancers linked to high BMI in women.

Cancers caused by obesity remain far more common in more developed countries than in LMICs. In North America, the burden of obesity-related cancer is very high, with 6.4% of new cancer cases being attributable to overweight and obesity. In Europe, the proportion of cancers due to overweight and obesity is also large, particularly in Eastern Europe with 6.5% of all new cancer cases in that region.

But LMICs are dangerously catching up with a striking rise of obesity-related cancers.

In Latin America, Argentina, Uruguay and Chile have the highest cancer burden attributable to overweight and obesity in the region, with 6.8%, 6.4% and 5.7% of new cancer cases, respectively.

Whereas in South Africa, 3.8% of cancers are attributable to obesity.

In Western Asia, parts of the Middle-East are particularly affected, such as Saudi Arabia, with a stunning 6.8% of cancers caused by obesity.

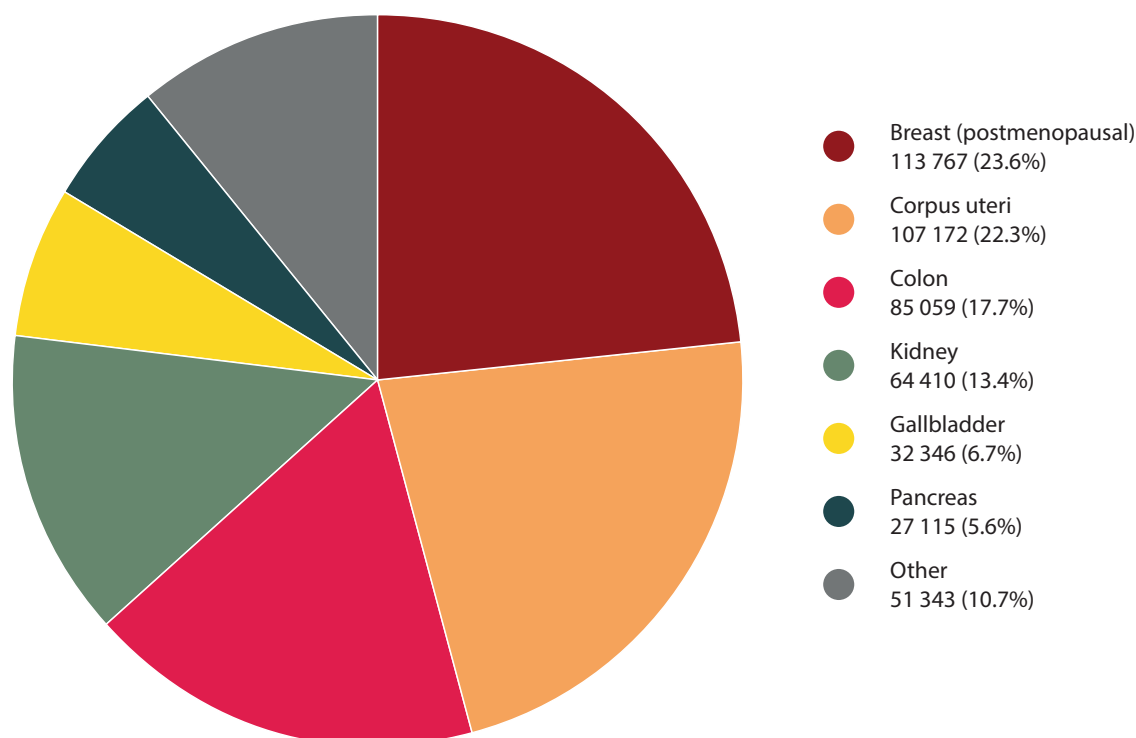
"The rapid economic growth and urbanisation in low- and middle-income countries have resulted in changes in lifestyle, dietary habits and physical activity," explains Dr Isabelle Romieu, who coordinated an IARC publication on Energy Balance and Obesity, which will be published later this year.

"Traditional dietary patterns are being replaced with increased consumption of processed foods and sugary drinks, high in energy content and poor in micronutrients. This, along with a reduction in physical activity and an increase in sedentary behaviours across all ages, explains the striking increase in obesity, hence the rise of obesity-related cancer in these countries."

Obesity and cancer sites

In 2016, the IARC Handbook of Cancer Prevention Vol. 17: Body Fatness re-evaluated the link between overweight/obesity and reconfirmed that overweight/obesity was a risk factor for cancers of the colon and rectum, oesophagus (adenocarcinoma), kidney (renal cell carcinoma), breast in postmenopausal women, and endometrium of the uterus. In addition, it also concluded that overweight/obesity caused cancers at 8 more sites than previously thought, such as the gastric cardia, liver, gallbladder, pancreas, ovary, and thyroid, as well as meningioma and multiple myeloma.

Image: © WHO 2017



Cancer cases (at all anatomical sites) among both sexes (worldwide) in 2012 attributable to excess body mass index, shown by anatomical site as percentages of the total number of all such attributable cases at all anatomical sites in this population

Obesity in children and future cancer cases

The tide of obesity cases is rising not only in adults but also in children. Indeed the number of children affected has also significantly increased over the years. In 2014, there were 41 million overweight children under the age of 5 years worldwide, about 10 million more than there were 2 decades ago. A recent UNICEF report shows that the number of overweight children in LMICs has more than doubled since 1990, from 7.5 million to 15.5 million. In 2014, almost half of these lived in Asia and one quarter lived in Africa.

The link between obesity and cancer has long been established in adults but there is less data available for children. Also studies showed that obese children are at a higher risk of becoming obese as adults. Data in children, adolescents and young adults showed that obesity at those ages leads to cancers in adult life at the same sites as obese adults, except for postmenopausal breast.

“Obesity has become a major public health concern worldwide, and as the epidemic continues to spread, the number of people who suffer from obesity-related diseases, including cancer, will rise” stresses Dr Béatrice Lauby-Secretan, in charge of the IARC Handbooks of Cancer Prevention Series.

“These patients will require long and expensive treatment and care and this is particularly concerning for developing countries, with limited resources. It is urgent that all possible measures are taken now to help people keep a healthy weight.” ■

1 Body fatness is assessed primarily by body mass index (BMI), defined as a person's weight in kilograms, divided by the square of their height in metres (kg/m²). In adults, overweight is defined as BMI ≥ 25 kg/m², and obesity as BMI ≥ 30 kg/m².

International Agency for Research on Cancer



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Disease-associated myosteatorsis in people with cancer: Can it be treated?

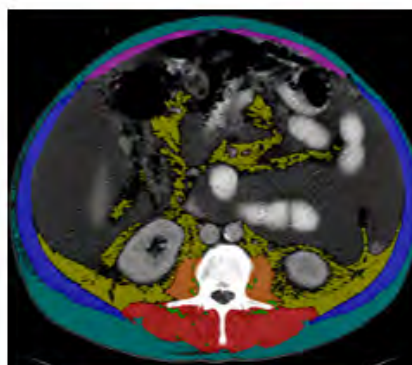
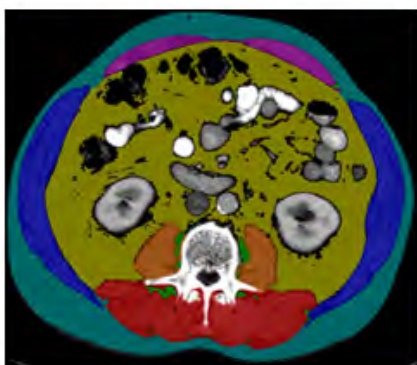
Pathological fat infiltration into muscle is a feature of disease-induced muscle loss that significantly associates with shorter survival in people with cancer. Fat is associated with skeletal muscles in the form of intra-myocellular lipid droplets within the cytoplasm of myocytes as well as intermuscular adipocytes. These lipid stores are thought to provide fuels for skeletal muscle contraction, however, excess deposition of triglycerides within cells and organs that normally contain only small amounts of fat (such as liver, pancreas, skeletal and cardiac muscle) is defined as steatorsis. Myosteatorsis (steatorsis of the muscle) is a pathological phenomenon reflecting an impairment of synthesis and elimination of triglyceride.

Myosteatorsis is revealed in vivo by computed tomography (CT) imaging as muscle with low radiodensity combined with presence of intermuscular adipose tissue. The evidence for a relationship between low muscle radiodensity and shorter survival in people with cancer is building. Loss of skeletal muscle mass appears to generally occur with accumulation of adipose tissue into muscle. We reported that patients undergoing treatment for lung cancer lost muscle mass and concurrently gained intermuscular adipose tissue during treatment for cancer, whereas patients who supplemented their daily intake with fish oil containing eicosapentaenoic acid and docosahexaenoic acid [EPA+DHA (2.2 g/day)] maintained or gained muscle

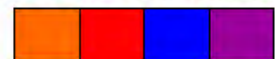


This slide shows a CT image from a cancer patient who underwent 16 weeks of first line platinum doublet chemotherapy for lung cancer. Only the intramuscular adipose tissue is shown in color

mass and experienced a decline in intermuscular adipose tissue over the same time period. This intervention also resulted in a greater response by the tumor to the drugs being used to



Skeletal Muscle

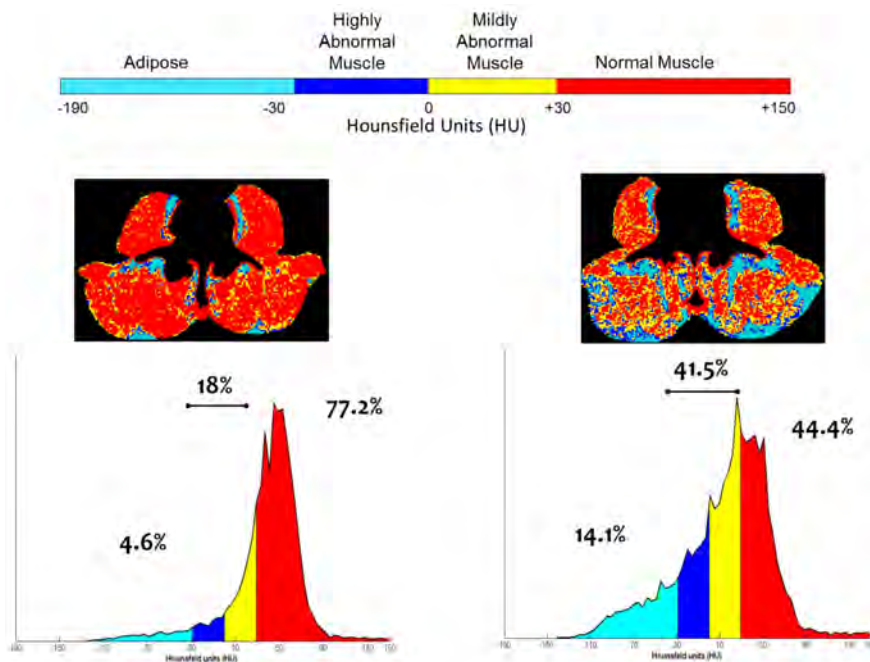


Adipose Tissue



To quantify different tissues for body composition analysis using computed tomography imaging, a bony landmark is used to consistently measure the same region of the body across patients. The 3rd lumbar vertebrae is an established landmark in body composition analysis that correlates with amount of whole body muscle and fat. Each tissue attenuates radiation in a specific way which is recognised by a software program to enable skeletal muscles and different types of adipose tissues to be identified. Each tissue of interest is then color coded (see legend). When more than one CT image exists in the patient record, tissue changes over the trajectory of the disease can be determined. This image presents 2 scans taken approx 6 months apart at the same region within the same patient. The marked decline in muscle and adipose tissue is evident, concurrent with deposition of adipose tissue into muscle

Illustration of Variation in Muscle Radiodensity



An illustration of annotated CT images, and accompanying histograms of radiation attenuation showing the percentages of total tissue cross-sectional area within the ranges of adipose tissue in paraspinal/psoas muscles is useful to understand the problem of myosteatorsis. This illustration shows the percentages of total tissue cross-sectional area within the typical attenuation ranges determined for the respective tissues for 2 subjects. Subject 1 is a 63 year old male with muscle characteristics at the median values for male cancer patients with a diagnosis of solid tumor at our centre. For Subject 2 there is extensive macroscopic adipose tissue and less than half of the cross sectional area of his muscles falls within the normal attenuation range. Overall, Patient I has a greater proportion of fat and low attenuation muscle, than muscle with normal characteristics. Patient II is remarkable in several respects, including extensive visible fatty infiltration and extremely high proportion of total muscle area falling within a range of attenuation values generally recognized to be abnormally low (adapted from Aubrey et al 2014)

treat the cancer. Therefore there may be multiple benefits of dietary fish oil to the cancer patient undergoing treatment.

To explore these observations that cancer patients supplementing with EPA+DHA experience an improvement in myosteatorsis, we established a pre-clinical model to enable intervention with EPA+DHA at various time points in the cancer trajectory. We used an rat model bearing the Ward colorectal tumor and treated in a manner that mimics standard clinical care for this disease in humans with respect to the types of drugs used and the toxicities they evoke. Using this model we have demonstrated that the results align with our human data suggesting an improvement in muscle condition concurrent with a better response by the tumor to the anti-cancer drugs.

Using this as the rationale for the next step of this line of questioning, we have planned a clinical trial upon which to test the biological efficacy of fish oil to reverse cancer- associated myosteatorsis in a cancer population known to exhibit myosteatorsis, verified by in vivo imaging of muscle features by CT scan. At the time of diagnosis and treatment planning, patients will be randomized and consented to consume EPA+DHA (2.2 g per day) until day of surgery (at least a 4 week period) or receive standard of care (no intervention). Muscle from the subjects will be collected at the time of surgery and prepared for analysis. Analysis of the muscle tissue will enable determination of differences in Triglyceride-fatty acid content (a hallmark of myosteatorsis). We expect that this research will verify the tantalizing evidence we have in hand that

suggests an improvement in pathological features of myosteatorsis by dietary EPA and DHA. If so demonstrated, this work will provide critical translational knowledge required to effectively plan treatment interventions that have significant potential to impact the lives of people diagnosed with cancer, a major cause of death globally.



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An ounce of prevention, a pound of cure: What makes successful obesity policies?

Philip Sherman, Mary-Jo Makarchuk and Keeley Rose at the Canadian Institutes of Health Research, highlight the need for research to inform successful obesity policies...

Obesity is a chronic condition in which excess body fat is associated with impaired health. Rates of obesity have risen in Canada over the last 2 decades¹; it is estimated that 1 in 4 Canadian adults and 1 in 7 Canadian children are now obese². Rates of obesity vary by geographical area and in specific populations, such as in Indigenous Peoples^{1,3}.

Concern about obesity rates is not limited to Canada. Worldwide obesity rates have been rising globally since 1980, with an estimated 600 million people globally estimated to now be obese⁴. Although obesity is generally associated with higher income countries, rates of obesity are also increasing in low and middle income countries⁴. Recognising the impact of rising obesity rates around the world, in April 2016 the UN General Assembly declared a Decade of Action on Nutrition (2016-2025), calling for the reversal of rising trends in overweight and obesity and reducing the burden of diet-related, non-communicable diseases across all age groups⁵.

Obesity is a risk factor for the development of chronic diseases such as stroke, heart disease, type 2 diabetes, osteoarthritis, and cancer,^{2,4} which have the potential to negate health advances that have contributed to increased life expectancy over the last century. In addition, those with obesity face physical and emotional consequences of stigma and discrimination associated with their body weight⁶. In Canada, the significant economic costs of obesity include direct costs such as the costs to treat obesity-related health conditions, and indirect costs such as workplace absenteeism, disability, and premature mortality^{1,2}.

It is recognised that multiple factors – including biological, behavioural, and societal factors – contribute to obesity. As a result, interventions at multiple levels



(including individual, organisational and community levels) will be required to address the challenges of obesity^{1,7}. Additional research is needed to support this multi-tiered approach, with focus on understanding the underlying causes of obesity and developing more effective preventative strategies and treatment interventions. For example, numerous animal studies suggest a role for the gut microbiome in obesity, but more work needs to be done to establish the role of microbiome in human obesity and determine whether microbiome-based interventions can be used to either prevent or treat obesity. Evidence to inform the development of effective population health interventions is also greatly needed, particularly evidence to inform effective interventions that target health inequities.

Translating research into policy

The Canadian Institutes of Health Research (CIHR), the Government of Canada's health research investment agency, supports health research across 4 health research themes (biomedical, clinical, health services, and population health research). Obesity has been a strategic focus of the CIHR Institute of Nutrition Metabolism and Diabetes (INMD) since 2001⁸. As a result of targeted investments in research, Canada is now inter-

nationally recognised for producing excellent and highly impactful research in the field of obesity⁹. To support the development of evidence to inform policy and treatment, CIHR will continue to fund research on obesity and healthy body weight and to mobilise knowledge for effective preventive and therapeutic interventions and public health policies.

“Concern about obesity rates is not limited to Canada. Worldwide obesity rates have been rising globally since 1980, with an estimated 600 million people globally estimated to now be obese⁴. Although obesity is generally associated with higher income countries, rates of obesity are also increasing in low and middle income countries⁴.”

The Government of Canada is taking actions to address the challenges of obesity in Canada, including initiatives related to nutrition. For example, in October 2016, the Honourable Jane Philpott, Canada’s Minister of Health, launched the Healthy Eating Strategy for Canada that contains elements to support the maintenance of healthy body weight, including the revision of Canada’s dietary guidance, improving food labelling, and restricting the marketing of unhealthy food and beverages to children. In addition, CIHR and Health Canada, have partnered to support research on dietary sugars and health outcomes, as well as population level approaches that could contribute to reduced consumption of sugars. ■

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Optimising the menstrual cycle: Fact not fiction

Researchers at the Human Performance Laboratory are separating the fact from the fiction when it comes to optimising the menstrual cycle of female athletes

Athletes, coaches, and sport physiologists know that the menstrual cycle can impact athletic performance, positively and negatively, despite limited research. In the mid-80s, female athletes were overlooked for research studies because of the challenges and complexity of measuring hormones. I wanted to investigate biomarkers associated with overtraining in rowers, specifically females. An important research component would be understanding how hormonal responses impact the metabolic stress of exercise. My graduate supervisor, however, said it would be too difficult and costly to measure the many factors affecting menstrual cycle characteristics.

Menstrual 'cycle'

A quick review highlights that the idealised model of cycle length is 28 days. In the follicular phase, days 1-13, the pituitary gland stimulates egg development through estrogen production. After the egg is released the ovary produces the hormone progesterone to ready the uterine lining for implantation. Days 13-15 are the ovulatory phase. The luteal phase, days 16-28, is dominated by progesterone and follows post ovulation. Ovulatory disturbances include cycles where no egg is released, (anovulation) or shorter or longer follicular and luteal phases. Throughout the cycle, the luteinising hormone (LH) is secreted and controlled by the hypothalamic-pituitary-

ovarian (HPO) axis. Energy balance factors associated with caloric intake, low body fat and weight restriction, influence the ability of the HPO-axis to withstand the stress brought on by exercise (Loucks & Horvath, 1985). Subsequently, a negative energy balance results in ovulatory disturbances including amenorrhea (periods are absent), which often associated with the Female Athlete Triad.

The female athlete 'triad'

The triad is a combination of energy deficiency, ovulatory disturbances, and bone loss (osteoporosis) or bone weakening (osteopenia). Triad research in the early 90s was focused on athletes participating in aesthetic (gymnastics, figure skating, and ballet) and endurance sports (cross country skiing and running). At the time, I was the sport physiologist for the national ice hockey team. We investigated energy expenditure and the metabolic-hormonal profiles of elite ice hockey players (HG) and non-athlete but active university students (CG) (MacDonald & Doyle-Baker, 2000, 2001). We measured luteal phase length using basal body temperature (BBT). This method coupled with keeping a menstrual cycle diary was too time intensive for the HG, with only a 28% completion rate versus 70% with the CG. Our data suggested that although HG and CG were in a chronic state of negative energy balance, they did not exhibit a loss of body weight or percent body fat, commonly associated with disor-

dered eating practices and the triad. But they did have varying cycle lengths.

'Cycle' length

The mean cycle length for both groups was within the defined range of a typical length, 21-36 days (Munster et al., 1992). The maximum cycle length of both groups, however was suggestive of the occurrence of oligomenorrhea, i.e. greater than 36 days. Similarly, the minimum cycle length was indicative of polymenorrhea, i.e. less than 21 days, but was only observed in the HG. Both groups were classified as having short luteal phases (less than 10 days), with the mean luteal phase length for the CG slightly less than that of the HG. Anovulation occurred in 50% of HG and 43% of CG cycles. Overall, the HG group exhibited slightly longer cycle lengths when compared with the CG. These results loosely supported Loucks and Thuma's seminal research to show that low energy availability, not necessarily the stress of exercise or athletic involvement, was the factor responsible for altering the LH pulsatility in exercising women (2003).

Energy availability

We continued to ponder the idea of energy availability in the menstrual cycle from a substrate utilisation and fuel perspective for a decade before embarking on more research. Estrogen is well known to reduce carbohydrate oxidation and increase free fatty acid



availability, and progesterone promotes protein catabolism. Therefore, hormone fluctuations high or low during the menstrual cycle may influence: 1) endurance and high intensity exercise performance and 2) the trainability of muscle strength and increase in muscle mass. Hormones also play a role in fluid regulation measured by blood plasma volume (hematocrit). When hormones are high, estrogen and progesterone may contribute to a decreasing plasma volume resulting in blood viscosity changes (hemoglobin). Based on the above, we hypothesised that in a 4-week training study aerobic fat oxidation would be improved during the luteal phase when compared to the follicular phase (Minichiello et al., 2016).

Training study

Recreationally trained eumenorrheic (menstruating) cyclists ($n=8$, 46.0 ± 5.1 years) were recruited in Calgary Alberta. Weekly performance testing was accompanied by 'day of cycle', urine colour selection, body composition, hematocrit and hemoglobin measures. To mimic training intensities two

workloads below ventilatory (anaerobic) threshold were used maximizing fat burning (approximately 60% $\text{VO}_{2\text{max}}$) and two mean max power (MMP) tests (6 and 60 second) were used for power output measures. Fat oxidation mean results were significantly different ($p<0.05$) over the four weeks specifically between week 1 and 4 and week 3 and 4. The six second MMP test showed no significant difference with means of 747.25 watts, 718.00 watts, 751.88 watts, and 715.63 watts for weeks one through 4 respectively. Although inconsistencies occurred throughout the 4-weeks, these findings suggest a trend towards improved fat burning during the luteal versus the follicular phase. More training studies with larger numbers are needed to fully understand the effect of menstruation on sport performance determinants such as fat oxidation and power output.

Menstruation and sport performance

The combined research and anecdotal evidence I have heard as a sport physiologist identifies that the menstrual

cycle effect on sport performance is not science fiction. After three decades of menstrual cycle research there is no clear consensus but agreement exists that substrate availability and fluctuating hormone levels play an important role particularly in endurance performance (Abdollahpor et al., 2013; Oosthuysen and Bosch, 2010). There is complexity in measurement, which is influenced by individual variability, a fact identified in the 80s by my supervisor. Verification difficulties in hormones and cycle length have been lessened with cost effective mobile device apps that chart BBT and urine based ovulation tests. Despite these advances the underrepresentation of females in sport research related to the perceived barrier in menstruation, unfortunately still exists (Costello et al. 2014).



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WHO's European Food and Nutrition Action Plan 2015-2020

Programme Manager João Breda explains the likely repercussions of the WHO's European Food and Nutrition Action Plan 2015-2020...

With the unanimous adoption of the World Health Organization's (WHO) European Food and Nutrition Action Plan 2015-2020 at the 64th session of the Regional Committee for Europe, countries have taken a further decisive step towards promoting healthy diets and addressing the alarming rates of obesity that we witness across the WHO European Region. The Action Plan proposes a large number of policies to help citizens from all groups to achieve better diets and maintain a healthy weight.

The connections between energy-dense diets, excess consumption of fat, trans-fats, free sugars and salt, low consumption of fruit and vegetables, and the increased burden of obesity, cardiovascular diseases, diabetes and some cancers, is very clear. Based on data from the WHO Childhood Obesity Surveillance Initiative (COSI), on average one in three children aged 6-9 are overweight or obese in the countries studied. WHO data also shows that more than 50% of adults are overweight or obese in 46 countries across Europe. More worryingly, the problem is disproportionately affecting our most vulnerable groups in society and is advancing more rapidly in the eastern part of the WHO European Region.

Governments at national and local levels can contribute to improving the diets of their population through changes to the wider environments and contexts in which we make our daily food choices. Such policies will influence the ways in which foods are promoted, their availability in different settings, and – in some circumstances – their affordability. Specific policy options highlighted in the action plan include stronger restrictions on the marketing of foods high in saturated fat, free sugars and salt to children, the promotion of better labelling on the front of food packages, and strict standards for the foods available in schools.

Furthermore, the elimination of industrially-produced trans-fats is possible and called for by many stakeholders including the food industry in many countries.

The action plan further underlines important actions at key stages throughout the life course, in order to maximise impact. These stages range from the protection and promotion of exclusive breastfeeding, to the improvement of the baby food market landscape, which is full of sugar, to the increase of intake of fruit and vegetables. Collaboration within and beyond the health sector is also central. Delivery of the action plan will require multiple actors from the education, agriculture, finance and planning sectors to name just a few.

The 5 priority areas of the action plan

Because its overall mission is so broad, the action plan has been subdivided into 5 key priority areas. These are likely to be effective in promoting healthy diets when implemented collectively.

- **Create healthy food and drink environments.** Arguably the most important to the food industry, this part of the plan has implications for marketing practices and product reformulation. With an eye to reduce childhood obesity, it aims to control food advertising aimed at children, as well as improving school nutrition policies. Further points include addressing product labelling (see clean label feature on pX) and fostering healthy retail environments.
- **Promote the gains of a healthy diet throughout life, especially for the most vulnerable groups.** This entails taking a lifecycle approach to nutrition, beginning at pregnancy and continuing to old age. It means dismantling barriers to breastfeeding, improving food and nutrition education and addressing the spe-



cial nutrition needs of vulnerable groups, including older people in care.

- **Reinforce health systems to promote healthy diets.** This aims to ensure that all healthcare settings remain committed to health promotion, and that healthy eating is a priority, e.g. by providing nutrition counselling or nutritional intervention procedures to those who need it.
- **Support surveillance, monitoring, evaluation and research.** This involves consolidating and extending existing monitoring and surveillance systems, which log factors such as childhood obesity. Through improving the use of available data, it will be possible to develop policies that better target the most vulnerable groups.

- **Strengthen governance, alliances and networks to ensure a health-in-all-policies approach.** If food-related policies are to have any impact, they need to be internally consistent and coherent. This part of the plan aims to ensure that countries take a coordinated regulatory approach, enabling multi-stakeholder action. ■

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Promoting
a sustainable change
towards healthy lifestyles
with an holistic and
multidisciplinary approach



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eHealth[®]

Promoting sustainable healthy lifestyles with a holistic and multidisciplinary approach

The PEGASO project is helping address the global obesity epidemic by promoting change towards sustainable healthy lifestyles, as Renata Guarneri describes

The increasing prevalence of overweight and obesity among children and adolescents reflects a global 'epidemic' worldwide. Obesity in younger age groups has been recognised as an alarming key predictor for obesity in adulthood, with greater risk of social and psychological problems. Addressing the obesity issues requires a comprehensive approach, taking into account the individual's physical-physiological characteristics, personality, as well as the social and psychological environments influencing decisions and habits in their everyday life.

Challenging teenagers in their own fields of interest, PEGASO – Fit 4 Future is an EU funded project that aims to promote a sustainable change towards healthy lifestyles, with a holistic and multidisciplinary approach.

PEGASO is an ICT-based system that motivates behavioural changes towards healthy lifestyles thus preventing overweight and obesity in the younger population. Its framework is developed along 3 main dimensions:

- **Individual and environmental monitoring** – using wearable sensors, mobile phones, as well as multimedia diaries for the acquisition of physical, behavioural and emotional attitude of adolescent;
- **Feedback system** – providing feedback in terms of "health status"

changes, required actions to undertake, proposing personalised healthy options for alternative lifestyles;

- **Social connectivity and engagement** – addressing social networking strategies for users to share their experiences in a community of peers through different gaming strategies.

In order to effectively address challenges and achieve objectives, PEGASO activities have been organised according to the following workflow:

- **Iterative service design and user/customer requirements:** The requirements were prioritised and a set of technical features has been identified. This activity has been performed in cooperation with the development of the virtual individual model;
- **Development of SW/HW components and modules:** The set of activities which addresses the different technology aspects of PEGASO;
- **Integration of the PEGASO System:** Integration workshops provided the opportunity to perform retrospective analysis. An integrated set of features constitutes the PEGASO prototype and is now ready for the pilot phase;
- **Evaluation and user/customer feedback:** This phase will generate insights about the service from a user point of view and will feed-back

in a new updated loop. The PEGASO system has been released and the full pilots have been launched in 3 different countries. The pilot will provide feedback on the medical side and will be used to evaluate PEGASO with regard to the key objective of impacting young people lifestyle.

PEGASO project is expected to have effects in reducing overweight, obesity and associated diseases and social costs leveraging the possibilities offered by innovative ICT as well as teens' affection to mobile and social network.



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Therapies for weak muscles

Research into personalised interventions is helping pave the way for a new generation of therapies for weak muscles at the Balgrist Campus

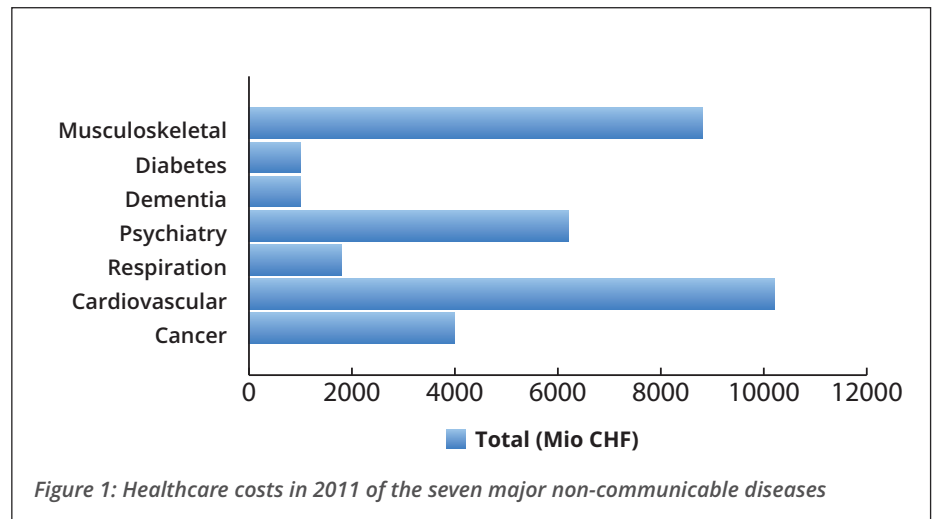
It is estimated that 10% of the cost of healthcare in Switzerland (or the equivalent of €500 billion per annum in the EU) being associated with lost work is related to injury or dysfunction of the musculoskeletal system (Fig. 1). Surgical and subsequent rehabilitative interventions are important part of the therapy that re-establishes musculoskeletal function.

The Laboratory for Muscle Plasticity at Balgrist University Hospital aims to shed light on the underlying mechanisms in skeletal muscle with the goal of translating the findings into more effective clinical applications.

Skeletal muscle plays a major part in control of movement and posture and affects whole body metabolism through its effects on energy expenditure. Affections ranging from simple overuse injury to rupture of tendons and bones, or disease, lead to deconditioning of skeletal muscle as a result of inactivity and damage signals. The consequent loss in muscle strength and fatigue resistance exerts a distinct negative impact on the quality of life and may render the affected individual dependent. In these situations a surgical intervention and rehabilitation may be indicated, yet may come too late as irreversible changes may have resulted.

Focus on muscle plasticity

The Laboratory for Muscle Plasticity investigates the mechanisms that



underlie the conditioning of skeletal muscle structure and function during recovery from surgical interventions and rehabilitation. As shown through research on sport performance, this process is driven by mechanical and metabolic stimuli. It is mediated through a gene response that instructs adjustments in muscle composition with the repeated impact of exercise during training. In consequence, force production and fatigue resistance of muscle may be improved or maintained.

By contrast, a muscle's functional capacity is reduced in the absence of a physiological stimulus by a reduction in the size of muscle fibres and their content in mitochondria (Fig. 2).

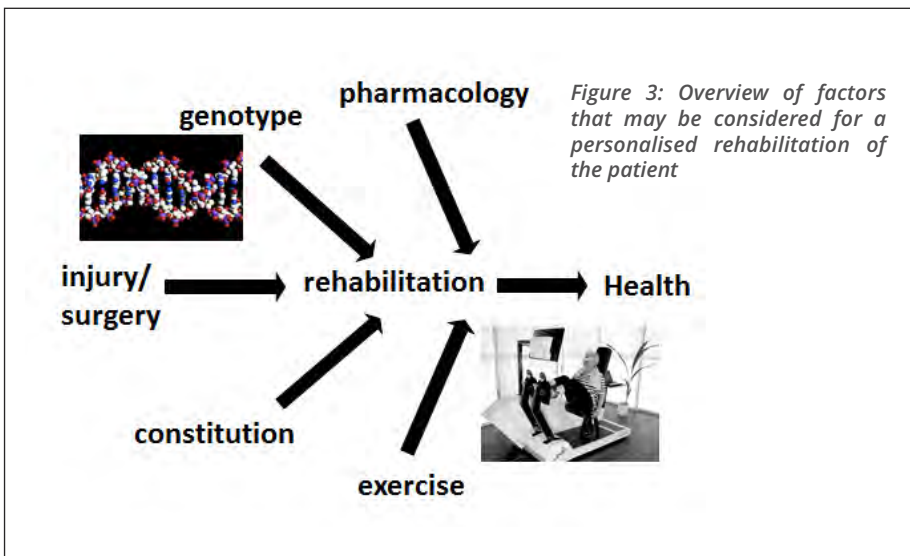
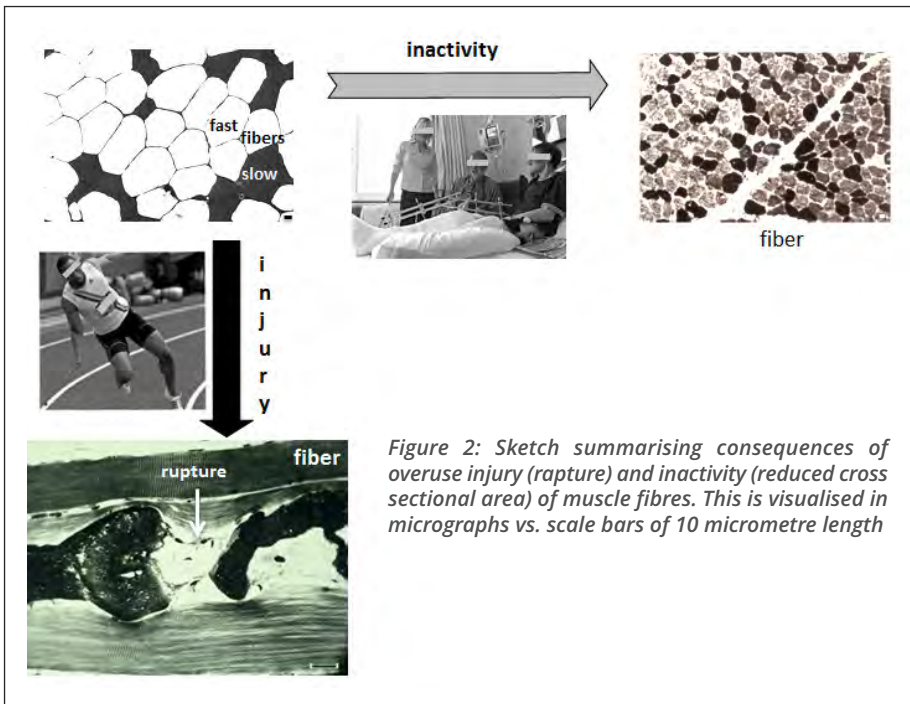
In fact, while the safety and effectiveness of physical factors for muscle conditioning are well established, the dose-effect relationship between

exercise and muscle adaptation is often not fully respected in clinical practice. An example of this biological regulation is the important role of muscle contraction and loading in preserving muscle mass of the bedridden musculoskeletal patient after surgery, who would otherwise lose muscle mass at a pronounced rate. Genetic factors (so called gene polymorphisms) significantly affect this adaptation. This indicates that gene polymorphisms contribute to the inter-individual variability of the response to surgical interventions and rehabilitation.

Research projects

The emphasis of the research team lead by Prof Martin Flück at Balgrist is on major musculoskeletal affections that arise in the context of the orthopaedic clinics at Balgrist Hospital. A special focus is put on resolving the contribution of gene polymorphisms

PROFILE



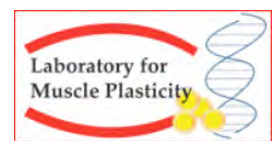
to inter-individual differences in the healing of muscle with re-attachment of the ruptured rotator cuff tendon, and the strengthening of skeletal muscle with rehabilitative exercise in patients.

The aim is to develop personalised forms of intervention that maximise muscle adaptation (Fig. 3). The latter approach is based on previous investigations pointing out the important exercise-intensity and exercise-type related influence of gene polymor-

phisms on muscle response to leisure-type sports activities. This opens a venue to tailor the therapeutically effective exercise intervention for patients which otherwise would demonstrate little plasticity to a generic exercise stimulus and for which pharmaceuticals alone do not work due to the importance of activity-induced muscle metabolism for muscle adaptations. In this regard, the clinical investigation ACE-REHAB into personalised rehabilitation of cardiac patients has been initiated.

Patient-led research

The laboratory is situated in state-of-the-art research facilities at the Balgrist Campus. A key ingredient of this research facility is an open-space landscape where research and development into musculoskeletal medicine is integrated under one roof between clinicians, biologist, engineers, and industry. The facility situates in the vicinity of the orthopaedic hospital at Balgrist; thus providing a pipeline for a reality-driven approach that re-integrates questions from bedside to bench and returns to the patient. The Laboratory for Muscle Plasticity is looking for potential partners that may want to exploit the research options presented in the future campus in the frame of collaboration.



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Obesity in children: Government needs to do more

The current strategy will not be enough to tackle overweight and obesity in children, insists Professor Neena Modi, President of RCPCH...

This time last year there was a sense of optimism for the year ahead. Campaign groups and health organisations up and down the country, and indeed elsewhere in the world, were waiting in anticipation for the publication of the UK government's Child Obesity Strategy.

At the time, UK spending on obesity related conditions had risen from £5bn to £6bn a year, and around 1 in 5 five-year-olds and 1 in 3 10-year-olds were overweight or obese. The strategy was to be a catalyst and bold blueprint for reducing these numbers and the expectation was of tough policies to come, with an emphasis on legislation.

However, when the strategy was published in August, after considerable delay, it sent shock waves through health communities. No longer a hard-hitting strategy, it had become a watered down 'plan' that placed an

emphasis on physical activity, personal responsibility, and voluntary product reformulation.

The Royal College of Paediatrics and Child Health (RCPCH), like many other organisations, felt these recommendations didn't go far enough. For example, an emphasis on exercise, while welcome as an important component of a healthy lifestyle, will not address overweight and obesity. It takes an hour of hard exercise to burn off one chocolate chip muffin, so to expect weight issues to be resolved through more physical activity is unrealistic. Infants and children are wholly vulnerable to the myriad influences that surround them, so an emphasis on personal responsibility is a clear abrogation of adult responsibility.

Sugar tax is a good start

Nonetheless we are pleased that government has acknowledged there is a problem and is providing some

direction – although sadly limited – to help tackle the growing problem of overweight and obesity in children. The recently published draft legislation on a soft drinks tax was included in the Childhood Obesity Plan and is seen as a major strength. Although not yet law, some companies have already reduced the amount of sugar in their soft drinks.

It has been suggested that an industry response focussed on reducing sugar content is likely to have the greatest impact on health, with estimates of a 30% reduction in the sugar content of high-sugar drinks and a 15% reduction for mid-sugar drinks resulting in 144,000 fewer adults and children with obesity, 19,000 fewer cases of Type Two Diabetes, and 269,000 fewer teeth affected by decay each year. These are projections, of course, but lend support to our consistent call for careful evaluation of the impact of the “sugar-tax” on a range of health and economic outcomes.

This policy alone, though very welcome, doesn't go the lengths needed to win the fight against obesity. Findings from the National Child Measurement Programme were published in November 2016 and revealed that the prevalence of obesity in children has continued to rise. The Health Survey for England 2015, published just before Christmas 2016, echoed this point, confirming that there has been little progress in reducing the prevalence of child obesity.

More support is needed for parents

Looking to 2017, we urge government to introduce further actions urgently. Parents who are a healthy weight are more likely to raise healthy weight children, so more support for parents is needed, to help them maintain a healthy weight before, during and after pregnancy. This includes education in schools, and effective national public health campaigns.

We'd also like to see the National Child Measurement Programme commence in infancy as this is a period when trajectories leading to overweight and obesity are often established. We recommend restrictions on advertising junk food before 9pm to children, a move backed the [Obesity Health Alliance](#), a campaign group made up of more than 30 prominent organisations.

Some progress on protecting children from marketing was made in 2016, when at the end of the year the Committees of Advertising Practice (CAP) announced a ban on advertising food and drink high in fat, salt and sugar in non-broadcast media, including print, cinema and crucially, online and social media.

The ban is due to come into effect in the summer of 2017. It is another welcome move, but again, doesn't go far enough to protect the thousands of children and young people who watch television shows not specifically directed at them. This loop hole should be closed by extending advertising restrictions further. We suggest the next step should be a blanket ban on junk food advertising before 9pm.

The bigger picture: Ending obesity in children

We also support the recommendations included in the report of the World Health Organisation Commission on [“Ending Childhood Obesity”](#). In 2016, the 69th World Health Assembly requested the Director-General to develop, in consultation with Member States and relevant stakeholders, an implementation plan guiding further action on the recommendations of this report. This will be submitted in 2017 for consideration by the 70th World Health Assembly and is an important opportunity for the UK to show global leadership.

Childhood obesity is a time bomb that destroys life-long health. About 4 in 8 overweight or obese children will become obese adults, and will suffer the consequences. These will be as severe as the consequences of smoking, and HIV infection before the public safe-sex campaigns of the 1980s, if action is not taken now. Some progress has been made in introducing hard-hitting interventions, but much more remains to be achieved. A long vision, not short-term consideration, is needed. ■

Professor Neena Modi President

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[www.twitter.com/RCPCHtweets](https://twitter.com/RCPCHtweets)

Do we need specialist training for interviewers of child victims?

Based on her research, Dr Kim Roberts of Wilfrid Laurier University stresses the need for specialist training for interviewers of child victims of abuse

There are many ways to interview alleged victims or suspects of crimes ranging from hostile interrogation tactics, to active listening that encourages open, uninterrupted free recall of events. Naturally, different types of situations require different techniques. It is fair to say, however, that most police officers are trained to interrogate suspects but a minority are trained to interview children. Why might this be? In this article, I will provide some possible reasons and, then, suggestions for how to ensure that children are interviewed by people who are expert in child interviewing.

Why we need specialist training for interviewers of child victims

First, is there any evidence that child interviewing is an expert skill? In dozens of studies, in various countries, alleged child victims are not being given the chance to describe their memories unhindered and uninfluenced. The preferred technique to elicit descriptive narratives of events and to reduce the risk of suggestibility (believing what someone suggested happened rather than what actually did happen) is known as 'open-ended' questioning. Open-ended questions invite rather than demand responses, and provide no direction or suggestion as to what the alleged child victim should describe. Some examples are: Tell me what happened that day, and then what happened? Tell me more, and so on. Yet, interviewers rely more

often on narrow question types such as, did he touch you at home? Was it before or after your mum came home? Where were you? And so on. I now provide some possible reasons given to me by police officers for the disappointing quality of many interviews of alleged child abuse.

Lack of belief in expertise

Prosecution rates of child sexual abuse are typically low compared to other crimes. Thus, pessimism is often displayed which stems from the belief that it is difficult to get reliable, corroborated evidence so expert training is wasting time and resources. The irony here is that with expert training, interviewers would be able to get convincing and reliable testimony from children which, in turn, would improve prosecution rates (see Lamb's study in the US showing increased closure of cases when expert interviewers investigate the cases).

Perceived failure of open-ended questions

A typical beginning to an investigative interview of an alleged child victim is to ask the child between 1 and 3 'open-ended' questions which get little response from children, and then to move onto narrower questions requiring the child to choose between presented options, or answer yes or no to suggestions provided by an interviewer. While there is international consensus that open-ended questions elicit lengthier and more



Dr Kim Roberts, Professor

accurate descriptions than do narrow questions, interviewers receive little information from children. Hence, the move to narrower questions to 'help' the children give information. Indeed, open-ended questions are difficult for children; it requires them to retrieve memories of an event, choose what information they think is important to report, and choose whether or not they want to provide that information. Therefore, a critical component in a good investigative interview is to give the child practice answering open-ended questions about an event that they are comfortable talking about. When the child has got the hang of answering open-ended questions, the interviewer can then proceed to ask about the alleged abuse using similar questions (see Practice Narrative publications by me and my colleagues).

PROFILE

Lack of training

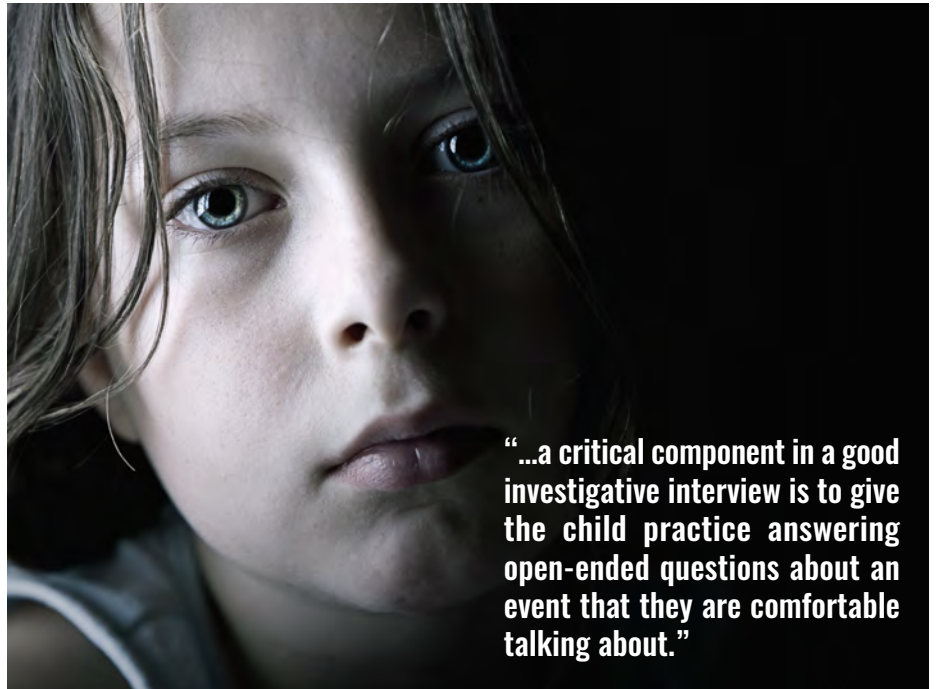
We were recently commissioned by the Canadian Department of Justice to assess the type and amount of training in child interviewing across Canada. While most relevant professionals had received some preliminary training either before or after working on these cases, there were very few instances of refresher or continued formal training. It is a common adage that you cannot be an expert just by reading about it – you have to try it and receive critique and feedback on your efforts. This is an essential part of training, and as the literature clearly shows, interviewing does not improve without this piece.

Lack of funding

The lack of training is likely to be linked to the lack of funding devoted to training child interviewers. In many countries, police services are publicly funded. Hence, police administrators with relatively small budgets must be very careful regarding where they spend their money. Providing feedback to individual interviewers, especially when an objective party is hired to provide feedback is expensive and time consuming.

Secrecy and mistrust

Police officers are very protective of their interviews. There is a very real fear that courts can subpoena external parties to divulge their critique to the courts. I, however, believe this is a flimsy argument. First, defense lawyers often hesitate to ask a collaborator to testify against the relevant party. Second, knowing that your



interviews may be publicly scrutinised is an excellent motivator to get the needed critique that will improve your interviewing practices.

In sum, police interviewers of alleged child abuse victims face an extremely difficult task if they are not provided with the consistent training and feedback that has been shown to improve the quality of children's testimony. In a 9-month training project by me and colleague Heather Price, for example, we found that social workers increased their use of open-ended questions by a third which, in turn, doubled the amount of information children produced. This project was possible only because we were able to pool our research funds with those of the community organisation, which also gave us chance to scientifically evaluate the project and distribute our results to other agencies.

I urge research funding councils and benefactors to consider the value in the outcomes that are possible when university-community research is possible. The tangible benefits for police, the judicial system, and the children who are involved in these investigations are very clear.



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Early learning and behaviour research at the US NICHD

Research on early learning and behaviour translates into effective interventions and care,
Dr James A Griffin of the NICHD at the US National Institutes of Health...

The National Institute of Child Health and Human Development, at the National Institutes for Health (NIH), was established with support of Congress, to study the 'complex process of human development from conception to old age'. Here, Dr James Griffin, Deputy Chief, Child Development & Behavior Branch, at the NICHD answers Adjacent Government's questions with regards to early learning research and the impact this can have on a child's development.

How does research help us to further understand child development and the importance of this?

Research funded by the Child Development and Behavior Branch (CDBB) within the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD), helps us to understand and make sense of child development in all its complexities. Basic research helps us to understand the complex relationship between genetic and environmental factors as they interact to shape brain development and early learning and behaviour. This basic research, in turn, helps to inform translational research that addresses topics ranging from how to promote optimal health and development over time to how to create and implement interventions addressing the needs of children at-risk for language and learning delays and behavioural difficulties.

How does the NICHD support research in child development, particularly in early learning?

The Early Learning and School Readiness Research Program within CDBB funds a range of research studies seeking to understand the influences that come together to support or hinder early childhood development and how they impact early learning opportunities and affect a child's ability to make the successful transition to school. Studies supported include: descriptive

studies of how early care environments (home, family and centre-based child care) are associated with later school achievement and adjustment; intervention studies in paediatric primary care settings that examine the impact of early developmental interventions during well baby/child visits on parent and child behaviors (e.g., increased parent reading to the child, decreases in problem child behaviours); and preschool intervention studies that attempt to boost school readiness skills, including early language, pre-literacy, early numeracy, and self-regulation, social-emotional and social skills prior to entering kindergarten.

"Several studies that have followed children from disadvantaged backgrounds who received a preschool intervention continue to show positive effects on academic performance and behaviour well into adulthood."

How important is early learning for a child's development?

Early learning is both the result of and shapes the overall development of a child. Parents, siblings and other family members, and caretakers are an infant's first teachers, and interaction with them provides essential learning opportunities, as well as influencing the physical health and safety of an infant. Infants learn how to interact with the world from these early experiences, developing early gestures and vocalisations leading to language, and the capacity to better regulate their own emotions and behaviour. Lack of appropriate stimulation (unresponsive caretakers, lack of reciprocal language exchanges, unmet physical and emotional needs) can result in less developed early language and learning skills and difficulties regulating their own impulses and behaviours. Such deficits will make it more difficult to interact with family members and



peers and may make it difficult for a child to transition to a school environment.

How does early learning impact children later in life?

Several studies that have followed children from disadvantaged backgrounds who received a preschool intervention continue to show positive effects on academic performance and behaviour well into adulthood. These interventions commonly employed a stimulating preschool environment coupled with home outreach focused on parent skill training and support. The current hypothesis is that these interventions, above and beyond enhancing immediate school readiness skills, produced long-term effects by promoting children's early executive function (EF) skills. These skills, developed in the first three years of brain development and then again in late adolescence, help children to regulate their own behaviours by teaching them impulse control, the ability to shift and focus their attention, and other abilities necessary for both learning and social interactions. These EF skills likely help children in their transition to school, providing them with an increased ability to learn in school, make friends, and engage in fewer problematic and disruptive behaviours. The cumulative effect increases the likelihood of a positive outcome in adulthood, relative to peers raised in the same disadvantaged environments who did not receive a preschool intervention.

How does research help to figure out the best ways for parents and caregivers to help children develop early skills?

NICHD has funded research ranging from observational studies of parenting behaviours in home and laboratory

settings to intervention studies that attempt to teach early parenting skills. Both types of studies have resulted in recommendations regarding: talking and reading with children from infancy onward; how to interact with them to promote their early language skills and promote curiosity about the world around them; providing a secure attachment relationship that provides a safe base from which a child can explore the world from infancy onwards; and sensitive support from dependence to independence and a greater capacity for self-regulation and social exploration with peers.

How can areas such as home life/the environment/economic stability impact a child's early development?

NICHD has supported a range of studies examining how stability in home life, family income, and neighbourhood conditions etc. impact children's early development. Fluctuations in income and neighbourhood conditions are often beyond the control of parents, but early sources of stress for infants and young children often can be changed once parents understand how such stress negatively impacts their children's development and capacity to learn. Examples of home environment stressors include constant loud music, television or computer sounds that may make it difficult for a young child to focus their attention or which disrupt their sleep, lack of space for a child to safely move about and play, and lack of safe and age-appropriate toys and household items for the child to manipulate and play with. Chronic exposure to stressors may negatively impact a child's development of executive function and school readiness skills. ■

Dr James A Griffin Deputy Chief, Child Development & Behavior Branch – Early Learning and School Readiness Research Program

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Umbilical cord blood: A life enhancer for all babies

Judith Mercer and Debra-Erickson Owens have found positive changes after a short delay in cord clamping, indicating the benefits of umbilical cord blood

When cord clamping is delayed at birth (DCC), an infant receives a placental transfusion and benefits from a 30% increase in blood volume and a 50% increase in red cell volume, resulting in increased iron stores over the first 6 months of life. Red blood cells hold 80% of the iron in our bodies, making this added volume of red blood cells responsible for the observed increase in iron stores. Thus, DCC results in less iron deficiency in early infancy.

Iron deficiency in infancy has been shown to adversely affect cognitive, motor, socio-emotional, and behavioural

development. These first 6 months of life coincide with the most critical period of brain growth and myelin development, during which most of the brain's eloquent neural pathways are established and refined. Iron is an essential component of myelination which is critical for normal brain development and function.

Mercer and Erickson-Owens decided to take the current research a step further and look at the effect of DCC on brain development and myelination over the first 2 years of life in infants receiving either DCC, or immediate cord clamping (ICC) at birth. They

wondered if the higher iron stores from DCC would result in greater brain myelin content at 4 months of age.

Significant positive change in brain myelination

Myelin is a fatty white substance that is wrapped around nerve cells in the brain to form an insulating layer and creates the white matter in our brains. Myelinated white matter is a cornerstone of human neurodevelopment, establishing and maintaining efficient communication pathways across specialised neuronal systems. Iron plays an essential role in the formation of the cells responsible for producing



myelin. Animal studies clearly link low levels of brain myelin with iron deficiency and neurodevelopmental impairment. Also, abnormal myelination underlies a variety of childhood developmental disorders, including conditions such as dyslexia and autism, thus making it a key area of study. Through their research, Mercer and Erickson-Owens hope to fill the knowledge gap on the effects of cord clamping time, at this critical and dynamic period of infant neurodevelopment.

“We chose to do this study because a high percentage of babies world-wide are anaemic or iron deficient (ID) by 6 to 9 months of age. Cord blood is an excellent source of iron and is readily available to every infant via placental transfusion at the time of birth. Anaemia and ID in infancy are also associated with decreased cognitive abilities, and behavioural problems. And, there is good evidence for the safety and benefits of DCC.”

After receiving US National Institutes of Health funding, Mercer and Erickson-Owens were joined by Dr Sean Deoni to launch their latest study known as the ‘Infant Brain Study’. Deoni brought expertise in using MRI scanning to examine myelin and normal brain development in infants and children. Normal healthy women delivering at term with healthy foetuses were recruited and randomised to either ICC (within 20 seconds) or DCC (5 or more minutes). [If the provider felt that they could not delay cord clamping, they were instructed to milk the cord 3 to 5 times – a safe alternative to DCC]. At 4 months of age, blood samples were collected and MRI quantitative myelin scans were done with accom-

panying developmental assessments (within one week of scanning). Currently these researchers are reporting the study’s 4-month MRI scan results and are awaiting the 12 and 24-month results to be finished later this year.

Most of the MRI scans were conducted in the evening so infants could be scanned during natural sleep. Mothers put infants to sleep in a comfortable room and they were then placed on the scanner table and inserted into the MRI scanner. Several techniques – ear covers, special headphones, slowing the scanner, and noise insulation – were used to reduce noise. The imaging times ranged from 20 to 30 minutes. Parents were invited stay in the MRI room or wait outside. If the child woke, mothers attempted to get them back to sleep and the scan was restarted.

Haemoglobin higher after delayed clamping

There were no significant differences between the mothers or infants in each group – an important finding in any clinical trial. Drainage of the placental blood showed that infants who had ICC left about 30% more blood in the placenta. Blood levels of haemoglobin were higher in those infants who received DCC, without any adverse effects. Ferritin levels (a proxy for iron stores) at 4 months of age were higher in the DCC infants, as expected.

There was significantly more myelin content in several areas of the brain in the infants with DCC, compared to those with ICC. Differences occurred in the earliest myelinating brain regions such as the cerebellum, the internal capsules, and the motor

cortex. As the infants were just 4 months old at the time of scanning and these are the brain areas that are rapidly myelinating during this stage of development, DCC appears to have a significant impact on myelination across the brain. Thus, placental transfusion (DCC & milking) facilitates the transfer of residual placental blood without adverse effects and supports increased brain myelination at 4 months of age.

This study, in its fifth year, will be completed in December 2017. Currently, Mercer and Erickson-Owens are awaiting the results of the MRI scans of brain myelin content and parallel developmental testing at 12 and 24-months. They expect differences at 2 years of age when data on young infants is more robust. A Swedish study that reported no differences in development at one year for children who had DCC or ICC at birth, found significantly better outcomes at 4 years in fine motor skills and social-emotional functioning.

Dr Mercer began her research examining DCC for preterm infants as they have the most serious life-threatening problems. In 2006, she reported less bleeding in the brains of infants who had only a brief delay in cord clamping (30 to 45 seconds), compared to infants who had immediate cord clamping. Her work has been replicated by others and these findings are the major reason DCC is being adopted at the time of birth of premature infants. Erickson-Owens joined her in 2005 and added her research which examined umbilical cord milking in term infants. Her study showed that milking the cord at caesarean section was safe and resulted in



better haematocrit levels at 2 days of age – a marker of better iron levels later in infancy.

Umbilical cord blood and stem cells

In the future, these researchers plan to explore stem cells in umbilical cord blood. Stem cells augment the infant's own healing system in ways that may benefit the child not only in infancy but over his lifetime. Umbilical cord blood contains many millions of stem cells that help to protect the infant. If the cord is cut right away, the infant will leave about 80 millilitres of blood, containing approximately 1 billion nucleated cells behind in the placenta. However, both human and animals studies demonstrate the immense healing power of stem cells.

Human umbilical cord blood stem cells, used for transplants in human diseases, are remarkably successful in

promoting healing. In the United States and Japan, scientists are extracting stem cells after birth and placing them back into the bodies of infants afflicted with a life threatening condition known as hypoxic-ischemic-encephalopathy. They have had some success in reducing mortality. Mercer and Erickson-Owens believe these precious stem cells should be allowed to transfuse into every infant's body at the time of birth and that they might help prevent or lessen the severity of this devastating disease. There is, however, a dilemma. The infants who may need their stem cells the most often receive ICC. Current neonatal resuscitation policies demand ICC so that infants can be quickly moved to warming tables, denying a placental transfusion to the very babies who may benefit the most.

To address this problem, scientists in the UK and the US are conducting

research on resuscitating infants near the mother with the umbilical cord intact to allow the placental transfusion to continue. In order to examine whether obtaining cord blood at birth would help these infants, a team from Virginia is conducting a large trial in which they will resuscitate preterm infants without clamping the cord. If successful, this will encourage transitioning of all infants with an intact cord.

Umbilical cord blood donation is not the answer

But shouldn't parents be altruistic and donate their infant's umbilical cord blood? In 2017, experts still do not know how to prevent most newborn diseases, such as cerebral palsy, hypoxic-ischemic-encephalopathy, and persistent pulmonary hypertension. While some treatments such as head cooling for encephalopathy have improved outcomes, still over half the infants who develop this condition are

either permanently disabled or die in their first 2 years of life.

Mercer and Erickson-Owens do not support cord blood donation at this time except in rare cases such as blood for a sibling in need. Instead, they urge scientists to continue to learn how to make the umbilical cord stem cells proliferate or expand in the laboratory so they can be used for transplantation. Some modest success has resulted in reproducing stem cells but they are not yet as potent when transplanted as the stem cells from cord blood. The race to find the perfect medium continues. Even after a long delay in cord clamping, there is still a small amount of blood remaining in the placenta, which could provide many stem cells via successful expansion techniques. Meanwhile, scientists have identified stem cells in the umbilical cord tissue itself, in amniotic fluid, and in the placenta. All of the sources are under intense study to develop them as alternatives to cord blood stem cells.

It is true that the usual obstetrical practice of ICC, a practice lacking evidence-based support, denies an infant up to 50% of its iron rich red blood cells and stem cells. The birth setting can influence the timing of cord clamping. Historically, obstetricians delayed cord clamping in hospital. However, in the middle of the last century there was a major shift to ICC. The shift in practice led to institutional policies and the adoption of ICC which we now know does not benefit the infant's well-being. Many midwives have used DCC throughout history, often in birth centres and home birth settings, but institutional policies often prevent this practice.

Mercer and Erickson Owens are passionate about umbilical cord clamping and present their work nationally and internationally. Their ongoing research supports the idea that DCC (or milking) is a low tech, no cost approach that is valuable for all infants of all gestational ages across the globe.

"Our knowledge about the value of cord blood for infants is akin to what we knew about colostrum fifty years ago when most people thought it did not matter and could be discarded! Now we know of its great value to newborns. All babies can benefit from a placental transfusion."

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What do we know about cognitive development in infancy?

Research into cognitive development in infancy has thrived over recent years, but there's still a lot we don't know, as UCLA Professor Scott P Johnson writes

Our research focuses on the origins of knowledge in humans. The past several decades have witnessed a blossoming in research on perceptual and cognitive development in infancy, and a view has emerged that infants take in far more information, and are more aware of their surroundings, than we often give them credit for.

By the end of the first year after birth, infants seem to know many of the basics of the world around them: Objects tend to behave in certain ways (e.g., they persist when they are hidden), people interact with each other using language and gesture, and moving around and handling objects are good ways of obtaining more knowledge.

Despite these advances, fundamental questions remain concerning how this state of knowledge comes to be. The UCLA Baby Lab explores these questions with preferential looking and eye tracking paradigms, as well as connectionist modelling of developmental phenomena. Because the focus is on origins, we are less interested in participating in traditional “nature vs. nurture” debates (though we do it anyway), than in understanding and elucidating precise developmental mechanisms: Endogenous prenatal or postnatal organisation; the role of experience in shaping responses to recurring patterns; contributions of perceptual (i.e., low-level) skills to



cognitive (i.e., high-level) functions; and the context of the family and wider social environment. The question of origins of knowledge lies at the intersection of developmental psychology, social psychology, vision science, cognitive science, and developmental neurobiology.

Cognitive development in infancy

Many “smart” mechanisms emerge from simple mechanisms, given the right environment. Infants are born with rudimentary perceptual and learning skills and a handful of reflexes, but there is little evidence that “knowledge” is available to neonates, beyond the ability to acquire information quickly and retain it over short intervals.

Within several months, however, the situation is radically different. The goal of our research is to explain developmental phenomena, first by describe age-related changes in visual perception and early learning abilities, and then by revealing the mechanisms responsible for these changes. We distil a question to its fundamental essence, see how and when infants respond to the simplest possible version of a cognitive challenge, and from there, develop new theory.

We devote a lot of time and energy to new methodological advances, such as computer-controlled experiments and eye movement recordings in infants. Computer-controlled experiments give us precise management of stimulus generation and presentation.

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Recording eye movements is technically challenging but the resulting data are incomparable in their precision, and, I believe, bring us as closely as possible to what infants are thinking. We also use imaging techniques such as fMRI and EEG (functional magnetic resonance imaging and electroencephalography) in studies of cortical correlates of perception and learning, and computational models of perception.

Our research programme currently involves studies of infant social attention and infant statistical learning.

Infant social attention

The means by which humans acquire and represent knowledge of other people is fundamental to social and cognitive science, and a central question asked by developmental psychologists concerns how infants learn so much in so little time in the absence of explicit instruction. The rapidity and apparent ease with which infants and young children understand and produce speech, recognise faces, and interpret others' mental states, for example, have led to suggestions that innate cognitive mechanisms provide some knowledge in each of these social domains.

Yet such views may risk neglecting the potential roles of perception, attention, learning, and experience in guiding social development. Recent theoretical proposals that account for such skills, such as social-orienting models, hold tremendous promise for elucidating the nature and origins of human social cognition. Central to these models is the possibility that social attention in infancy serves to identify targets that afford social relationships which in turn promote normative brain and behavioural development. This cycle acts like a positive feedback loop, affecting

subsequent social development. Social attention, therefore, is the initial "gateway" through which the social environment is engaged.

Social attention develops in context, and a central research question is whether differences in social context – for example, language background or racial composition of the family – yield specific "downstream" consequences for categorisation, just as social categories, once formed, have consequences for impressions, attitudes, stereotypes, and prejudice. A series of studies currently underway examines infants' ability to discriminate or categorise various properties such as gender and emotion from face and body stimuli. We recently discovered visual preferences for minority faces (African-American and Hispanic) vs. White faces in Hispanic and White 11-month-old infants, a finding that may bear important implications for the origins of social cognition and social categories.

Infant statistical learning

"Statistical learning" refers to the ability to detect associations among items such as visual stimuli or words, eventually leading to grouping and detection of coherence among items and the acquisition of sophisticated knowledge structures, such as words and sentences. That is, statistical computation mechanisms may contribute to early language acquisition by segmenting the speech stream into units.

Statistical learning exists broadly across sensory modalities. Certain animal species have been found to learn statistically structured speech streams, and human infants can parse streams of musical tones based on statistical probabilities and detect statistical information in sequences of

discrete, looming shapes. These results imply a domain-general statistical learning device that is available early and operates across modalities, across time and space, and across species, suggesting that statistical learning might be a predisposed, general associative mechanism. This hypothesis is supported by reports of statistical learning of visual and linguistic sequences in newborns, constituting evidence for sensitivity to statistical information at birth in at least two modalities.

However, more recently, research in the UCLA Baby Lab has revealed striking limits in infants' visual statistical learning, and revealed some of the fundamental perceptual mechanisms underlying learning performance. Current evidence suggests that statistical learning actually consists of the gradual accrual of "chunks" of structure, not specific computations. Alternatively, statistical computations might contribute the first steps in pattern learning, to be superseded by a chunking mechanism that does not retain statistical information.



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Through the looking-glass: Endocrine disruption and child health

Alberto Mantovani and Francesca Baldi at the Italian National Health Institute discuss the need for further research on endocrine disruption and child health...

When assessing potential health hazards in food chains or the environment, it is clear that children cannot be considered as miniature adults. In fact, children breathe more air, consume more food, and drink more water compared to adults, in proportion to their body weight, thus they are more exposed. Compared to adults, children are also exposed differently: Their diet is different (e.g. much more milk and less shellfish and crayfish) and non-dietary oral exposure may be important, especially in toddlers, due to behaviours (crawling, mouthing) that may lead, for example, to the ingestion of soil.

In children, internal exposure to pollutants may also show specific patterns; differences may exist in absorption (e.g., it is higher for lead), distribution (e.g., because of different percentage of water and fat in tissues), as well as metabolism and excretion, since in toddlers the metabolism enzymes and renal system still have to achieve functional maturation.

But, most importantly, children are constantly growing and whilst doing so, they are developing from weaning through to puberty. It is evident that the toddler and the pre-pubertal stages represent different developmental windows; and the hormone balance is a foremost player in orchestrating the development's progress. As a consequence, with regards to

endocrine disrupting chemicals (EDC), children are not miniature adults, both because of different exposure and because of biological susceptibility. Thyroid function and steroid balance are recognised as major EDC targets. Indeed, the thyroid axis is pivotal for body growth and central nervous system development, whereas the estrogen/androgen balance is critical for the reproductive system maturation and sexual differentiation that have their climax in puberty.

"If toxicologists walk through the looking-glass, and find how to link molecular mechanisms with health disorders, they might actually help protect the future of children."

Going through the looking-glass

Since 2003, the Environment and Health Strategy of the European Union identified children as both a highly vulnerable group, as well as the future of society.

Therefore, as in Carroll's novel, toxicologists have to climb through a mirror into the world that they can see beyond it: a world where standardised models ("the dose makes the poison", and that's it) have to cope with the different sensitivities present in the population, hence developing a child-specific perspective.

The international regulatory frameworks for chemicals state the need for a children-targeted risk characterisa-

tion. In fact, risk assessors now always give specific attention to exposure in children, especially 1 to 3 year olds. What about effects? Scientific and regulatory consensus has not been reached yet on what children-specific effects are; as a consequence, there is no consensus on whether "juvenile toxicity studies" – somewhat similar to those required for pediatric pharmaceuticals – are of use in the safety assessment of chemicals, for example when direct child exposure is foreseen (toys, baby food containers, sunscreens, etc.).

Indeed, investigations on the effects of chemicals, including EDC, due to exposure during childhood are not as numerous as one might expect. Nevertheless, the available evidence points out adverse effects on neurobehavioral and immune development, as well as on the processes of puberty and body growth (including body mass composition, e.g., adiposity). In addition, there are indications that exposure to EDC during childhood may enhance the predisposition to adult diseases, e.g., oestrogen-active EDC may enhance the risk of breast cancer. Therefore, the current evidence indicates that EDC may elicit specific effects on childhood growth, prompting the development of a more robust data set.

Addressing regulation and reducing current risks

As we already pointed out in former interventions about EDC in [Adjacent](#)

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Government, the matter is not just, “we need more research on EDC”, although of course increasing knowledge is always beneficial, in principle. Rather, the matter is, “we need more research on EDC in order to address regulatory actions and reduce the current risks”.

A toxicologist’s viewpoint on environmental health from the children-specific perspective has been presented at a roundtable on “Health risk prevention in EU areas characterised by High Environmental Pressure”, held at the European Parliament on December 6, 2016. One possible approach is to exploit the current development of Adverse Outcome Pathways (AOP), which are main components of the ongoing Horizon 2020 project EuTox-Risk – the integrated European ‘flagship’ programme driving mechanism-based toxicity testing and risk assessment for the 21st century. AOPs link pathophysiology and toxicology; the aim is to identify and assess the sequence of events from an alteration at molecular level through to a clinical damage at tissue/organism level. Therefore, any chemical triggering the upstream molecular/cellular events with sufficient intensity has the potential to adversely perturb a physiological pathway and consequently, can cause the relevant adverse outcome.

By identifying events at the cellular or molecular level that are consistently linked to adverse health outcomes, AOP may result in the development of early and predictive biomarkers of effects. About the several possible practical uses of AOP, let’s step beyond the mechanistic-based screening of chemicals (however important it may be) for a moment and go through the looking-glass, to find the real world of population groups experiencing high exposure levels to EDC.

Linking molecular mechanisms with health problems

Let’s consider an emerging but widespread and persistent EDC like perfluorooctanoic acid (PFOA). The toxicity mechanisms of PFOA include the displacement of molecules bound to serum albumin, such as thyroid hormone, and the receptor-mediated disruption of fatty acid metabolism and lipid transport; steroid biosynthesis is hit at the very early steps.

“...children are constantly growing and whilst doing so, they are developing from weaning through to puberty. It is evident that the toddler and the pre-pubertal stages represent different developmental windows; and the hormone balance is a foremost player in orchestrating the development’s progress.”

The main effects of PFOA as detected in toxicological studies, and in some human studies, are all definitely relevant for child health (see US Environmental Protection Agency, 2016), reduced ossification and accelerated male puberty in rodent pups, impaired production of thyroid hormone, elevated cholesterol in children, whereas the impairment of immune function maturation and of postnatal breast development deserve further attention. Thus, from the perspective of child health, PFOA exposure is of concern. Since such exposure is widespread, albeit very variable, and PFOA hotspots exist (e.g., in the densely populated province of Vicenza, North-Eastern Italy). Hence, for PFOA we have both substantial indications of a toxicological hazard for children and widespread exposure. An AOP-based approach can interpret the experimental data and link them to clinically relevant outcomes in humans (e.g., short and long-term consequences of thyroid and cholesterol disruption in childhood). An

AOP-based approach can also help to select early and well targeted biomarkers for potential health risks in highly exposed populations, taking into account children’s susceptibility.

If toxicologists walk through the looking-glass, and find how to link molecular mechanisms with health disorders, they might actually help protect the future of children.



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Europe needs a plan to address refugees' and migrants' mental health

Refugees' and migrants' mental health care needs must be addressed, and a coordinated response is essential, stresses Ophélie Martin at Mental Health Europe...

More than a million migrants and refugees crossed into Europe in 2015 and 2016, with more expected to arrive in 2017. Many of them have endured physical and emotional trauma, including torture, loss of loved ones, violence and exploitation. The psychological reactions and distress they may experience in response to the challenges they face are completely normal. Many can be supported by social interventions, whereas some may need more extensive mental health care and support.

Upon their arrival in Europe, migrants and refugees may also encounter distressing situations such as detention in camps, deportation, denial of basic services and protection, poverty, separation from family members and social exclusion. Many organisations on the ground are warning authorities of the heightened risk of migrants and refugees experiencing mental distress which could lead to mental health problems in the absence of appropriate support.

A question of rights and cohesion

Providing access to mental health and psychosocial support for migrants and refugees is not only a human rights obligation but it is imperative to social cohesion, as well as beneficial for European economies in the long-term. States must fulfil their obligations under existing international, European human rights and refugee frameworks, such as the International Covenant on Economic, Social and Cultural Rights (ICESCR), which includes an explicit obligation to ensure the right to the highest attainable standard of mental health to all, without discrimination (Art. 12). The right to access good quality health care includes the provision of access to mental health care and support, regardless of migration status which, simply put, means that all migrants and refugees have the right to access such care.

Providing mental health support is key to helping migrants and refugees settle in Europe. Denying access to mental health care today will only lead to future challenges in European countries tomorrow. In terms of cost, the World Health Organization has also acknowledged that prevention and early intervention in relation to mental health is cheaper in the long run than simply providing access to emergency or acute care for migrants and refugees.

Facing the reality on the ground

The increased migration flows of the past 2 years have led to the development of acute humanitarian situations in certain places in Europe (Greece, Southern Italy, and Calais). Personnel on the ground are working under very difficult circumstances and should be given the means to support migrants and refugees appropriately. In its [most recent position paper](#), Mental Health Europe encourages the use of guidelines such as the [IASC Guidelines for Mental Health and Psychosocial Support](#) (2007) and the [Multi-agency guidance on Mental Health and Psychosocial Support](#) which can be helpful in these settings.

MHE also calls for states to ensure that all personnel who come into contact with migrants and refugees, such as police, immigration officials, medical professionals and social workers are given basic mental health and cultural training which helps them to better identify and support people experiencing mental distress. Many migrants and refugees may never have even heard of mental health and wellbeing before, or they might understand it differently or associate it with stigma. They may express fear or other emotions in ways that are unfamiliar to us. If mental health support is to be effective it needs to be culturally sensitive, person-centred and accessible. The question of language is also crucial for the provision of mental health sup-



port since without the ability to communicate or to understand information from health care professionals, migrants and refugees are more likely to receive poorer care.

Towards a stronger European coordinated response

The EU must ensure there is a coordinated European response that addresses the humanitarian and protection needs of migrants and refugees, in line with existing international recommendations and obligations. Regrettably, the current political crisis has been caused by the failure of many Member States to deal with the situation in a unified way. Instead of acting together to meet this challenge by developing a common plan, Member States have entered endless discussions around strategies which are unlikely to work in the longer term and which focus only on stemming the flow of migration.

Initiatives such as the [EU Blue Card proposition](#), the International Organisation for Migration's "Equihealth project" (supported by the Commission), as well as the

EU Commission's [call for projects](#) on the health of migrants and refugees are already positive developments that will hopefully help support migrants and refugees. However, more could be done at EU level, such as giving incentives to Member States for the strengthening of national and local capacity which ensures access to long-term health and social services and support for the social inclusion of refugees.

Read more about [MHE's recommendations to the EU](#) as well as existing European initiatives and international frameworks. ■

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We need different thinking about communication in healthcare

Pfalzlinikum CEO Paul Bomke suggests that a new paradigm is needed in our thinking about communication in healthcare, especially around mental health...

It is increasingly clear that greater dialogue between stakeholders and innovative new approaches go far in addressing the challenges facing healthcare systems today. In an interview, Pfalzlinikum's CEO, Paul Bomke, underlines the importance of communication in healthcare settings.



What are the primary challenges today in healthcare, and how can a focus on leadership help to overcome them?

The primary challenge at the moment is confronting the so-called 'VUCA-World': volatility, uncertainty, complexity and ambiguity. These four issues are increasing in our work at the moment, in Germany and across Europe, in health issues, particularly when it comes to mental health. As a leader I am dealing with new forms of complexity while working to increase contact with more stakeholders. For leaders generally, we need to encourage the spread of skills beyond those that make a good administrator or manager; you need an understanding of what is



important across the sector. For example, you have to find ways to implement new instruments for scanning the (social) environment.

How can healthcare leaders better engage with policy makers, and why is this so important?

As the complexity is increasing, policy makers need to be aware that they are part of this. When it comes to health legislation, we occasionally encourage them to reduce the complexity through their own interventions. Recently, two big laws were passed in our field. The first is about social welfare and the second is about financing mental health. In this process, my role was to speak to policy makers about the issue of interdependence of the two sectors (welfare and health), which are involved when they discuss new laws and what is important for day to day work.

We take this approach of working to understand how others are organised in order to confront challenges. Taking into account the European view can help policy makers understand that there are other solutions for the challenges we face across Europe. I always try to bring this into the discussion when meeting with policy makers in Germany; for instance, looking at how the UK is dealing with the prevention or how mental health is being treated in Scandinavia or in Italy. New ideas must always be brought into the discussion to help policy makers widen their understanding.

Do you feel the European institutions can play a greater role in this arena?

The EU work on health is focused on bringing together all the different healthcare systems. Improvements could be made on how experts come



together at the European level to enhance their understanding of innovation and different practices. In many ways Europe should act to improve dialogue between countries rather than taking up new powers and its own legislation issues.

“We have to invest and embrace a broader view of communication issues: rather than how can I convince a partner, or market, of a solution to a problem, the emphasis should be on social change for all and the role that communication plays.”

How do you think the dialogue between the healthcare system, policy makers and the public can be enhanced?

This is a key area in which we are working at the moment, this is what we call social communication. We have to invest and embrace a broader view

of communication issues: rather than how can I convince a partner, or market, of a solution to a problem, the emphasis should be on social change for all and the role that communication plays. For example, when it comes to interest in our work on mental health, we have seen that experts like to have a disease marketing and communication strategy. However, there is no view on health literacy in the mental health context. The reason for this is that we are trained to focus on things that are not working, always trying to convince people that if they do not do something they will get ill.

Our frameworks approach is more about improving health literacy or improving competence and participation in the communication process. This is more an approach of focusing on what is good for health, rather than what helps you to avoid becoming ill.

This kind of thinking requires a totally different approach to communication with partners and stakeholders. The approach is a new form of dialogue which I am working on to implement in our region, when it comes to prevention around mental health.



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Out of sight: Low vision is a National Eye Institute priority

Low vision can be a blight on the lives of those it affects, which is why it's a National Eye Institute priority, as Dr Cheri Wiggs told Adjacent Government...

Around 4.2 million people in America are visually impaired, which is expected to increase to 7.2 million in 2030. Of those 7.2 million in 2030, 5 million will have what is known as low vision. Low vision is an impairment characterised by partial sight that cannot be corrected or treated by wearing glasses, contact lenses or through surgery. With people living longer it has now become a major public health concern in America.

Having low vision can have a devastating impact on someone's life. The impact on day-to-day activities can leave people feeling depressed and anxious. Low vision sufferers may struggle to carry out everyday tasks, such as reading, shopping, cooking, driving and even matching up clothes when getting dressed. Although the majority of people who suffer from low vision are said to be 65 years and older, younger people and even children can also suffer from this health issue.

There are a wide range of causes of low vision, from eye diseases, cataracts to glaucoma. Health problems such as diabetes can also lead to low vision developing. The National Eye Institute (NEI) in America, part of the National Institutes of Health (NIH), supports research and other programmes, relating to visual disorders including low vision.

Causes of low vision issues

Dr Cheri Wiggs, Program Director for the Low Vision and Blindness Rehabilitation Programme at the NEI, speaks to Editor Laura Evans about the importance of raising awareness for people with low vision and how advances in science have helped over the years.

"The majority of low vision issues are caused by eye diseases and/or injury, but brain damage can also lead to visual impairment", explains Dr Wiggs.



"There has been more attention recently on cortical blindness, or cortical visual impairment. This is where people can still see, but they have difficulty interpreting that visual information. Some people have double or tunnel vision, or their vision is extremely blurred. This can be caused by traumatic brain injury, and we are seeing a lot of people that come back from combat and complain about these visual issues after a situation with an IED.

"Cortical visual impairment can also be caused by insults to the brain at birth. Vision loss due to neurological damage to the brain affects both children and adults," adds Dr Wiggs.

Age-related macular degeneration

As the majority of people with low vision are over the age of 65, this could become a bigger problem due to ageing populations. One of the most common causes of low vision is age-related macular degeneration. However, there are a few studies being done to ascertain how to prevent low vision in later life.

"There have been a few studies on vitamin regimens to keep these eye health problems at bay," says Dr Wiggs.

"In particular, a clinical trial examined whether taking antioxidants and zinc would reduce the risk of developing advanced age-related macular degeneration (AMD). The results showed that the dietary supplements, while not a cure for AMD, could help at risk older people keep their remaining vision.

"However, it is also integral to ensure that the public are aware of the importance of regular eye examinations that include looking at the retina. Because if you can catch it early you may be able to start some therapy that can at least decrease the probability that it will advance.

"The biggest problem is how low vision can impact day to day life," adds Dr Wiggs. "It really does impact people's quality of life and their independence. People who have low vision are at an increased risk of falls, which means fractures, time spent in bed and limited mobility for a number of reasons. If part of your vision is absent then it's difficult manoeuvring around, including driving but even just walking. People with low vision are at an increased risk for depression, and it can also complicate the management of other health issues."

Understanding the mechanisms behind low vision

Research is integral in order to better understand the mechanisms behind the problem and to develop therapies and rehabilitation that are tailored to help people who have low vision cope with everyday living. As science has evolved, technology is key to this area and has led the way to develop a number of assistive devices that help people with low vision carry out everyday tasks, such as reading.

"Part of the mission of the National Eye Institute (NEI) is to address the special health requirements of the visually impaired," Dr Wiggs says. "We have encouraged collaborations between vision scientists and people from both engineering and computer science backgrounds to help develop creative strategies to address some of the issues faced by people with low vision."

As well as assistive devices, rehabilitation plays a major role in helping people to adapt and maintain their current lifestyle. It can help them to feel more confident

and comfortable with their vision loss, by teaching them how to move safely around the home, continue to read, cook and do other activities, and find resources, adaptive devices, and support. Rehabilitation is something that the National Eye Institute supports. The low vision and blindness rehabilitation programme at the NEI aims to develop further understanding about those already living with low vision.

"In addition to the applied translational work that develops assistive devices and rehabilitation strategies, NEI also supports basic science on the impact of vision loss," explains Dr Wiggs.

"For example, neuroscience research indicates that the brain reorganises functionally after losing sensory inputs; for instance, areas of the brain used for processing visual information get recruited for other functions, such as touch. The long-term impact of visual impairments on brain structures and functions remain unclear and could be very useful for informing rehabilitation efforts," she adds.

"We have a lot of behavioural studies which we also support that target the types of changes you see in crucial activities, such as navigation, driving, reading strategies, and movement in people who are losing their vision. So, even though that's more on the basic science side, it's always with the understanding that information can inform whatever rehabilitation strategies you might develop."

February is [Low Vision Awareness Month](#) at the NEI as they raise awareness for people living with low vision, as well as their family and friends. ■

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Innovative device for cataract surgery in sight

In 1950, the British ophthalmologist Sir Harold Ridley performed the world's first implantation of an artificial intraocular lens (IOL) to restore a patient's vision after cataract surgery. This innovation rose from his observation of WWII pilots, who suffered eye injuries in which acrylic pieces from shattered cockpit windows lodged within their eyes.

The realisation that artificial IOLs can replace the diseased lens removed during cataract surgery, has arguably been one of the medical technologies that have benefited the greatest number of patients worldwide. Today, IOL innovation continues at a rapid pace, and many believe that a quantum leap in IOL performance may be just around the corner and bring rejuvenated, perfect vision to an ageing population.

One hurdle, however, is the delicate capsule that surrounds the lens. In cataracts, the normally optically clear lens becomes cloudy and, if left untreated, it can result in blindness. During surgery, an opening is made by the surgeon using forceps in the paper-thin capsule bag that encases the lens. This capsulotomy procedure allows the physician to remove the diseased lens through the capsulotomy opening, while preserving the bag to hold the IOL.

Performing the perfect capsulotomy

Capsulotomy is one of the most difficult steps of surgery, and a perfectly round, accurately sized and well-centred

capsulotomy is required for optimal patient visual outcome. This is well-recognised for advanced multifocal IOLs currently on the market, whose performance is significantly degraded if misaligned. New IOLs under development place an even greater premium on a perfect capsulotomy, as they either stretch the capsulotomy opening to its limits or depend completely on the centration of the capsulotomy position for IOL alignment on the visual axis.

While some physicians are well-practised in capsulotomy, others are not and may struggle with technique. All agree, however, that making consistently perfect capsulotomies by hand is difficult. Five years ago, femtosecond laser systems were introduced for automated capsulotomies. While effective in making accurate capsulotomies, the femtolasers suffer from their considerable financial outlay that requires the physician to pass on significant costs to the patient and also limit technology accessibility to the majority of surgeons and patients. In addition, the femtolasers add time to each surgery, interrupt patient flow and operating theatre throughput, making this technology less attractive to surgical practices. Lastly, the medical literature indicates a higher capsule tear rate and other complications after femtolasers for cataract surgery has slowed significantly since its introduction.

The realisation of upcoming IOL innovations may instead hinge on Zepto, a disposable automated capsulotomy

device about to enter the market (Mynosys Inc. Fremont, California, USA). (Zepto is the metric unit of measurement 1 million times smaller than femto). Zepto comes as a handpiece attached to a small control console. The handpiece's tip comprises of a soft, clear silicone suction cup that houses a nitinol super elastic capsulotomy ring, which compresses to enter a small corneal incision and re-expands within the eye to its native circular shape. Suction is applied through the cup to oppose the bottom edge of the capsulotomy ring to the capsule surface, trapping a very thin layer of water. A 4-millisecond pulse train causes a quick phase transition of the water molecules into vapour, and the accompanying volume expansion results in the cutting effect, which occurs simultaneously everywhere along the circular capsulotomy path. The tip is then withdrawn and the surgeon continues with the remainder of the cataract surgery.

Reaching for Zepto

Zepto requires no change to the steps of cataract surgery or patient flow. Instead of forceps, the surgeon simply reaches for Zepto to obtain quick, consistent, perfectly circular capsulotomies of the desired size (~5.2mm diameter). To date, Zepto has been used in over 200 cases worldwide with consistently excellent results. Patient follow-ups 8 months after surgery have shown stable capsulotomies with well-centred IOLs.

Test data and surgical experience have highlighted a number of unique

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and noteworthy Zepto capabilities. Biomechanical testing showed the Zepto capsulotomy edge to be much stronger and more tolerant of stretching than from the manual method or by femtolasers, due in part to an innovative capsule collagen re-modelling effect that results in a slight upturn of the capsulotomy edge. This upturning provides a rounded capsulotomy edge that presents the undisturbed undersurface of the capsule as the functional edge encountered during surgery. Zepto therefore potentially provides a greater surgical safety margin. Importantly, Zepto's resilient capsulotomy edge is also critical for the safe implantation of the upcoming generation of larger IOLs, designed to change shape in response to the eye focusing at different distances.

Zepto's product design and mechanism of action also help the surgeon avoid potential complications. The use of suction stabilises the lens during capsulotomy and eliminates stretching the delicate zonular tissues that is inherent in the manual capsule tearing method. This significantly benefits patients with weakened zonules from disease or trauma. As Zepto's capsulotomy action also occurs simultaneously everywhere along a circular path, Zepto can be used to instantaneously relieve pressure underneath the capsule in advanced cataracts, and the potential for explosive capsule rupture is eliminated. Thus, patients with these and other co-morbidities benefit when complicated surgery becomes easy with Zepto in the surgeon's hands.

Zepto is the only technology that allows the surgeon to place the capsulotomy intraoperatively precisely on the patient's visual axis. The eye's complex anatomy exists to ensure

that images are focused along the visual axis onto the fovea, the retinal area with the highest visual acuity. In today's surgery, despite available imaging technologies, surgeons are – at best – still guessing at the location of the visual axis when performing capsulotomy. Surgeons are already aware of this limitation for multifocal IOLs that require proper centration. The same limitation presents itself even more acutely for new IOLs that are anchored to the capsulotomy edge. Surgeons can interact with patients looking through the transparent Zepto suction cup and use Purkinje reflections to align the capsulotomy on the patient's visual axis. Zepto will be a real game changer as visually-centred capsulotomies are increasingly used to specify effective lens position.

ZACS

These advantages and unique capabilities of Zepto have engendered much interest in the concept of Zepto assisted cataract surgery (ZACS), as a potential new gold standard in cataract surgery. With ZACS, physicians can offer their patients not only a dimensionally perfect capsulotomy, but also one that has added safety. Complicated cataract cases will become routine while providing patients with the best possible results regarding IOL performance and stability. ZACS, for the first time, allows surgeons to precisely locate the capsulotomy on the patient's functional visual axis. This ability to tailor capsulotomies to the specific patient's ocular anatomy promises to be a new paradigm of personalised cataract surgery with optimised visual outcome.

As an easy-to-use tool that automates the most demanding step in cataract surgery, Zepto and ZACS offer something for every surgeon. For the surgeon

less confident in capsulotomy, it offers quick and perfect results. For surgeons contemplating offering premium IOLs to their patients, it offers capsulotomy quality along with personalised visual centration, to support practice expansion. For the high volume practitioner, Zepto and ZACS offer safety, consistency and efficiency in both simple and complex cases, while at the same time ensuring premium outcomes for patients via visual centration.

Zepto is expected by physician leaders to significantly impact cataract surgery, not only by being a highly versatile clinical tool, but also by being a low cost disposable tool that is easy to learn and integrate into routine cataract surgery. Of note, Zepto can be placed easily into phacoemulsification machines, and is commercially attractive not only as a standalone device, but also as a platform product that can be offered together with premium IOLs, viscoelastics, and cataract surgical packs. Be prepared to see Zepto and ZACS broadly disseminated and potentially become a new gold standard in the years to come.



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How can we prevent alcoholic liver disease?

Samuel W French, Professor of Pathology at Harbor-UCLA Medical Center, calls for collaborators on efforts to prevent alcoholic liver disease with the use of betaine

The purpose of my current study is to investigate alcoholic hepatitis pathogenesis by utilising liver biopsies derived from a clinical trial consortium. The major goal is to determine how to prevent alcoholic liver disease, since only liver transplantation can reliably treat this disorder.

In 2010 it was estimated that alcohol related cirrhosis accounted for 47.9% of all cirrhosis deaths and 46.9% of all cirrhosis disability. This disease burden costs about €125bn annually in Europe and represents 1.3% of GDP. Alcoholic hepatitis occurs in 35-40% of alcohol abusers with high mortality rates (40-50%) among untreated patients with severe disease (Singal and Anand, Clin Liver Dis, 2013; 2: 53-56). Alcoholic cirrhosis is the second most common indication for liver transplantation.

Clearly the time has come to provide a method to prevent alcoholic liver disease (ALD) (French Exp Mol Pathol 2015; 98: 304-307), rather than waiting for ALD to develop. In animal studies, we have shown experimentally that feeding betaine with alcohol can prevent ALD. Betaine is a small molecule normally present in the human body. It is a colourless, tasteless, soluble, cheap, odourless, and non-toxic chemical, which normally functions in the body to provide methyl groups to assist enzyme reactions.

Betaine has been used to treat non-alcoholic fatty liver (NASH) in clinical

trials in humans (20mg/day) without any liver toxicity or negative consequences. Betaine is a very potent antioxidant, blocking the liver toxicity mechanism caused by high blood alcohol levels (~500mg) that occur while binge drinking. In an experimental rat model where blood alcohol levels reached 500mg, a 7-10 day cycle (equivalent of binge drinking) lead to progressive liver injury. However, when betaine was added to the alcohol liquid diet (2g/kg body weight), the cyclic elevation of the blood alcohol levels remained low (between 100-200 mg) and no liver injury occurred (Li et al., Exp Mol Pathol 2011; 91: 540-547).

The mechanism by which betaine keeps the blood levels of alcohol low is complicated but it can be explained as follows:

1) During alcohol ingestion an enzyme called alcoholic dehydrogenase oxidises alcohol to form acetyl aldehyde (Fig). The rate of alcohol oxidation depends on the available levels of NAD⁺, because NAD⁺ is required for alcohol dehydrogenase to oxidize the blood alcohol and to eliminate it from the blood. Binge drinking overwhelms this mechanism and depletes the NAD⁺ levels and the blood levels go sky high which injures the liver.

2) Adding betaine to the diet replenishes the NAD⁺ levels by a complicated mechanism. In binge drinking the catecholamine from the adrenals are

released into the blood due to stress. Both norepinephrine and epinephrine become elevated in the blood. Betaine provides methyl groups for an enzyme that is required to convert norepinephrine to epinephrine. The enzyme is called phenylethanolamine N-methyl transferase. When it converts norepinephrine to epinephrine this causes an increase in the body's metabolic rate. Epinephrine is 5 to 10 times more potent to increase the metabolic rate than is norepinephrine. The increase in the metabolic rate generates NAD⁺ from the mitochondria. The 100 NAD⁺ increases the rate of elimination of alcohol from the blood by increasing the activity of alcoholic dehydrogenase. Then the blood alcohol falls to non-toxic levels to 100-200mg. In fact, betaine added to alcoholic beverages will keep the blood alcohol level at 100-200mg, despite binge drinking behaviour. This is how to prevent ALD.

This is a request for collaborators to assist in the prevention of ALD by adding 20g of betaine to alcoholic beverages or by the drinker prior to drinking the alcohol. Beer or wine would be ideal drinks to add betaine to, due to their large volume and common consumption. The drinker should be motivated to buy or prepare the alcoholic/betaine drink because of the many obvious benefits, such as not damaging their liver or not having an accident on the highway and killing many people.

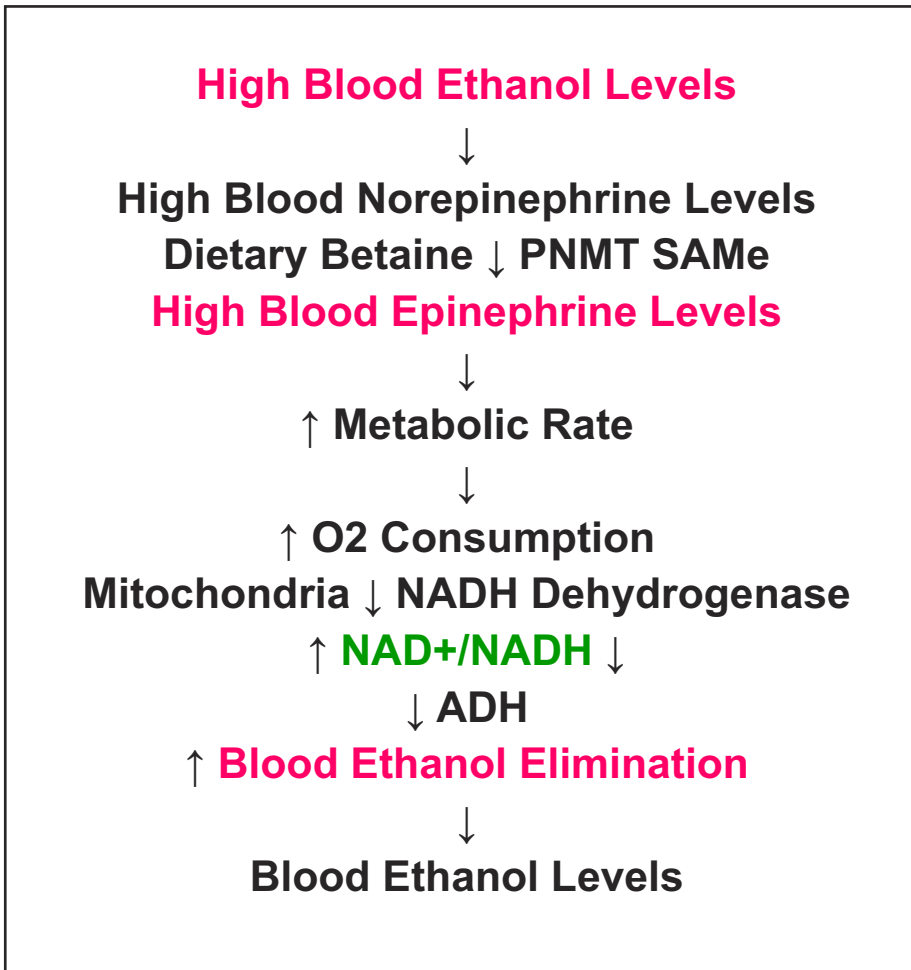


Fig. This is a scheme showing the mechanism by which betaine or SAME fed with ethanol causes an increase in the blood ethanol elimination rate and a decrease in blood alcohol levels through NAD⁺ generated by an increase in the metabolic rate caused by epinephrine conversion from norepinephrine. Published with the permission of Springer.

Please help me achieve this life saving process where dangerous blood alcohol levels are prevented by betaine added to the beverage.

About the author

Samuel W. French, M.D., FRCPS, FAASLD, FCAP, Born Milwaukee, Wisconsin 8/7/1926, AB UC Berkeley, 1949; UC San Francisco Medical School MD 1952. Currently Distinguished Professor of Pathology UCLA and Chief of Anatomic Pathology, Harbor-UCLA Medical Center. Board Certified in Anatomic Pathology. Honors: Distinguished Achievement

Award by the Research Center for the Alcoholic Liver and Pancreas Disease 1999; Life Achievement Award, LA Pathology Society 2011; Gold Headed Cane, American Society of Investigative Pathology, 2014; Legend Award, Los Angeles BioMed Institute, 2015. Publications: One Book; 44 Book Chapters; 471 peer reviewed articles; 59 case reports; 480 Abstracts; 19,500 citations.

Research Interests: Since my first NIH grant in 1960 my focus has been alcoholic liver disease (ALD) pathogenesis and I have been funded for studies on

ALD to this day by NIH, VA and Medical Research Council of Canada. Early on and continuing I focused on hypoxia of the liver in experimental models of ALD. I then focused on nutrition, i.e. vitamins, fatty acids, phospholipids and methyl donors effects on epigenetic mechanisms and liver pathology. I developed a new model of ALD in rats using continuous feeding of an alcohol diet intragastrically. Many scientists have adopted this model. We used it extensively to determine the mechanism of the 7 day cycle of the blood alcohol levels. These studies lead to the discovery how SAME or betaine in the diet increased the blood alcohol elimination rate and prevented ALD liver pathology. I focused on the role of CYP2E1 and oxygen toxicity using the intragastric tube alcohol feeding model. I focused on the mechanism of Mallory-Denk body (MDB) formation due to alcohol and drugs. We showed that MDB formed because of the loss of quality control of protein degradation and turnover because of inhibition of the 26s proteasome and a shift to form the immunoproteasome.



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The IMI programmes driving access to innovative medicines

By providing the infrastructure to support drug discovery, the IMI is accelerating access to innovative medicines, as the EFPIA highlights here...

Innovation is the lifeblood of the pharmaceutical industry, providing us with the potential to cross new therapeutic frontiers to bring novel medicines to market that benefit patients and deliver solutions to key healthcare challenges.

Against this backdrop, the Innovative Medicines Initiative (IMI) is working to improve health by speeding up the development of, and patient access to innovative medicines, particularly in areas where there is an unmet medical or social need. IMI does this by facilitating collaboration between key players in healthcare research, including universities, the pharmaceutical and other industries, small and medium-sized enterprises (SMEs), patient organisations, and medicines regulators.

During its first phase (2008-2013), IMI had a budget of €2bn, half of which came from the EU's Seventh Framework Programme for Research (FP7), and the other half from in-kind contributions by member companies of the European Federation of Pharmaceutical Industries and Associations (EFPIA). The total budget for IMI 2 is €3.276bn, with up to €1.638bn coming from the EU's Horizon 2020 programme, and €1.425bn in kind contributions from EFPIA companies. In addition, other life science industries and organisations may contribute a further €213m if they decide to join IMI 2 as members or as partners in individual projects. These projects envisage a public-private set-up and an honest broker (the IMI office) as a condition for success, where competitors can join forces and input from the academic and healthcare communities is needed.

Accelerating access to innovative medicines

IMI's primary focus is not on developing new medicines (although it does so for a few areas of high unmet need, such as antibiotics or vaccines for Ebola), but on

providing tools, methodologies, and infrastructure to accelerate the translation process from discovery to delivery in a range of therapeutic areas. Not only does each project deliver individually excellent results that will make a difference, but the combination of tools delivered by different projects will add additional quality and acceleration power, to integrate these new solutions in healthcare practice and systems.

Here we have put together a number of projects that showcase IMI 2's commitment to accelerating discovery in the research process, many through a data-driven approach: from a better understanding of diseases, through acceleration of discovery and validation of therapeutic targets and biomarkers, to infrastructures to enable identification of new molecules, improving clinical trials and optimising achievement of patient outcomes.

The European Lead Factory – ELF

Academics and researchers from small and medium sized enterprises (SMEs) often have scientifically sound and progressive ideas for new therapies, but limited ways in which to develop them. The European Lead Factory (ELF) is a collaborative public-private partnership that aims to deliver innovative drug discovery starting points. It is open to all defined molecular targets in all human disease areas and offers free access to a library of up to 500,000 novel compounds, a unique industry-standard (ultra-high through-put screening) uHTS platform, and much more.

Any European researcher from academia or SME can submit a target assay or library idea to ELF's committee of independent and industry professionals to assess, under confidentiality. If it passes this phase, the applicant will receive up to 50 hits from the library, which will enable them to open up business opportunities to develop the therapy.



eTOX

When a new drug is brought to market, efficiency and safety are of paramount importance. During the R&D process, vast amounts of data are generated, much of which remains in the archives of the pharmaceutical manufacturer. The eTOX is focused on developing a drug safety database from the pharmaceutical industry's legacy toxicology reports and from public toxicology data. It also aims to create innovative in silico strategies and novel software tools to better predict the toxicological profiles of small molecules in early stages of the drug development pipeline. The end products will be a comprehensive database with toxicity studies for thousands of drugs and drug candidates, and a collection of visual software applications for toxicity prediction.

The eTOX project furthermore represents a significant opportunity for academia, as it offers a unique opportunity for collaboration with the pharmaceutical industry on a state-of-the-art topic, from a scientific perspective. It aims to ensure that duplications, time- and resource-wasting in the research process are a thing of the past.

ULTRA-DD

The number of annual drug approvals has been on the rise over the last few years, while the number of first in class therapies has remained relatively constant – often less than 10 per year. It is the level of attrition in phase 2 proof-of-concept clinical studies that remains the biggest hurdle for these drug candidates, because often tests that use either simple cultures of human cells or animal models of disease are poor mimics of how diseases actually behave in humans.

ULTRA-DD has been designed to define and validate novel targets in auto-immune and inflammatory diseases by the use of patient-cell derived assays. Its goal is to deliver new tools and resources to speed up the development of truly innovative medicines, especially in areas where treatments are lacking currently, such as autoimmune and inflammatory diseases. The project is in the process of developing a suite of probes, tests and methodologies to study disease-specific research materials in depth. In addition, through one of its project partners, ULTRA-DD will work closely with related

initiatives carrying out similar work on neurological diseases and cancer.

There are also a number of IMI 2 projects that aim to boost the translational research infrastructure to accelerate R&D.

SPRINTT

Frailty has a dramatic impact on the quality of life of many elderly people, rendering them at greater risk of falls and disability, while also making hospitalisation more likely. The SPRINTT project focuses on providing all the necessary information and tools for identifying and treating a specific subpopulation of older persons at risk of mobility disability (loss of independence) showing precise clinical, biological, and functional characteristics. Specifically, it aims to offer a clear, objective, scientifically-based and clinically-relevant operational definition of Physical Frailty & Sarcopenia (PF&S).

At the heart of SPRINTT is a large clinical trial, designed to assess treatment options that could prevent the frail from becoming disabled and losing mobility. It will involve some 1,500 patients from across Europe, and will allocate participants randomly to one of two groups, followed over 2 years. The first will receive a multi-component intervention, including physical activity and nutritional advice and supplements, as well as innovative technologies. The second will take part in a general health education programme.

New Drugs for Bad Bugs – ND4BB

Antibiotic-resistant bacteria kills 25,000 people in the EU every year and costs the economy €1.5bn. This is now a major global public health threat, compounded by the fact that only 2 new classes of antibiotics have been brought to market in the last 30 years and many drug developers have left the field.

The €700m New Drugs for Bad Bugs (ND4BB) programme aims to bring new antimicrobials closer to patients, share information and boost research on improving the uptake (and decreasing the efflux) of

antibiotics into Gram-negative bacteria, which is one of the greatest challenges facing drug discovery for Gram-negative pathogens. The first projects kicked off in early 2013, and the programme now encompasses 7 projects that are starting to deliver exciting results in diverse aspects of antibiotic development.

European Medical Information Framework – EMIF

In their drive to develop new therapies, it can be difficult for health researchers to find out what digital data is available and where. IMI's European Medical Information Framework (EMIF) is developing a secure online data platform, with the help of some 50 million de-identified patient records, and also has proof of principle work in 2 disease areas in which it pursues the development of early biomarkers: Alzheimer's disease and metabolic disorders.

The common information platform will address the numerous challenges of handling personal health data, including ethics and data privacy. When complete, the framework should be sustainable, underpinned by a business and governance model. It will support future health data research in addition to the current research topics, potentially increasing both publicly funded academic and also industry research.

These are just a few significant examples of IMI 2's commitment to driving innovation in research to ensure that patients across Europe benefit from these new discoveries. ■

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ProteoLipins and LipoFishins: Novel nutraceuticals and their effects

Dr Ramón Cacabelos, President of EuroEspes Biomedical Research Center, highlights the potential benefits of novel nutraceuticals including ProteoLipins...

Pharmacotherapy is a fundamental cornerstone in the global fight against disease worldwide. The value of drug production has grown four times more rapidly than the world's income. High-income countries dominate in world pharmaceutical production (90% vs 7%). The cost of drugs represents about 10-20% of direct costs in the management of a particular disease; in the EU, outpatient pharmaceutical spending accounts for 16% of total expenditure on health care and 1.6% of GDP.

The EU is the second biggest pharmaceutical market after the US, totalling around €200 billion/year. Total current expenditure on health (outpatients) has increased from 5% GDP in 1970 to 9.9% GDP in 2010, and a parallel increase has been observed in total expenditure on pharmaceuticals (from 1% to 1.6% GDP) during the same period.

Health expenditure per capita tends to correlate positively with GDP per capita, especially in European countries with low GDP per capita. About 70-80% of health spending is publicly financed. Private health insurance accounts for only about 3-4% of total health expenditure across European countries.

Despite controversies about the price of drugs and the high cost of health services in the EU, there is a growing concern about drug use-related

issues, including over-prescription, misuse, self-administration, symptomatic vs anti-pathogenic effects, unclear mechanisms of action, cost-effectiveness, impact on the quality of life, and long-term side effects. Furthermore, drug-drug interactions are the cause of an important number of cases of acute hospitalization in people over 50 years of age.

Traditional medicine still popular in the East

All these circumstances together are contributing to the popularisation of opinions against the abusive use of therapeutic compounds in Western society, where a growing number of persons are prone to consume natural products instead of chemicals for health purposes. In Asia, particularly in China and Japan, traditional medicine is very popular. In Japan, Kampo Medicine (the Han Method, referring to the herbal system of China that developed during the Han Dynasty), restored by Keisetsu Otsuka and Domei Yakazu in the past century after several decades of suppression during the rise of Western medicine, is currently used by over 30% of the Japanese population.

The modern nutraceutical market began to develop in Japan during the 1980s. The term "nutraceutical" was introduced in 1989 by Dr Stephen L. DeFelice in the US. A nutraceutical is a type of food substance (functional food, nutritional supplement) that

helps to maintain health and prevent illness. They are vegetal, marine or animal bioderivatives. Over the past 30 years, many different types of nutraceuticals have been produced for the natural management of diverse health conditions. It is estimated that the worldwide nutraceutical market will reach \$250 billion by 2018.

A novel category of nutraceutical compounds is represented by the ProteoLipins, a series of lipoproteins derived from natural sources. Among ProteoLipins, LipoFishins (LFs) are a new class of lipoproteins derived from the muscle of different fish species. Examples of LPs obtained from biomarine sources by means of non-denaturing biotechnological procedures include the following: E-JUR-94013 (DefenVid®), E-CAB-94011 (CabyMar®), E-Congerine-10423 (AntiGan®), E-SAR-94010 (LipoEsar®), and E-MHK-0103 (MineraXin®). Clinical studies with some of these products in different clinical conditions (cardiovascular disorders, cancer, Alzheimer's disease) have revealed that most of the effects of these novel bioproducts are genotype-dependent, showing specific nutrigenomic and pharmacogenomic profiles.

Some ProteoLipins and their effects

E-CAB-94011 is an LF obtained from the muscle of the species *Scombrus scombrus*, with anti-oxidant, anti-inflammatory, and bio-energising

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properties, with potential utility in several medical conditions such as anemia, debilitating disorders, alterations in growth and development, vascular disease, and neurodegenerative disorders.

E-Congerine-10423 is an LP extracted from muscular structures of the species *Conger conger*. This compound displays a powerful anti-tumoral effect in many different tumor cell-lines, with specific effects in some solid tumors, sarcoma, liposarcoma, colon cancer, ulcerative colitis, and Crohn's disease.

E-MHK-0103 is an atypical LP derived from the Atlantic mollusc *Mytillus galloprovincialis* cultivated on the Atlantic coast of Galicia, Spain. This bioproduct regulates hypothalamus-pituitary hormones, influences growth and development, protects against menopause-related biological decline, and modulates bone metabolism, acting as a powerful anti-osteoporotic agent.

E-SAR-94010 (Sardilipin, LipoEsar®, LipoSea®) is an LP obtained from the species *Sardina pilchardus*. The main chemical compounds of LipoEsar® are lipoproteins (60-80%) whose micelle structure probably mimics that of physiological lipoproteins involved in lipid metabolism. In pre-clinical studies, sardilipin has been shown to be effective in (i) reducing blood cholesterol, triglyceride, uric acid and glucose levels, as well as liver alanine aminotransferase and aspartate aminotransferase activity; (ii) enhancing immunological function by regulating both lymphocyte and microglia activity; (iii) inducing antioxidant effects mediated by superoxide dismutase activity; and (iv) improving cognitive function.

This LP displays a powerful effect in the regulation of lipid metabolism, especially by reducing total-cholesterol and LDL-cholesterol levels in cases of dyslipidemia or hypercholesterolemia, and also acting as an effective co-adjuvant of statins. E-SAR is an excellent cardioprotector and is effective in liver steatosis and in cases of primary or secondary transaminitis. It is also a strong anti-atherogenic agent, reducing the size of atheroma plaques in systemic atherosclerosis. E-SAR has shown cognitive-enhancing properties in hypercholesterolemic patients with Alzheimer's disease. The therapeutic response of patients with dyslipidemia to sardilipin is APOE-related. The best responders are patients with APOE-3/3 > APOE-3/4 > APOE-4/4. Patients with the other APOE genotypes (2/2, 2/3, 2/4) do not show any hypolipemic response to this novel compound. In patients with dementia, the effects of sardilipin are very similar to those observed in patients with chronic dyslipidemia, suggesting that the lipid-lowering properties of sardilipin are APOE-dependent.

E-JUR-94013 (DefenVid®) is an LP derived from the species *Trachurus trachurus*, with anti-inflammatory activity and powerful immune-enhancing properties in cases of immunodeficiency, microbial infections and/or diseases in which there is a functional compromise of the immune system. DefenVid significantly modifies white blood cell (WBC) numbers in a differential fashion, decreasing neutrophils, increasing lymphocytes, monocytes and eosinophils, and not affecting basophils. The effect of DefenVid is immunomodulatory due to the fact that in cases with high WBC numbers the general tendency is to reduce the

excess of WBC, whereas in cases with low levels of WBC DefenVid tends to increase WBC, approaching normal levels. This immunomodulatory effect of DefenVid is influenced, in part, by SNP variation associated at least with the IL1B, IL6 and TNF genes, classically involved in neuroimmune regulation and inflammatory reactions.

In patients with an immunodeficient phenotype, DefenVid reduces blood cholesterol levels in over 60% of the cases, similarly to LipoEsar in dyslipidemic patients. A differential pattern of cholesterol response to DefenVid is also associated with the IL1B-T3954C, IL6-G174C, IL6R-A1510C and TNFA-G308A variants, which are involved in inflammatory reactions associated with atherogenesis. These data, together with those reported on the APOE-dependent anti-atherogenic effect of LipoEsar, suggest that this class of LFs might be useful in the prevention of arteriosclerosis and vascular risk, either peripheral or central, in the hypercholesterolemic population and in neurodegenerative disorders.



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Developing bioactive compounds through cooperation

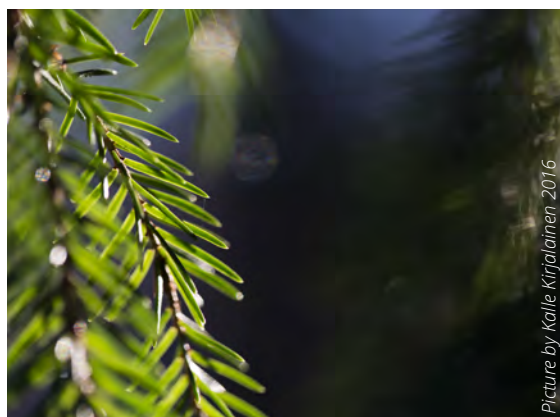
Montisera is working with world-leading Finnish researchers to develop bioactive compounds with health benefits

Montisera takes full advantage of bioactive molecules – molecules with a health promoting effect. Finland is globally known as the world leader in life science publications and inventions – but not in commercializing them. With Montisera, the best assets of Finnish university research are turned into a valuable business: Pharmaceuticals along with bioeconomy-based functional foods.

Montisera is a privately owned Finnish development company focused on discovering, developing and commercialising bioactive compounds from its development platform. The company's roots are in a joint project between the Finnish forest industry and research organisations. This "Future Biorefinery" project produced an innovation that now has one of the few patents that have been granted globally for an extract with health promoting effects. This patented extract is from spruce, and it has been proven to have a positive effect on lower urinary tract disorders.

Business model

Mira Povelainen, CEO of Montisera, explains the company's business model: "Our focus is on the early stage development of the compounds, where the development cycle in the different phases is rather short (1-3 years). We operate in a virtual, agile way by sourcing our innovations mostly from Finnish academia. Thus, investments in our own labs or extensive staff are



Picture by Kalle Kirjalainen 2016

avoided; this enables the company to use the best research expertise in each case, but also ensures the cost-efficiency of the development work. Montisera's lean organisation ensures fast management decisions, and relationships with investors and asset buyers are based on rewarding models and partnerships."

Pipeline

Montisera_D4.1 is a patented hot water extract for prevention and treatment of lower urinary tract diseases. The extract has passed the efficacy tests and is currently at the toxicological tests stage. The product is extracted from Norway spruce, *Picea abies*.

Montisera_D15 is a novel, patented molecule for CNS related diseases, especially dependency disorders. The molecule is a novel 6,7-disubstituted-isoquinoline, and both USPTO and EPO have issued patent for its' medical use. Montisera has concluded acute toxicity studies with the compound, and the efficacy studies for the treat-

ment of alcoholism are evident.

Montisera aims to finalise its novel alcoholism drug project so that the first human trials can start as soon as possible and help for patients. In addition to this, Montisera has its above-mentioned patented product from Finnish forest

in its development pipeline. The product will be taken further towards markets as a novel food, food ingredient and/or functional food.



MONTISERA

Bioactive Development

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For health technology, Finland is a haven

In Finland, health technology benefits from research investment and a culture of collaboration, as the former Minister of Economic Affairs details here...

When it comes to health technology, Finland is said to be among the three strongest economies in the world, with digital health being its largest high-tech export. Innovations in healthcare play a vital role in developing new treatments to help people live normal lives in spite of illness or health issues. In October last year, Former Minister of Economic Affairs in Finland, Olli Rehn, spoke about the Finnish government's actions to "boost the health industry growth".

Speaking at a symposium for brain diseases, Rehn said: "Finland has invested in health-related science, research and education, as well as research infrastructures and extensive public healthcare system for decades. Now these investments are starting to bear fruit not only in healthcare but also as a source for innovation, business opportunities, jobs and economic growth.

"Helping to resolve the health challenges by providing new solutions for health and wellbeing has become one of Finland's strengths. Finland's health sector and the sector's international links have grown at a faster pace than many other sectors in recent years. Today, Finland is a home of key centres of excellence for many globally operating corporations and has globally recognised research and technology spearheads in the health sector.

"Our common effort and investments are now delivering tangible results.

"Health technology, life sciences, digital health and wellbeing solutions as well as research related services are estimated to generate at the moment some €5bn as economic output annually (2.5% of Finland's GDP). According to the industry association, health technology accounts for about half of Finnish high-tech exports, having reached a new record level of €1.92bn in 2015.

"The growth of both domestic and foreign direct investments and number of new research collaboration agreements signals that the opportunities offered by our operating environment and innovation ecosystem are also recognised elsewhere.

"In spite of the breakthroughs in research, growth of exports and number of new investment plans, we still have room to improve to benefit from the opportunities available.

"Another essential objective for improving R&D impact is to boost the profiling and division of work between different players. In the health sector, nationally networked and strong hubs representing specific research fields could help to reach results and attract talent, as well as knowledge intensive companies and funding on the levels that no player would be able to achieve alone."

"Digital health, personalised medicine and healthcare, as well as scientific research in areas, such as cancer and brain diseases are among the areas where Finnish knowhow is world-class. Interestingly, these are corresponding to areas where need for new innovations and solutions is in high demand.

"Thinking big and global in this regard cannot be emphasised too much – only by having the right level of ambition and being one of the best you can attract investments, funding, talent and market share.

"In order to be successful in benefitting from the opportunities, we need cooperation between companies of different sizes from different fields – both domestic and foreign – and research institutions, universities, hospitals, biobanks and investors.



Image: © IMF Photo/Michael Spilotro

Former Minister of Economic Affairs in Finland, Olli Rehn

“Enhancing this type of multidisciplinary public-private cooperation is a key objective of Finland’s Health Sector Growth Strategy. The strategy was created and continues to be implemented jointly by ministries, key funding agencies, industry, universities and university hospitals. The recent growth in the sector and the new innovations and companies entering the market are an indication that, by working and innovating together, we are on right track.

“The government is committed to further developing Finland as a competitive environment for health-sector research, innovation and business.”

“Boosting health sector growth is one of the key priorities in our overall growth policy. We are building on our strengths, thus Digital health and personalised medicine are at the core of the growth strategy.

“Us Finns have high trust in science. Being able to rely on ethically sound legislation and research practices is not only important for our citizens, but a trustworthy environment is also a key enabler for research community and the companies doing research in Finland.

“As we are drafting and implementing new legislation we continue to take into account citizens’ fundamental rights, data protection and privacy when building research- and innovation-friendly operating environment. We already have good experience of balancing the different needs in the biobank legislation, and these same principles are high on our agenda when now drafting the law on utilisation of health data in research and innovation and enabling new digital services in healthcare.

“I will next go through some of the on-going actions, investments and plans we are implementing: As phar-

maceutical industry and research institutes are looking for more effective ways to do research utilising big data and advanced analytics, the combination of our world-class biobanks, relatively isolated gene pool, extensive healthcare registries and the innovation friendly biobank regulation creates a very competitive environment internationally. Government recently announced a package of investments, totalling €17m to make these unique assets of Finland even stronger.

“National Genome Centre and national Comprehensive Cancer Center Finland will be established in Finland. As part of this investment package we are also taking actions to enhance collaboration of our biobanks. At a time of tight public finances, this level of funding is a strong statement and reflects our commitment.

“Helping to resolve the health challenges by providing new solutions for health and wellbeing has become one of Finland’s strengths. Finland’s health sector and the sector’s international links have grown at a faster pace than many other sectors in recent years. Today, Finland is a home of key centres of excellence for many globally operating corporations and has globally recognised research and technology spear-heads in the health sector.”

“Without doubt health-related science, research and education, as well as research infrastructures and healthcare has been one of the most heavily invested areas of our society for decades. However, the high-quality basic research has resulted in fewer innovations and commercial applications than we would have expected and hoped for.

“In the funding for health sector research provided by Tekes and the Academy of Finland and in the development of mutually complementary funding instruments, key objectives now include increasing the impact of research and enabling the utilisation of research results. Challenge Finland, Research Benefit and Innovation Scout are examples of the programs going on.

Collaboration between Academy of Finland and Tekes to support commercialisation of the most potential Academy funded health research is also on-going.

“Another essential objective for improving R&D impact is to boost the profiling and division of work between different players. In the health sector, nationally networked and strong hubs representing specific research fields could help to reach results and attract talent, as well as knowledge intensive companies and funding on the levels that no player would be able to achieve alone. Academy of Finland provides funding for this.

“In the reform of Finland’s social welfare and healthcare sectors, many processes and structures within healthcare will be renewed. The reform cannot be realised without utilising the opportunities that technology, digitalisation and new treatments offer. At the same time we have an opportunity to look at ways to strengthen public-private collaboration in research and innovation.

“The government is committed to further developing Finland as a competitive environment for health-sector research, innovation and business. We do not pick the winners, and it is up to companies, universities and university hospitals how the possibilities are utilised. Finland’s future success in this demanding but fruitful market will depend on the added value and the effectiveness of all of our actions. Best of success in that endeavour.”

This is an edited version of a speech that [can be found here](#). ■

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The rapid blood alcohol test that could save lives

Albio™ is a rapid and cost-effective blood alcohol test which could help paramedics and emergency responders save lives

Albio™ is a new tool for paramedics and emergency responders (ERs) to obtain fast and accurate information about patient's blood alcohol level in order to make life-saving decisions on treatment and medication. Albio™ is designed to work in field conditions.

Alcohol is the most used drug in the world. More than 45% of the paramedics' and ERs' patients are under the influence of alcohol. Alcohol has a huge effect in treatment methods and medications. Yet, so far, the only reliable way to get blood-alcohol level information on an unconscious patient has been via a clinical lab test. Unfortunately, they take time, are expensive, require special instruments and skilled staff, and are not available on ambulances or in a portable kit.

Albio™ gives a reliable result in less than 20 seconds, is 10 to 40 times less expensive per test, and doesn't require special skills or expensive instruments. Enabling faster treatment and better diagnosis with Albio™ is beneficial both to medical professionals and patients. Several medicines, typically pain-killers, react with alcohol. Thus, it is very important to know what the blood-alcohol level is for the correct dosage.



Realising savings in the field and lab

Albio™ has a great economic impact. Tests being 10 to 40 times cheaper than current methods can bring up to €125 savings for each test. Savings also come from transportation (fewer unnecessary ambulance rides), as well as from staff and workload in laboratories. If this device is used in ER and by paramedics, annual savings would be in the millions. We have calculated, from dispatch data in Finland, that a single ambulance has 3 patients per shift where this device would be necessary.

The sample for Albio™ is drawn from the fingertip in the same way that it is in glucose monitoring tests. Albio™ test-strips are also used in the same way as glucose meters. The meter has enough memory for more than 940 test results. The data-exchange is done by standard USB-cable connection. The Albio™ meter doesn't need any expensive maintenance type calibration, it is connected by entering the four-digit code from the strip vial into the meter.

Breathalyzers measure alcohol from the patient's breath, which often is not

the same as their blood-level. The accuracy of a breathalyzer measurement is affected by recent drinking and smoking and even eating, through residues in the mouth's mucous membrane. Patients who are unconscious, who have had a bad trauma, or who are hysterical are not able to give a breathalyzer sample.

Albio™ is developed by PAL Finland together with partners including Finland State Research Centre, the University of Eastern Finland, Kuopio University Hospital and multiple companies both from Finland and from abroad.


Alcohol Biometer by PAL Finland

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Sustainable healthcare and the technological revolution

Anssi Pulkkinen, Director of Wellbeing and Health at Finnish funding agency Tekes, on the role of technology in securing sustainable healthcare for all...

Technological development and innovations have managed to produce wellbeing and prosperity in modern Europe. Today people enjoy longer, happier and healthier lives.

Parallel to this positive development, national economies have been challenged with recent limited global macroeconomic views and steadily growing healthcare spend. On a government budget level, the economical sustainability of producing health and wellbeing has become a key challenge. Furthermore, in healthcare, it has been shown that an extended Pareto rule exists – just over 10% of the population are likely to consume nearly 90% of healthcare resources.

Due to this imbalanced pattern of consumption in addition to budgetary limitations, there is an increasing need to reform publicly financed healthcare services as they no longer meet governments' efficiency measures. The systems are not just challenged by ageing demographics, but also epidemics of lifestyle diseases like Type 2 diabetes.

Patient engagement is vital

Key to addressing the sustainability caveats is to empower citizens to take better care of themselves and provide technologically advanced and innovative products and services which people can utilise for their benefit. In addition, MyData is opening a new window

for individuals to get engaged with their health and behavioural data. This secondary data might become more important than expected by healthcare professionals. MyData has a fair chance of impacting behaviour more than education and doctors' instructions. It also may represent valuable Real World Evidence for the pharmaceutical industry.

The saying, "The happiest people don't have the best of everything, they just make the best of everything" also addresses well the role of innovation in the context of healthcare. Societies in the Nordic latitudes, like Finland, may square the circle between sustainability and development in healthcare by innovation. People of the Nordic societies express high trust in public authorities and for decades already have been authorising the utilisation of personal data for research for the common good. The Nordics, in the modern sense including the Baltics, have some of the keys to developing logical solutions that will help the rest of Europe in the game of solving unsustainability in healthcare.

Finland is claimed to have one of the most efficient healthcare systems in the world. Its publicly financed healthcare system has a long history. Its maternal and infant care system was established more than a hundred years ago. The country is spending under 10% of GDP on healthcare, representing one of the top efficiencies in the world. Digitalisation is already building up in Finland, where 98% of all patients' records are now in electronic format.

Ushering in the digital era

Digitalisation is going to be the most sizeable force ever seen in healthcare. It is accelerating health provision at a rate comparable to the transformation driven by electrification and industrialism at the end of the 19th century. Digitalisation is a stimulus overpowering this profession-driven industry which ultimately translates to the greatest change in the era of modern healthcare. These advancements offer several business opportunities, particularly as the legal environment is considered positive for R&D and innovation. Finland

has been attracting foreign investments and global players, recently GE Healthcare and IBM's Watson.

Some nations are limiting their investments in healthcare infrastructure to gain better efficiencies. Paradoxically, the Nordic countries are not. They are going to spend €30bn in next 5 years for building new hospitals. They see that they need this transformative power to reform healthcare from good to great. Finland is looking to disruptive technologies and is transforming hospital blueprints, fitting them with the latest technology to drive dynamic setup of Internet of Things (IoT) Hospitals.

Digitalisation to propel sustainable healthcare

Some of the most intrepid visions paint future nations without today's hospitals. Artificial intelligence integrated with health records may offer comfortably advanced healthcare services in future homes. As the Nordic countries have their own individual high-end health tech profiles and there is a good cooperation between countries, there is a good chance that the rest of Europe will hear from these innovative nations.

The Nordics have already embarked on the digitalisation of health. Now, there is a window of opportunity to utilise the competencies and ecosystems of the Nordics in transforming European healthcare systems to meet citizens' needs and the standards of a digital era.

Let's make Europeans live longer, happier and healthier with the help of the Nordic health dimension. ■

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Anssi Pulkkinen

Director, Wellbeing and Health

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A strategy for digital healthcare in France

M F Warrender highlights the strides made on digital healthcare in France, and outlines what Health Minister Marisol Touraine is doing to secure its future...

Digital healthcare in France has evolved immensely over the last decade. New technology and innovations are leading the way to help to reduce the burden of many challenges, such as an ageing population and chronic health problems. In supporting patients and doctors alike, improving services and patients' quality of life, eHealth is proving to be a key tool for the healthcare sector.

"E-health brings strong promises, including a better quality, safer and more efficient healthcare system", declares French Minister of Health and Social Affairs, Marisol Touraine, as she describes the [benefits of France's current 2020 eHealth Strategy](#).

"Touraine has installed a dedicated action plan consisting of high priority actions to be implemented by healthcare institutions, and medical laboratories in order to protect information, manage accounts and secure internet access."

In December 2015, the French Association of Medical Devices Companies (SNITEM), the French Association of Pharmaceutical Companies (LEEM) and the main associations representing companies in the IT sector (FEIMA, LESISS and Syntec Numérique) created the alliance eHealth France, which aims to foster eHealth initiatives. The goal of this alliance is to create further engagement with new ideas and reinforce new and current eHealth initiatives.

Digital healthcare in France: The national eHealth strategy

Touraine, who has served as Minister of Health and Social Affairs since May 2012, unveiled [France's National eHealth strategy](#) in October 2016, boosting

eHealth initiatives and bringing together representatives of industry professionals, users, and public institutions that contribute to its implementation, with its 4 pillars of priority:

- Develop medicine connected through a "big data" plan. This plan will allow for example the development of new remote monitoring applications or interpretation of medical data to assist healthcare professionals in their diagnosis;
- Foster co-innovation between health professionals, citizens and economic players with the launch of calls for projects dedicated to e-health or development of "living labs" that allow companies to test their innovations in real life settings in order to imagine, in direct connection with users, the medicine of tomorrow (telemedicine tools, treatment tracking applications, etc.);
- Administrative simplification for patients (such as admission, and making appointments online) and equip health democracy with a digital platform to facilitate consultation and participation of users;
- Strengthen the security of health information systems through a dedicated action plan.

This strategy represents forward facing, modernising research, incorporating technology. It has been prompted by advances in the ability to collect substantial amounts of health data through a variety of connected devices such as phones, smart watches, and apps, which all present the opportunity to improve health monitoring, prevention and research. Everywhere in France, doctors, nurses, administrative staff and patients are proposing and implementing new ways of working thanks to today's digital age.



Image: © Mathieu Delmestre

In the strategy's introduction, Touraine states that these innovations are vital to our healthcare system in order to overcome new problems between professionals, to cope with the increasing number of patients suffering with chronic illnesses, and to enable patients to be more involved in their own healthcare. Marisol Touraine also announced in May, an investment plan of €2bn, including €750m for the development of digital tools.

Risk and reward

While there are countless benefits to this strategy, there are also many undeniable risks accompanying it. This is where the fourth pillar of the strategy comes to the forefront of importance. Touraine has installed a dedicated action plan consisting of high priority actions to be implemented by healthcare institutions, and medical laboratories in order to protect information, manage accounts and secure internet access.

Touraine stressed that "safety and security are indispensable to the trust and acceptability of innovation for patients, as well as professionals", ensuring questions from both the public and professional fields don't go unanswered and people are never left feeling unsettled

about this new approach, and the risks that inevitably follow. "I want healthcare institutions to take responsibility in this field and take all the necessary measures to ensure that they function effectively."

On 2 January 2017, Touraine released a statement wishing France all the best for the New Year, with reference to some priority areas that the Ministry of Health and Social Affairs will focus on during this coming year. She highlights complimentary health care for all employees, caregiver's rights, strengthening access to abortion, and finally, access to innovative treatments, which the 2020 eHealth strategy will aim to produce. ■

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Remote patient monitoring to enhance follow-up management

Digital solutions are opening the door to remote patient monitoring, as Nouveal e-health's e-fitback app demonstrates

Over the past few years, several issues have been raised in the health sector: Rising expenses, saturated healthcare centres, avoidable re-admissions, patients getting more involved in their care, and healthy ageing. The European Union has been addressing these concerns through its 2010-2020 plan for health. Simultaneously, Information and Communication Technologies (ICTs) have become more widespread in healthcare.

In order to address these key issues, Nouveal e-health has been developing a remote patient monitoring solution called e-fitback to put ICTs at the forefront of healthcare. In a few words, e-fitback is an e-health solution that is available on the web, via electronic tablets and smartphones (App Store and Google Play) and has been designed for use by both patients and healthcare professionals. It is currently used to enhance day surgery, and is about to be applied to many other fields, including psychiatry and oncology.

What is e-fitback and how does it add value for healthcare centres?

For healthcare centres, e-fitback automates many time-consuming tasks such as administrative paperwork, and phone calls before and after surgery. e-fitback also allows for better priority management by highlighting patients who need particular attention from the healthcare team. This solution also includes an analytical tool to assess



protocols' efficiency and therefore track and increase patient satisfaction.

As for patients, they are assisted through their whole pathway, from pre-admission to the end of their recovery. Back home after the first appointment with the surgeon, patients create their ID, log into the application and start the pre-admission paperwork directly via e-fitback, without having to return to the healthcare centre.

They also receive pre-operative information regarding their surgery: Information about how to be well prepared, about their recovery, and checklists to ensure they are ready for their operation to help to avoid cancellations. Back home, patients receive medical questionnaires to fill in about their condition. According to their answers, an alert is triggered and sent to the medical staff in charge of the e-fitback follow-up. Patients are then taken care of accordingly, depending on the level of the alert

which is triggered, to prevent further complications and re-admissions.

During the entire pathway, patients can use the app's messaging service, where media are redeveloped to ensure the confidentiality of the exchanges. This way the remote patient follow-up is entirely secure as they are constantly monitored by the solution.

Contact us and we will be glad to show you all the features of the solution e-fitback.

nouveal
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Membranous nephropathy: A renal auto-immune disease

Professor Pierre Ronco describes advances in our understanding of membranous nephropathy and the promise of precision medicine to treat the disease

A rare disease which affects the kidney, membranous nephropathy, is the second-most common cause of nephrotic syndrome that is characterised by massive protein loss in the urine. The consequence of that is the decrease of serum albumin in the blood, generalised oedema, weight gain, fatigue, and sometimes fatal thrombotic complications such as lung emboli.

The disease can evolve in three ways; spontaneous remission, persistent proteinuria, or end-stage renal failure requiring dialysis or transplantation. It is caused by a thickening of the basement membrane of the glomerulus, a filtering unit in the kidney. This thickening is the consequence of the accumulation of immune deposits, composed of antibodies and antigens. The result of that is the activation of a cascade of inflammatory events which involves the complement system and causes proteinuria. Since the identification in the early 1980s of an antigen called megalin in Heymann's nephritis, the rat model of the disease, the quest for a human antigen had been disappointing.

Moving towards more personalised medicine

My co-worker, Dr Hanna Debiec (Research Director at INSERM), and I re-opened the field in 2002 by characterising the first human antigen called neutral endopeptidase at the surface

of podocytes, the cells in the glomerulus which control the selectivity of the renal barrier to proteins. Interestingly, this antigen was identified in a rare subset of the disease that develops in neonates born to mothers that lack neutral endopeptidase and develop antibodies to it during pregnancy. This discovery provided the proof of principle that in humans like in the rat, a podocyte antigen could serve as target for pathogenic circulating antibodies.

Additional podocyte antigens have been identified including in 2009, the type-1 phospholipase A2 receptor (PLA2R1) and in 2014, the thrombospondin type-1 domain-containing 7A (THSD7A), which are respectively associated with about 80% and more than 5% of adult forms of the disease. This clearly establishes that this disease is auto-immune in nature. My lab has also identified food antigens such as bovine serum albumin as a cause of the disease in young children. Other environmental factors may account for the dramatic increase in frequency of the disease.

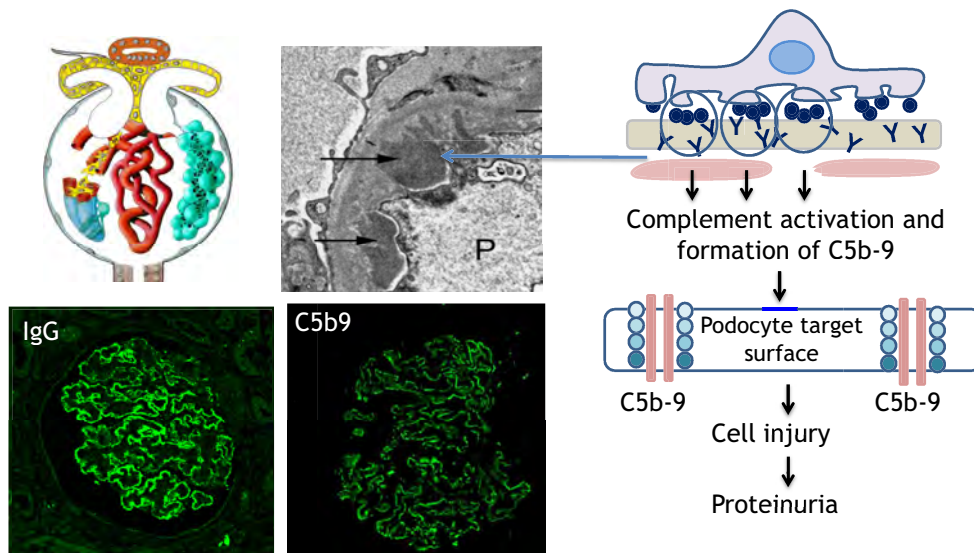
These discoveries have been paradigm-shifting in patients' care. They led to the development of diagnostic tests showing that the detection of anti-PLA2R antibodies in the blood was specific for the disease which means that a kidney biopsy, a potentially hazardous diagnostic

procedure, is no longer needed. While measuring daily urinary protein excretion was the only means to evaluate disease activity, it has now been shown that high PLA2R1 antibody titres are associated with a worse prognosis and that antibody titre is correlated to disease activity.

A further step has been taken toward more personalised medicine with the identification of epitopes that are defined by small domains of the PLA2R1 antigen recognised by circulating antibodies. It has been shown that the more epitopes are recognised, the more severe the disease. Immune response spreading to additional epitopes will likely be accessible to routine lab tests in the near future, which will allow most accurate evaluation of disease activity and risk for developing severe renal failure.

Triggering events behind membranous nephropathy

A lot of questions remain unsolved. One primary objective of my lab is to understand the triggering events that lead to the disease and the pre-disposing factors behind positive or negative outcomes. The first step is the presentation of the antigens to the immune system by the HLA class-2 molecules, which we have identified in our European consortium in a whole-genome study of more than 600 patients. What is not known is the trigger event: molecular mimicry with



Major cause of urinary protein loss and renal failure

Figure legend: Pathogenic mechanisms in membranous nephropathy, a model of auto-immune disease. Upper left: scheme of a glomerulus, the filtering unit of the kidney, and immune deposits shown as dark formations (arrows) in the glomerular capillary wall by electron microscopy. Upper right: scheme of the glomerular capillary wall showing endothelial cells (pink) facing the blood, the basement membrane (dark green) and the podocyte (magenta). Antigens such as neutral endopeptidase, PLA2R1, or THSD7A (dark blue circles) and the corresponding antibodies (black Y) are shown. Accumulation of immune complexes involving those antigens and the corresponding antibodies induce activation of the complement cascade resulting in the formation of C5b-9, the membrane attack complex of complement which becomes inserted into the podocyte membrane causing cell injury and proteinuria (lower right). Deposits of IgG (the antibodies) and C5b-9 in the kidney biopsy of a patient with membranous nephropathy are shown on the lower left.

microbes or toxic agents could play an important role.

Neither does one know why the disease does not invariably progress to a point where treatment is required. Spontaneous remission could be due to the disappearance of the triggering event, or possibly another mechanism is involved. We think that genetic variants and epigenetic events within the HLA-D and PLA2R1 loci, and outside in the genome, might play an important role.

The current methods of treating membranous nephropathy rely primarily on immuno-suppressive agents such as corticosteroids. Alongside their toxicity, there are two main problems with this method of treatment. The first is that a maximum of 70-80% of patients will enter remission of proteinuria. The second is that the effect of the treatment is delayed. It is necessary to develop alternative new therapies that will work more rapidly.

Implications for organ-specific autoimmune disease

Our OSAI project, supported by an advanced grant from the European Commission, is meant to address those questions. It is using cutting-edge techniques such HLA peptidomics – a method which has been developed with our colleagues in Zürich (Tim Fugmann, Dario Neri) – to identify PLA2R1 T-cell epitopes in the blood. This technique has never previously been used to study auto-immune disorders. The second key technique is molecular modelling of the membrane attack complex of complement.

With this model, we will be able to identify each of the possible intermediate steps of the membrane attack complex assembly. Then we can potentially propose new compounds that block complement assembly and prevent inflammation (collaboration with Bogdan Iorga, Paris).

This research could also hold implica-

tions beyond membranous nephropathy, as the condition is considered to be a paradigm of organ-specific autoimmune disease. A major objective is to propose predictive biomarkers to clinicians, in order to determine those patients who will need treatment and those who won't, and this question is common to all organ-specific autoimmune diseases.



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How digital hospitals can help provide better care

Elisabetta Zanon, Director of the NHS European Office, describes how digital hospitals can deliver better care whilst improving productivity and efficiency...

Hospitals across Europe share the same challenge of improving standards of care and moving to a better patient-centred approach, while at the same time improving their productivity and efficiency to respond to the continuous increase in demand at a time of funding squeeze.

Responding to this challenge requires looking at innovative approaches to delivering care, including adopting new ICT solutions. The added value of digital technology is that it allows data to be shared between patients, clinicians and providers in the quickest and most effective way, not only to cure the patient, but also to put in place the most adequate preventative and early intervention measures to keep citizens healthy and reduce the risk of hospital admissions.

“Denmark in particular is a world leader in digital healthcare, with Danish hospitals having a tradition of working closely with industry to co-develop innovative solutions to meet their specific needs. This approach has recently been extended to a core methodology in so-called intelligent hospital construction, with more than €10bn being spent on 16 new hospital construction projects in Denmark.”

Pioneering digital hospitals

A pioneer in this area is Ribera Salud, a healthcare provider in Spain, which had been contracted by the regional authority to provide free, universal access to a range of primary, acute and specialist health services to the local population, against a capitated budget. This approach is also known as the Alzira model, from the name of the Spanish town where it was first launched more than 15 years ago.



The success of Ribera Salud relies on a highly integrated clinical, business and ICT model, stretching between and across primary and secondary care, with alignment of incentives for the different providers to ensure that work is carried out in the most appropriate, and therefore efficient, care setting.

An electronic health record, combined with citizens information from the local authority, and supported by a unified ICT system, is the building block of this model. A vast amount of personal data and a set of indicators and algorithms are used to allocate the local population into 12 different risk groups. This health pyramid approach allows effective prevention measures to be put in place for those citizens at higher risk, but local health services can also be adapted to take into account the health profile of the local population.

Importantly, the digital system enables spending to be tracked and provides information on exactly how much each patient costs. The financial information is broken down for each procedure, allowing a detailed picture of spending for each individual in each area. Furthermore, a set of financial and clinical data on individual clinicians

is also available, allowing performance comparison and variations to be identified (including readmissions and mortality rate) which may need to be addressed.

More patient-centred and efficient

When comparing the Alzira model with other healthcare providers in the region, some of the results are impressive. For example: emergency admission rates are 10% (compared to 14% for other hospitals); re-admission within 3 days per 1,000 discharges is 4 (compared to 6 in other hospitals); outpatient major surgery is over 73% (compared to 50% in other hospitals); patient satisfaction (on a scale of zero to ten) is over 9 (compared to 7 for other providers).

“The added value of digital technology is that it allows data to be shared between patients, clinicians and providers in the quickest and most effective way, not only to cure the patient, but also to put in place the most adequate preventative and early intervention measures to keep citizens healthy and reduce the risk of hospital admissions.”

These results clearly illustrate the power of data and technology to develop better patient-centred care while improving staff productivity and efficiency. Of course this is just one example. Other parts of Europe have also successfully embraced the use of digital technology to deliver better healthcare in a more efficient way.

Denmark in particular is a world leader in digital healthcare, with Danish hospitals having a tradition of working closely with industry to co-develop innovative solutions to meet their specific needs. This approach has recently been extended to a core methodology in so-called intelligent hospital construction, with more than €10bn being spent on 16 new hospital construction projects in Denmark. One of the larger projects is the New Odense University Hospital, which is scheduled to be ready in 2022 and which will become the largest hospital in the country.

Digitalisation will play a crucial role in this new hospital. ICT will help convert patient data into information, which will flow freely and automatically, supporting the hospital processes in the best possible way at any time and pro-

viding staff with the knowledge needed to perform their tasks in the most efficient way. The technology will allow information and knowledge to be integrated and used by all operators in the network, both inside and outside the hospital. This means, for example, that during an operation a surgeon can pull vital information to which the researcher at the university will have full access.

Digital hospitals in the UK

Both the Alzira and the Odense experiences are very inspiring and offer a useful insight for NHS leaders in their journey towards the development of local sustainability and transformation plans. The recent Wachter Review has indeed been unequivocal about the fundamental role of ICT for the future of the health service, arguing that successfully digitalising the NHS will be essential to achieve the triple aim of better health, better healthcare and lower cost.

Following this Review, 12 of the most digitally advanced hospitals in the NHS have been selected to trailblaze new ways of using digital technology to drive radical improvements. These exemplars will get funding to invest in digital infrastructure to deliver benefits for patients, doctors, nurses and other NHS staff. They will share learning and resources with other NHS organisations through networks, which it is hoped will lead to a wide uptake of technology across the service.

While this is a very positive development, the lesson from the Alzira and Odense experiences is that transformation takes time and requires perseverance, and that it is important to set realistic timelines. Furthermore, they also teach us that the digital revolution is not only about technical change, but also about cultural and whole system change, which requires a new paradigm to structure the way in which healthcare is organised and delivered. ■

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Elisabetta Zanon

Director

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Planning the smart private hospitals of the future

UEHP President, Dr Paul Garassus, on the importance of investing in smart private hospitals for sustainable healthcare

In an historical moment in which uncertainty is becoming regular in our agenda, with recent elections and political changes worldwide, social policies and healthcare systems could be shocked by new constraints and passively suffer from hard decisions imposed by the EU or Member States. The European Union of Private Hospitals (UEHP) is on the frontline of the major battles Europe is facing, challenging the necessary evolution of healthcare systems, including in the field of innovative technology. One major topic is that of social protection and sustainability of healthcare systems, which now depend on performance. Therefore, we are developing the concept of smart hospitals for the future. As innovative partner of changes, we consider that four goals can be achieved: patient information, professional collaboration, benchmarking by regulators, and investor strategy support.

A smart hospital is first and foremost dedicated to a more informed patient. To ensure equal access to quality treatments in all countries for all European citizens, information is the first major point. Free choice of treatment for patients, including the best access without waiting times, requires new IT tools explaining hospital activities, references and quality outcomes. We can give the example in Germany of the “Qualitätskliniken” website supported by BDPK, Initiatives by “Clinique Pasteur” in Toulouse and by his manager



Dominique Pon. Patients mobility is a chance, and we have to manage this challenge of a competitive offer to reduce waiting lists. UEHP is involved in long-term cooperation with patients associations, healthcare experts and policy makers. May we limit the risk to “see progress coupled with growing health inequalities” (Deaton).

Hospitals are centres of expertise

A second aspect is that the future of hospitals will integrate new technologies, cooperation between actors, and a more confident relationship between professionals and industries. The

pharmaceutical and medical device industries develop fantastic innovative treatments or tools. Robotic surgery is now available, as well as new drugs for cancer treatment, day care units are more common, and all trends orient to shorter stays in hospital.

But hospitals are often the centre of expertise now and for the future, if it is a communication hospital. We have to fight fee barriers and tariff decreases to adapt our service to modern efficiency. A connected hospital, or a “smart hospital”, just like a smartphone, could be the relevant

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image. Nevertheless, “The ways of paying providers are often poorly aligned with health system priorities” (OECD). A new deal for cooperation with healthcare sector industries is required, including the full involvement of all professionals to assess a global successful performance. However, barriers remain to be broken.

The third point is not to suffer from hard regulation. We have to be a partner of change, helping regulatory states to adapt the offer to their needs. All UEHP members prepare for this major challenge in order to transform uncertainty into achievements and progress. Many UEHP hospitals are already exploiting the potential of big data, wearables, and new technologies, as well as investing not only in innovative projects, but also in the training of their highly-qualified workforce. Big data from national and EU authorities will help determine relevant solutions, according to a new policy including outcome indicators and incentives fees. Without scientific information and measurement, no management success will be obtained. We ask to be solicited as experts to define the reforms without any discrimination between providers. A fair competition will assess performance and sustainability of healthcare systems.

Strategically invest for sustainable healthcare

The final aspect is not often studied by academics: Strategic investment in healthcare. But major information will follow the EU report on “Investing in Health” (EXPH), published by the European Commission’s DG SANTE. As stakeholders of European working groups on quality, patient safety, eHealth, and strategic investment, UEHP expresses the position of private hospitals ready to undertake the next

IT revolution. UEHP is an active partner of change, working on new financing rules, integrating public and private insurances cooperation, and hospital reforms. New fields will be explored for prevention, education and training, as well as professional cooperation. But efficiency remains our major goal to offer the right service “on time” to an informed patient. Financial aspects must be cleared, including public financing by national government or European programmes. We can explain what the strategy of private investment dedicated to hospitals is, conditioning the future global performance and the best way of connecting hospitals. The recent mergers in European hospital groups need attention, demonstrating private talent and expressing a new European management dimension (examples: Quiron in Spain bought by Helios Germany, Ramsay buying Générale de Santé in France).

We have to effectively promote the modernisation of healthcare. UEHP accepts the challenge of performance for the next generation of hospitals; hospitals connected with patients and professionals, accessible for quality of service without delay. Despite “difficulties in measuring the impact of the crisis on health systems” (WHO), we know the major impact of economics on healthcare delivery. Sustainability of social systems depends now and over coming years on the management of innovative performances, certainly with the greatest implication of the private sector, in a positive competition to offer the best service, following performance engagement.

We support actions to innovative hospital management. UEHP organises working sessions for all Member States recently in Italy and Bulgaria, meeting

MEPs and Ministries to be connected with health policy reforms. A proactive evolution of healthcare systems will be European and not only national, each experience being useful for all. We are concerned with the implementation of quality standards, as financial incentives including outcome for positive reforms. The key to success is being actors of change. Long live smart hospitals.

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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.

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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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An ERIC on Health Information for targeted investments in people's health and wealth

Petronille Bogaert and Herman Van Oyen, on behalf of BRIDGE Health, explain the challenge of creating an EU health information system and how an ERIC can help...

A healthy population is a prerequisite for economic productivity and prosperity. EU member states share the ambition of improving citizens' health, providing optimal prevention and universal access to safe, effective and efficient healthcare in a financially sustainable way. Population ageing, technical innovations in health care and growing citizen expectations increase the pressure on health systems. At the same time, EU economies continue to experience low growth rates and find it difficult to afford increases in health expenditure simultaneously with growing demands for health care. To make the most of health spending and investments at EU and Member State level, health policy and decision making must be based on robust evidence in the form of high quality and timely data on population health and systems, as well as thorough research outcomes.

More and better health information is needed throughout the EU

Accordingly, the EU and its Member States need timely, sound, and high-quality health information (such as comparable and policy-relevant indicators on population health and health system performance) to support policy making, strengthen programme action and improve individual and population health outcomes. However, at present, there are three main challenges to ensure the availability and use of health information for policy-making and research.

1. Much of the gathered evidence and knowledge is dispersed, incomplete in important areas and difficult to access. A good example is the limited data on non-communicable diseases, even though they are the main cause of death and poor quality of life in the EU. Better health information governance is needed to ensure that the data we collect and knowledge we generate reflect our priorities.

2. Large differences can be found in terms of quality and, as a consequence, comparability of health information between and within EU countries. This makes it difficult to learn from each other. Moreover, health information tends to be poorest in areas where health itself is poorest. This does not even allow to assess the full magnitude of health inequalities across the EU, let alone to identify appropriate, targeted action. Better support and coordinated action is required to reduce health information inequalities across the EU and improve the quality and comparability of the collected data.

3. Under the lead of Eurostat, the European Statistical System provides a solid working basis for gathering and providing health data. Beside this however, a wide range of health information activities are often funded through ad hoc projects as opposed to more sustainable structures. This lack of research continuity results in lost expertise, data collection mechanisms, research capacity, and networks. Mechanisms are needed to feed the

knowledge and know-how generated by these projects into more permanent data collections.

The solution: creating a European Research Infrastructure Consortium (ERIC) on Health Information

Both the European Commission and the Council of the European Union have already expressed the wish to examine how an improved alignment of health information activities at an EU level would function. This gave rise to the BRIDGE Health project which examined the establishment of a "sustainable and integrated EU health information system", as requested by the Council of the European Union. After thorough analysis, BRIDGE Health concluded that the creation of a European Research Infrastructure Consortium (ERIC) to collect, process, analyse, report, and communicate health information can overcome these obstacles and can facilitate the governance of health information activities in the EU in a way that best supports evidence-based health policies and investments.

The European Research Infrastructure Consortium on Health Information would be able to:

- Coordinate health data collection and analysis as informed by health policy priorities;
- Facilitate research on health indicators and population health and provide technical support to Member States;

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- Effectively support policy and decision-making and strengthen programme action in a coherent and sustainable way.

These are based on an overall aim of improving individual and population health outcomes. Implementing the European Research Infrastructure Consortium on Health Information at EU level would represent a major step forward in supporting EU Member States and European Economic Area countries in their evidence based policy-making. The outputs of the Consortium in terms of better and more relevant knowledge on population health and health systems could be used to provide benchmarks, define policy ambitions and set realistic targets.

What to expect from a European Research Infrastructure Consortium (ERIC) on Health Information?

An ERIC serves us in multiple ways:

- An ERIC operates under strict Member State governance, therefore it is tailored to their needs and priorities. It works with, through and for its members. It supports Member States in their actions in health both at national level and at EU level e.g. in the context of the European Semester.
- The ERIC is at the core of health information activities in the EU providing a contact point for Member States, and responding to specific requests by competent national authorities. It builds on existing structures and their knowledge by bringing key players together whilst representing the interest of its members. It will function as a network of networks, linking sets of national and international experts and research facilities and thereby providing clear, valid, coherent and comparable health information in ways that is most useful for policy makers. The ERIC will not do what other stakeholders already do, but liaise and guide researchers to available and comparable data. As such, the ERIC:
 - Generates knowledge that is valid, coherent and comparable. It fills the gaps where data collection is lacking and analyses comparable datasets from EU Member States. This will prevent work from being duplicated and reduce both inefficiencies and costs.
 - Manages knowledge for better access to data through virtual and integrated platforms and by guiding users to (meta)data and help them in their use.
 - Exchanges knowledge by enhancing best practice exchange between Member States and support mutual learning by focussed capacity building. It will support more and stronger health research networks and communities.
 - Translates knowledge of health research outcomes to the general public and policy makers and enable researchers to optimise their research output to better suit target groups.
- The ERIC has a legal status and available expertise to benefit from relevant EU funding opportunities at a comparatively low cost to its members utilising economies of scale and scope.
- The ERIC carries out horizon scanning activities to detect early signs of important developments including new technology and its effects on the

issues at hand. It also explores persistent problems and trends in population health and health systems. This will allow the ERIC to guide Member States in designing work plans and setting priorities in health policy.

On the 20th of April 2017, BRIDGE health is organising a meeting entitled "Health Information in the European Union – the ERIC as a tool" in Brussels at the Royal Library of Belgium. Participation is free, but registration is mandatory at <http://www.bridge-health.eu/registration>.

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7 When referring to Member States in this document all EU Member States and EEA countries are included.



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mHealth in the EU: Challenges of technology applied to health

As mobile technologies advance, Francesca Cattarin, Health Policy Officer at The European Consumer Organisation (BEUC), explores the role of mHealth in the EU...

Mobile health (mHealth) is an emerging field that has the potential to transform the traditional way of delivering healthcare. Thanks to mobile phones and wireless devices, including related software called applications (or 'apps'), consumers can check how many steps they make, the calories they consume, as well as managing chronic conditions, such as blood disorders, and send the information to doctors or nurses.

As our populations age, chronic diseases increase and healthcare budgets are cut, remote solutions can ease the burden of European healthcare systems.

Through updates about their condition a few clicks or swipes away, mHealth can help make consumers more responsible and aware of their health status. It can also

allow them to perform services traditionally provided only in hospital or at a general practitioner's office.

Because of this potential and its attractiveness, mHealth solutions are booming in the European Union. At the moment consumers can choose from around 165,000 mHealth apps. One economic forecast expects the mHealth sector to represent €23billion in 2017.

mHealth in the EU: Rules and requirements

Despite these achievements, mHealth raises important questions for consumers, particularly regarding the safety, security and privacy of mHealth devices and apps.

There is no comprehensive set of rules for mHealth in the EU. Mobile health solutions with a medical purpose fall into the scope of the Medical Devices Regulation whilst all the others, designed for general purpose, will only be subject to voluntary guidelines, which are expected to be published soon. In practice, this means that once a mobile health app is classified as a medical

device, strict safety requirements will apply: The manufacturer will have to report serious incidents in a designated database (Eudamed) and a post-market surveillance of the product will be conducted and reported to the notified body annually. Furthermore in case of problems caused using the device, consumers will be able to get corrective actions and seek redress.

This will not be the case for lifestyle, fitness and well-being apps, despite them accounting for over two-thirds of the current mHealth apps global market and some of them providing important advice for consumers' health. The voluntary guidelines the European Commission will propose for them do not seem appropriate to ensure a high quality



standard and consumers' legal protection in case things go wrong.

We believe it is high time to define these standards for the manufacturing and marketing of all mHealth solutions, including rules on liability to grant consumers the right to seek redress. Additionally, when it comes to mHealth, liability deserves particular attention as many players are involved in its life-cycle such as manufacturers, distributors and doctors.

“As our populations age, chronic diseases increase and healthcare budgets are cut, remote solutions can ease the burden of European healthcare systems. Through updates about their condition a few clicks or swipes away, mHealth can help make consumers more responsible and aware of their health status. It can also allow them to perform services traditionally provided only in hospital or at a general practitioner's office.”

Protecting patients' privacy

Privacy protection has to be at the core of mHealth. Any health device or app entails the processing of a large amount of consumers' personal information. The recent adoption of the [European Data Protection Regulation](#) certainly brings an important contribution in this sense, as it considers health a special category, whose data merits additional protection and can be processed only under strict conditions. However, its definition of health data clearly does not apply to fitness, lifestyle and well-being, although the information they provide are certainly linked to individuals' health.

Furthermore, mHealth can facilitate the information gathering and analysis of a large amount of health data that can be stored, combined and analysed in large databases. This so-called 'big data analysis' has the potential to develop more advanced mechanisms for detection and the prevention of diseases. But, if not properly regulated, it can also expose consumers to

serious privacy risks, first and foremost if their profiling is used for merely commercial business [strategies](#).

Embedding safeguards

To effectively control their data, consumers should always have the possibility to revoke any prior consent given for specific data processing. Equally, this consent has to be informed and explicit, and must be sought any time the terms and conditions change. As for the majority of apps, [terms and conditions](#) of mHealth tools are often indecipherable, never-ending and do not reveal the reason for collecting the information. Unsurprisingly, most consumers accept these terms without knowing what the company behind it gives itself the right to do.

The protection of personal data is strictly linked with security. If a mHealth tool is not secure, consumer data can get processed improperly and without being authorised. To guarantee this protection in case of loss or theft of the device, mHealth solutions should embed specific safeguards at each stage of the data processing, such as encrypting patients' data and creating authentication mechanisms.

Overall, mHealth might open a new era in the way healthcare systems are set up in the EU. Yet, these technological health developments have to go hand in hand with a robust regulatory framework to guarantee consumers' safety, security and privacy. EU policy makers should bear that in mind and address the challenges it poses in a more resolute way. ■

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GoTreatIT® sensor tech collaboration reaches across Europe

Norwegian company DiaGraphIT reveals more about a successful collaboration on sensor technology with the Irish Insight Centre for Data Analytics

In our [previous article](#) about GoTreatIT®, we described how our company – DiaGraphIT – is constantly innovating as a part of our daily work. We have been searching for ways to bring us closer to the goal of giving patients 100% control and monitoring of their condition.

This search brought us all the way to Ireland and the Insight Centre for Data Analytics at NUI Galway. For the past 6 months, DiaGraphIT has been engaged in a project with Insight with the aim of selecting a personal sensing device to connect to the GoTreatIT® system.

The goal was to identify a device that could be worn by patients and communicate with the GoTreatIT® system. This would allow for remote monitoring of physical activity and physiological parameters of the patients. Transmission of this data to GoTreatIT® means data can be reviewed directly by the patient's clinician for ongoing treatment.

Insight Centre for Data Analytics

The Insight Centre for Data Analytics was a great fit for DiaGraphIT. The Centre is a 400 strong data research

body hosted across 4 universities (NUI Galway, University College Dublin, University College Cork & Dublin City University) with particular strength in the field of connected health. The Centre also works with sensor developers for a wide range of applications, such as smart cities, agritech and logistics. Applying sensor technology for clinical use is a core activity at the Centre. Researchers at Insight regularly work at the interface between industry and patient care, to deliver solutions that meet the demands of both.

Established by Science Foundation

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Ireland in 2013, the Insight Centre brings together Ireland's large community of world class data researchers to work across disciplines and to partner with industry and international research consortia. With an expert business support team, the Centre is structured to identify and meet the needs of industrial partners.

The application of research in the selection process

Faced with a huge number of candidate personal sensing devices available on the internet, DiaGraphIT turned to Insight to make use of a research based method of device selection in order to narrow the field.

Insight researchers made use of a framework which was developed in consultation with experts in different evaluation domains. Researchers also engaged with industry members

throughout the development process to ensure this tool attended to real user requirements.

Insight researchers also worked closely with DiaGraphIT's technical staff and with recommended clinicians already familiar with the GoTreatIT® system.

DiaGraphIT's technical team supplied suggestions as to the integration of personal sensing devices and the mechanisms by which data could be transferred from these devices into the GoTreatIT backend.

Next phase of GoTreatIT®

The clinicians were interviewed by the Insight representatives following a structured set of questions designed to help them identify core requirements to support their intended usage of the devices. This exercise helped to clearly define the application requirements and provide documentation of the rationale for choosing a particular device, making it possible to justify or revisit these decisions in the future. The primary concern was that the outcome would reflect a systematic and rigorous evaluation.

Devices were evaluated according to 6 different domains: Background information, cost and supply information, regulatory compliance, scientific evidence, technical evaluation, and human factors.

Current devices on the market were found to be of questionable accuracy and therefore of limited clinical value. However, DiaGraphIT were eventually able to identify a suitable device with which to begin the next phase of the project: Integration and testing with the GoTreatIT® system.

Collaborations of this type are rewarding for both partners. For DiaGraphIT, working with Insight gives the company access to world class researchers, spearheading development in connected health, sensor technology and more importantly data analytics. The collaboration provides deep interaction and the rapid development of task-specific technology that is scalable with the growth of DiaGraphIT. Cooperation with industry is of great importance for Insight, who aim to conduct research that will result in the development of innovative products to meet future challenges.



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Three essential steps on the way to integrated health and social care

Mark Raeburn, Managing Director of Capita One, shares three points local authorities should be aware of in their approach to integrated health and social care...

The debate about how best to bring the NHS and local social services together is not new. Indeed, the issue has occupied the minds of local authority senior leaders for many years.

But with the drive for more joined-up health and social care gaining pace, local authorities up and down the country are drawing up roadmaps towards integration, as part of a wider strategy aimed at helping them to meet future demand.

“It is important that, for social workers and health professionals, it feels as if it is one integrated system rather than multiple systems”.

This work is uncovering some of the challenges and opportunities ahead and these were among the topics of discussion at a roundtable event jointly hosted by the Association of Directors of Adult Social Services (ADASS) and Capita One.

Outlined below are 3 of the key points highlighted by the local authority senior leaders who attended.

Build sustainable relationships

Delegates agreed that bringing together 2 services that have traditionally worked separately can be a challenge. Developing strong relationships is crucial to achieving a collaborative working environment. But where these relationships do not already exist, there is a clear need to cement new connections between the services.

Getting these connections in place will enable multiple teams to provide more effective support to vulnerable people and their families. As John Powell, Director of Adult Social Services for the London Borough of Redbridge

explains: “Where integration and joint working is successful it is because of long-standing arrangements with relationships between people in the various organisations.

“We’ve opened a dialogue between services because we have a locality team that’s fully integrated health and social care services under one line management. GPs, district nurses and social workers are all working together.”

Retain a distinct identity

Integration does not have to mean a loss of identity for either service, as one local authority pointed out. Health and social care each have longstanding areas of expertise, and these should be preserved so that the best possible support can be delivered in the community.

As Liz Bruce, Director of Adult Social Services for the London Tri-borough councils comments:

“We should be clear about our ask and our offer in social care. The strengths and skills that you have if you mix up health and social care are tremendous if we get it right. Health is really good at things that we in social care shouldn’t take the lead in. This shouldn’t be a land grab, it should be a partnership.”

“You want the different professions complementing each other rather than diluting the differences,” David Pearson, Director of Adult Social Services at Nottingham County Council, agreed. “If you go into a marriage you have to know who you are.”

Champion an information sharing culture

In a world where demand for health and social services is continuing to increase, professionals need quick and effective ways to get the information they require to support vulnerable people with complex needs.



“There’s plenty of unexplored potential in technology,” says Grainne Siggins, Director of Adult Social Services at the London Borough of Newham. “But there are plenty of hurdles to overcome first. Not least getting data sharing right.”

With a growing commitment to joined-up working, which is backed up by technology that supports it, the vision of health and social care integration can become reality. ■

To read more from the round table discussions, visit: www.capita-one.co.uk/AdjGov .

There is an explosion of innovation in the sector where new developments in technology are transforming the way data is shared across teams. This means that practitioners with the appropriate authorisation can access real-time information, quickly and securely, relating to the individuals and families in their care wherever they are. But key to its success is that systems are designed to make collaborative working easier.

As David Pearson adds, “It is important that, for social workers and health professionals, it feels as if it is one integrated system rather than multiple systems”.



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We are entering an era where vulnerable individuals – and their families – are increasingly likely to need a package of medical treatment alongside tailored support from social services to help ensure that, where possible, they can remain independent in their communities.

What will happen if the Affordable Care Act is repealed?

Dr Virginia M Stewart asks what will happen if the Affordable Care Act is repealed, sounding a warning for the health and lives of millions of Americans...

United States (US) citizens have the right to emergency care and medical treatment for life threatening injuries. With rising health care costs over prior decades, a single trip to the Emergency Department may cost thousands of dollars. Health insurance significantly reduces those costs; however, prior to the implementation of the Patient Protection and Affordable Care Act (PPACA) in 2014, an estimated 41 million Americans lacked health insurance.

The PPACA, also known as “Obamacare”, was enacted in 2010 to expand insurance coverage to uninsured Americans, and to lower the costs of health care. PPACA also addressed healthcare delivery system improvement, and increased the use of technology to improve health outcomes among patients. Major provisions of PPACA went into effect in January 2014.

Most insured Americans under the age of 65 years old obtain insurance through their employer. However, prior to PPACA, businesses were not required to offer insurance to their employees. Starting at the age of 65, Americans who have worked and paid into the system through their payroll taxes are eligible for Medicare. Medicare is a national social insurance program administered by the US Government.

Prior to PPACA taking effect in 2014, private insurance was sold to individuals, and the insurer could determine

the extent of insurance or even decline individuals seeking coverage, due to pre-existing health conditions. In other words, an individual with a chronic illness could be denied coverage for that illness, or any other illness.

According to the 2015 Centre for Disease Control's National Health Interview Survey (NHIS), approximately 52 million (27%) adults between the ages of 18-64 years reported at least one of the medical conditions listed in Figure 1. A limitation of the survey was that state identifiers were not included; many states did not have population sizes sufficient for this survey sampling. Therefore, the impact for each state could not be immediately extrapolated. Since it is the individual states that offer insurance plans through Medicaid, and exchanges developed for PPACA, the impact of repealing PPACA would vary from state to state.²

A regression model constructed by The Henry J Kaiser Family Foundation (a non-profit, non-partisan group), for the CDC's 2015 Behavioural Risk Factor Surveillance System (BRFSS), estimates the prevalence of declinable conditions at the state level. This model relies on respondent age, self-reported health status, and self-reporting of declinable conditions. Applying this prediction model yielded a nationwide prevalence of 28% of the total population with a declinable condition, which is significant when compared to the NHIS nationwide estimate of 27%. States such as California face an estimated



Figure 1: Examples of Medical Conditions that are Declinable for Medical Insurance Coverage¹

5,865,000 non-elderly adults with declinable pre-existing medical conditions. Arizona, Florida, Hawaii, Illinois, Iowa, Michigan, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Texas, Virginia, and Washington, all have over 1 million non-elderly adults with declinable pre-existing conditions.

PROFILE

State	Number of Adults with Declinable Conditions	State	Number of Adults with Declinable Conditions
Alabama	942,000	Montana	152,000
Alaska	107,000	Nebraska	275,000
Arizona	1,043,000	Nevada	439,000
Arkansas	556,000	New Hampshire	201,000
California	5,865,000	New Jersey	1,234,000
Colorado	753,000	New Mexico	332,000
Connecticut	522,000	New York	3,031,000
Delaware	163,000	North Carolina	1,658,000
District of Columbia	106,000	North Dakota	111,000
Florida	3,116,000	Ohio	1,919,000
Georgia	1,791,000	Oklahoma	706,000
Hawaii	209,000	Oregon	654,000
Idaho	238,000	Pennsylvania	2,045,000
Illinois	2,038,000	Rhode Island	164,000
Indiana	1,175,000	South Carolina	822,000
Iowa	448,000	South Dakota	126,000
Kansas	504,000	Tennessee	1,265,000
Kentucky	881,000	Texas	4,536,000
Louisiana	849,000	Utah	391,000
Maine	229,000	Vermont	96,000
Maryland	975,000	Virginia	1,344,000
Massachusetts	999,000	Washington	1,095,000
Michigan	1,687,000	West Virginia	392,000
Minnesota	744,000	Wisconsin	852,000
Mississippi	595,000	Wyoming	94,000
Missouri	1,090,000		
United States total		52,240,000	

Table 1: Estimated Number of Non-Elderly Adults in 2015 with Declinable Pre-existing Conditions under Pre-PPACA Practices²

What will happen if the Affordable Care Act is repealed?

Without the increased coverage and measures to decrease health care costs provided through PPACA, there is anticipated to be an increased strain on Emergency Care Services. Rather than providing mostly life-saving measures, emergency departments have become part of a safety net for those without access to healthcare. By evaluating the impact of loss of insurance due to loss of jobs in 2000s, the impact of loss of insurance from repealing PPACA may predict the impact of delivery of healthcare within emergency departments (ED). A 2009 qualitative interview study among ED administrators throughout the US summarised 10 major observations resulting from loss of insurance coverage. Academic, community, urban, suburban, and rural hospitals were included in four major US regions, and included the below findings.³

1. ED capacity was strained with almost all emergency departments reporting a rise in volume.
2. Many departments observed a new “recession” population, who previously had health insurance through their employer, but became uninsured from job loss.
3. Most uninsured people did not have other options to obtain primary care services other than the ED. Clinics that served uninsured individuals or that had a sliding fee schedule for care were not accepting new patients.
4. ED volumes of insured patients increased because they could not obtain a timely appointment with their primary care provider.
5. High volume and high occupancy in the ED and hospital led to overcrowding in the ED, which increased overall wait times to care. In the study, one facility had wait times within the ED of 18-24 hours.

6. Lack of insurance and access to primary care, led to sicker patients and repeated ED visits.
7. Patients refused recommended care due to their concerns about the costs.
8. Anxiety, depression, and stress increased among patients.
9. Uninsured patients did not have follow-up care from their ED visit. This impacted the care patients received, meaning more tests were performed at each visit.
10. EDs did not have financial and personnel resources to meet the rising patient volumes.

Repeal of PPACA may potentially mean the loss of medical insurance for approximately one-third of non-elderly American adults. The economic recession and increased unemployment in the 2000s may serve as a warning as to how PPACA's repeal could adversely affect healthcare and the lives of millions of Americans.

1. Claxton G, Cox C. Pre-existing Conditions and Medical Underwriting in the Individual Insurance Market Prior to the ACA. Issue Brief, December 12, 2016.
2. New State Data: ACA Marketplace Enrolees Receiving Estimated \$32.8 Billion in Tax Credits, Which Would be Eliminated Under Repeal of the ACA. Issue Brief, December 5, 2016.
3. Emergency Departments Under Growing Pressure. Issue brief, July 30, 2009.



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Innovative reform vital to action plan on antimicrobial resistance

Health First Europe's Honorary President, John Bowis, looks forward to a new EU action plan on antimicrobial resistance and healthcare associated infections...

"Excessive and inappropriate use of antibiotics and poor infection control practices have progressively turned AMR into a massive threat for humankind. With rising resistance and no action, we would be facing a return to the pre-antibiotic age, where people died from common infections and minor injuries. This would have major consequences for people's health and for the economy, not only in Europe, but right across the world."

Speech by Commissioner Vytenis Andriukaitis at the EU-Level Launch Event: European Antibiotics Awareness Day "The Future is Now" – 18 November 2016.

"I wholeheartedly believe there is a need for continued efforts in fighting AMR, to improve patient safety. In order to succeed, a holistic approach is needed. Member States need to share knowledge, experiences and new strategies, raising the importance of screening patients for infections, investing in new vaccines, as well as encouraging hospitals to publish data on infection and resistance rates so that patients can make more informed choices."

Antimicrobial resistance and the cost of inaction

The introduction of the first antibiotic in the 1940s marked a true turning point in human history. For the first time, once-deadly infectious diseases, such as pneumonia and bloodstream infections, became manageable health problems, new horizons for modern medicine were defined. Bacterial infections were considered to be permanently defeated.

However, the misuse of antibiotics worldwide has eroded their efficacy and antibiotic-resistant bacteria

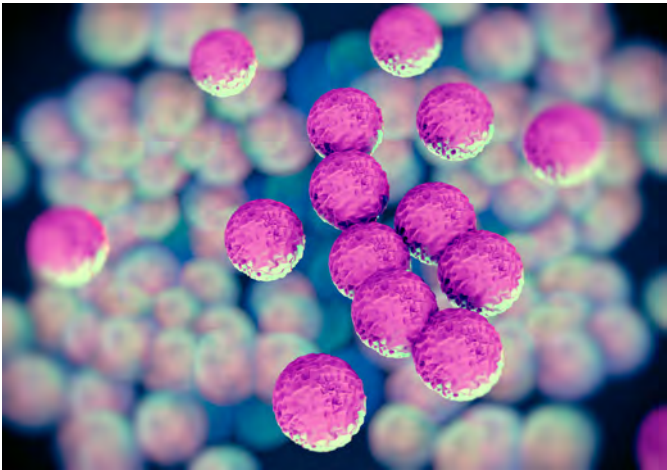
have rapidly emerged and spread across the globe. The World Health Organization (WHO) reports that we have arrived at a point where the pandemic of antibiotic resistance has become a global health crisis. Nowadays, patients are facing a new health threat: Not having a working treatment for their disease.

Resistant bacteria kill 25,000 patients annually in the European Union, with extra healthcare costs and productivity losses of €1.5 billion each year. The cost of inaction is projected to result in 10 million deaths globally per year and a cumulative loss of over €88 trillion to the world economy by 2050.

We need to prevent infections to reduce antibiotic use. According to the latest data released by the European Centre for Disease Prevention and Control (ECDC), 6% of all patients in European hospitals are infected with at least one healthcare-associated infection (HAI). HAIs account for twice the burden of 31 other infectious diseases. Approximately 4,100,000 patients are estimated to acquire a healthcare-associated infection in the EU each year and 20–30% of healthcare-associated infections are considered to be preventable with intensive hygiene and control programmes.

The role of prevention and diagnostics in fighting AMR

As Honorary President of Health First Europe, I emphasise the role of prevention and diagnostics in fighting antimicrobial resistance. Preventing and detecting infections is essential to reduce antibiotic use in healthcare settings and therefore decreasing the risk of developing resistance. Diagnostic tests represent significant tools to prevent the over-prescription of antibiotics. Also, identifying resistance and the correct, targeted antibiotic therapy through diagnostic tests can play a decisive role in patient outcomes.



Research and innovation need to be supported at the national, European and global level. It is necessary to support the development of new funding and business models, including public-private partnerships to foster research and improve access to innovative technological solutions that help to prevent and control AMR/HAls.

The need for reinforced action to fight AMR

The latest meeting of the European Parliamentary Interest Group on Innovation in Health and Social Care, held in November 2016, discussed the role of innovation in preventing, screening and tackling AMR and HAls to improve patient safety.

As a tangible outcome, MEP co-chairs of the Interest Group sent a list of recommendations to the European Commission in preparation for the next Action Programme on Antimicrobial Resistance to be published in November 2017. The aforementioned recommendations call on the European Commission to:

- Ensure the continuation of an EU Action Plan with measurable indicators, covering both AMR and HAls;
- Encourage and support Member States to put in place and monitor national targets for the surveillance and reduction of AMR/HAI through holistic action plans under a “One Health approach”;
- Create new business models and potentially a new European legislative framework for the improved use of diagnostic tools in order to control AMR;

- Encourage the implementation of antibiotic stewardship teams in hospital and healthcare facilities;
- Enable the uptake of technological solutions that prevent and control infections in hospital and healthcare facilities in the first place; and
- Raise awareness about AMR/HAls through educational programmes addressed to healthcare professionals, patients and families.

“Resistant bacteria kill 25,000 patients annually in the European Union, with extra healthcare costs and productivity losses of €1.5 billion each year. The cost of inaction is projected to result in 10 million deaths globally per year and a cumulative loss of over €88 trillion to the world economy by 2050.”

I wholeheartedly believe there is a need for continued efforts in fighting AMR, to improve patient safety. In order to succeed, a holistic approach is needed. Member States need to share knowledge, experiences and new strategies, raising the importance of screening patients for infections, investing in new vaccines, as well as encouraging hospitals to publish data on infection and resistance rates so that patients can make more informed choices. A joint effort and shared practices will help all European citizens, organisations and institutions make smart choices and investments to curb the entry and spread of highly resistant bacteria in all healthcare facilities. ■

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John Bowis
Honorary President

Health First Europe
www.healthfirsteurope.org
[www.twitter.com/HealthFirstEU](https://twitter.com/HealthFirstEU)

An international approach to the anti-infectives challenge

Professor Colin Suckling from the University of Strathclyde discusses the need for global collaboration on the anti-infectives challenge...

The British scientific community has responded solidly to the challenges of Brexit, by lobbying government strongly to act to preserve and enhance the attractiveness of Britain as a hot spot for international science. Looking back over the last 10 years, both my research teams and those of my UK partners have benefited hugely from the contributions of many excellent research associates and students from the EU.

Those who advocated Brexit were, if I'm charitable, taking a long-term view of the future of the UK. Academic research also fits into a long time frame and as a major part of the UK academic industry, if I may call it that, contributes immensely to our prosperity. We're especially conscious of this in Scotland. It would be perverse, therefore, to negotiate a Brexit deal that diminishes our attraction to researchers from overseas and reduces the international impact of our research.

Tackling the anti-infectives challenge globally

It's ironic that, unintentionally I expect, at the same time as Brexit is under-way the UK government is promoting a great expansion of research with less developed parts of the world, the so-called ODA (Official Development Assistance) countries, through the Newton Fund. For my own research, it's ironic, unintentionally I know, that all of our active recent and current overseas research partners are not in

EU countries. Compounds from our labs at the University of Strathclyde in Glasgow have found their way to Australia, India, South Africa, Switzerland and the USA, and will also shortly go to Brazil. This global coverage is important because many of the diseases that we are seeking to treat are not a problem in the UK, such as malaria and trypanosomiasis.

"Our pathway to potential medicines has not followed the conventional route used by many pharmaceutical companies in which a single biological target molecule for the drug is defined. That's because from an academic background we've wanted to add to what industry does well, not simply to reproduce it."

It's possible for us to work with such a world-wide group of partners, because we chose to investigate a class of compounds with the potential to treat a wide variety of diseases important throughout the world. In the case of infectious diseases, our focus is on compounds that interact with DNA so as to kill the infecting agent (bacterium, parasite, or fungus) without harming the host. It's also necessary to work with partners around the world because, as noted above, we're not directly affected in the UK by several of the diseases that we are trying to treat. In those countries that are affected, there is access to the strains of infectious organism currently causing problems and so our compounds can



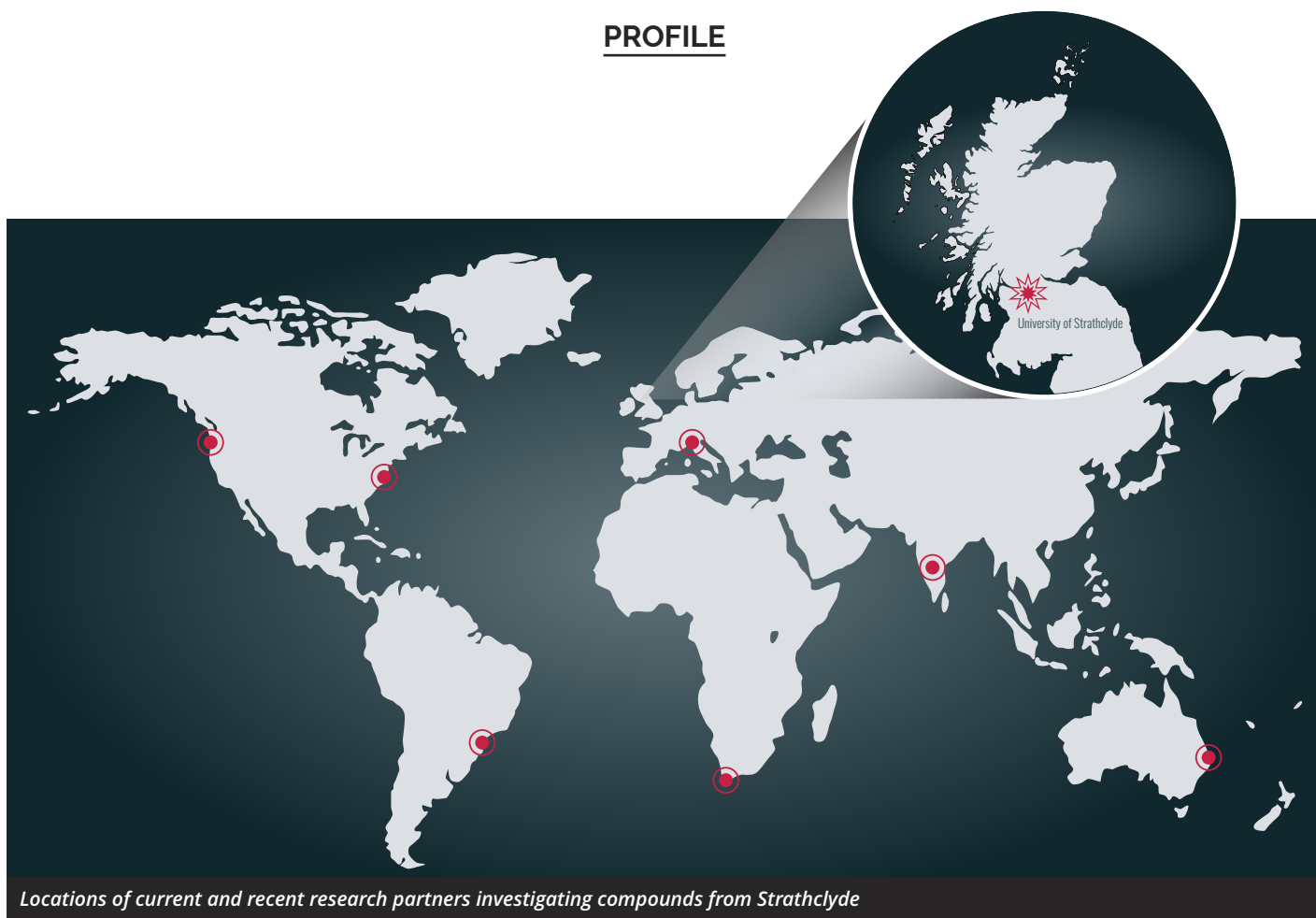
Weighing out a Strathclyde sample for shipment for evaluation

be evaluated confronting the need for treatment head on.

Developing suitable compounds

The challenge is to get selectivity between the host and the infecting organism. We've been able to identify suitable compounds in the lab and their development into fully functional medicines comes next. For this we need industrial development partners. Our first partner, MGB Biopharma, has successfully developed one of our compounds through Phase 1 clinical trials for treating *Clostridium difficile* infections, for which the compound is exceptionally well-suited. MGB Biopharma is seeking funds for the Phase 2 trial and to develop some of our other discoveries in the antibacterial space.

PROFILE



Locations of current and recent research partners investigating compounds from Strathclyde

There's another major class of diseases that I called 'diseases of imbalance' when I was teaching medicinal chemistry. These include, for our purposes, diseases like rheumatoid arthritis, lupus erythematosus, and asthma. In these cases, it's not a question of killing an infectious organism but of rebalancing the biology of cells or organs of the patient to regain the healthy state, or as near to it as possible.

We've approached this challenge by mimicking the properties of an immunomodulatory protein secreted by a parasitic worm that infects gerbils. The idea is that this protein dampens down the immune response of the gerbil so that the parasite is not attacked, but not so much that the gerbil becomes open to opportunistic bacterial infection. Our small compounds have exactly the same effects in cells and mouse models of disease in which the treated mice have nice shiny coats and are very lively. Their

active, twitching noses are pointing the way towards new treatments for diseases of imbalance.

Not the conventional route for drug development

Our pathway to potential medicines has not followed the conventional route used by many pharmaceutical companies in which a single biological target molecule for the drug is defined. That's because from an academic background we've wanted to add to what industry does well, not simply to reproduce it. We recognise that our drugs might act through several targets, even if one is predominant. By adopting less conventional approaches it's my belief that we can create greater opportunity from academic research to provide medicines that people need or want.

In the end we still have to satisfy the regulator with respect to efficacy and safety to obtain a marketable product like a drug emerging from

any pipeline. Creating unconventional new opportunities is great but, having achieved proof-of-concept, we still need a development partner. There's the rub, but that's a discussion for another time.



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The unrealised benefits of an ATP cleaning verification system

An ATP cleaning verification system can help ensure cleaning is thorough and effective, saving money and lives in healthcare settings

The financial impact of poor cleaning is huge, yet the delivery of this vital underpinning service is not measured at all. By contrast, in almost all other aspects of healthcare, a multitude of diagnostic tests are performed to monitor and diagnose the conditions to aid recovery, prevent infections and cure the problem. There are many cost effective benefits to be gained across the hospital from the adoption of simple objective measurement of cleaning efficiency and delivery of service.

Cleaning is a fundamental preventative principle of good hygiene, as promoted by campaigns such as WHO's 'Clean Your Hands' initiative, but it does not stop there. The recognition that healthcare associated infections (HCAIs) are preventable has driven many different interventions that have resulted in a decrease in MSRA and C. Diff infections since 2008. Over 15 years ago it was proven that effective cleaning had a cost benefit of £56,000 per ward, per annum (excluding the cost of lost bed days and additional domestic and maintenance staff). The concern for increasing antimicrobial resistance means that cleaning practices need to be more vigilant and effective to prevent the spread of infection.

Cleaning costs the NHS £725m per annum, but research shows that only 40% of hospital cleaning policies are delivered in practice, resulting in the

potential wastage of more than £400m. The NHS Productivity Review 2016 showed that a small improvement in cleaning practices alone would save £93m.

The cost of failure is high. A single infection is estimated to cost £5,000-£10,000. The National Patient Safety Association states that there are more than 200,000 slip injuries per annum, resulting in 26 deaths. It estimates that the average trust spends £92,000 per annum on these types of injuries.

Most hospitals rely on a subjective visual assessment of cleanliness, which is not fit for purpose and only detects gross lapses of practice. Visual assessment gives a misleading overestimate of cleaning that undermines infection control strategies.

The National Institute of Health Research (NIH) recognises that the NHS places greater reliance on visual assessment of surface cleanliness. However, reliance on observational evidence in judging cleaning efficacy is subjective and may be of questionable validity [...] the use of ATP bioluminescence can provide this, giving an instant indication of total surface contamination and importantly, an objective assessment of cleanliness. ATP detects invisible contamination and tells us that the surface has been cleaned.

The complex design of endoscopes makes them very hard to clean and



studies have shown that more than 30% are not adequately cleaned. In sterile services, the cleaning process is measured by an inadequate protein test where a single-minded focus on the potential unrealised hazards from prion proteins is driving an impractical, expensive, in situ, non-specific protein detection method; in total disregard for the more immediate and real biological hazards, that are quicker and easier to measure, as well as giving a broader reassurance.

The use of ATP bioluminescence for cleaning verification is well established and comes highly recommended in support of the fight against HCAIs. The test is also recognised by the CDC in USA and is written into a standard for cleaning in Denmark and Sweden. The test is simple and easy to use giving a numerical result in 15 seconds.

HOW IT WORKS



ATP bioluminescence is a simple rapid method for measuring organic soil. It requires a small handheld instrument and an all-in-one sample collection and testing device.

Earlier adopters, such as North Tees and Hartlepool NHS Foundation Trust have shown a consistent and marked improvement in cleanliness and reductions in infection rates since its introduction in 2008. The results have shown a more than 20% improvement in pass rates and a large reduction in fail scores to fewer than 5%, with a corresponding decrease of 35% in *C. difficile* cases, as well as a 39% reduction in infections per 10,000 occupied bed days. Monitoring officers, independent from nursing and environmental services staff, are assigned to act as project champions for individual facilities, reporting to departmental managers, wherever poor cleaning was discovered and where corrective action is required. Monthly reports are circulated for cross-functional team meetings of nursing, facilities and infection control staff. This allows for open discussions on all cleaning and maintenance related issues and stimulates actions for improvement.

The benefits of the ATP cleaning verification system include a dramatic improvement in hospital cleanliness, optimised cleaning performance and personnel training, increased productivity commitment and moral of cleaning staff and reduced infections rates.

Southport and Ormskirk NHS Trust have been using the ATP technology for more than 5 years, for several applications and departments from medical equipment library, ITU, IP&U, domestic services, planned care, catering and operating theatres. It is also used for hand hygiene training and compliance monitoring. Andrew Chambers explained: "We also use Hygiena ATP monitoring when we may have had an incidence of VRE, for example. After a clean, the area might look clean but a number of spot ATP tests could show that the area is, in fact, not clean."

"ATP gives you a clean hospital," said Val Hulme, Team Leader Domestic Services). "When you're doing a deep clean the staff know they are going to be tested, but they do everything to a very high standard now. ATP has helped us to achieve that. When you have a number – like the ATP machine

gives you – it's more objective than subjective. You can't argue with it. ATP makes the staff competitive. They all want to score five or below, or ideally zero."

Regular objective monitoring of cleaning increases compliance of cleaning policies from 40% to 82%. This decreases contamination levels, reduces infection rates, maximises the use and value of existing resources thus saving time, money and lives.



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The Swedish agenda to end AIDS by 2030

Gabriel Wikström, Minister for Health Care, Public Health and Sport, sets out to Adjacent Government the Swedish agenda to end AIDS by 2030...

Today we have the knowledge and tools to end AIDS by 2030, but to reach zero AIDS related deaths, stop the HIV epidemic and prevent discrimination, knowledge has to be transformed into action. To end AIDS, those actions must be grounded in the Agenda 2030 and in the UNAIDS strategy "On the Fast-Track to end AIDS".

From a Swedish perspective, global cooperation is crucial. We can only master the challenges of the future if we face them together. Since the 1960s Sweden has consistently contributed around 1% of our gross national income to development cooperation. We are among the largest core contributors to the majority of the UN Funds and programmes, including UNAIDS.

Let me highlight some aspects on top of the Swedish agenda to end AIDS by 2030:

Human rights

Full respect for human rights is a prerequisite for HIV prevention and treatment. Each and every one of us, regardless of age, sex, HIV status, sexual orientation, gender identity, ethnicity or disability - we all share the same human rights. There is a strong link between sexual and reproductive health and sexual and reproductive rights. This is one of the reasons why Sweden consistently stresses the need for the second "R" in SRHR. There will be no sexual and reproductive health without sexual and reproductive rights.

Prevention

To end AIDS we need to scale up primary HIV-prevention. Evidence-based prevention is the only way to reach the goal of zero new infections.

Knowledge is key

Everybody should have access to comprehensive



Image: © Kristian Pohl/Regeringskansliet

Gabriel Wikström, Minister for Health Care, Public Health and Sport

sexuality education in order to make informed choices about their own body and sexual life.

Gender equality

Gender equality has to be strengthened all over the world, as well as in Sweden. Globally AIDS is the leading cause of death among women of reproductive age. This means that we need to scale up efforts to make sure that we reach women and adolescent girls. However, strengthening gender equality cannot be done without the involvement of men and boys. They need to take part in sexuality education and have access to sexual health services.

Young people

Half of the world's population is made up by young people yet their knowledge and needs are neglected, despite the fact that they are part of the solution.



Young people must be included in the planning and implementation of HIV and SRHR-programs.

End stigma

Criminalising homosexuality is a violation of human rights as are laws that discriminate people living with HIV. Whenever human rights are violated through discriminatory laws or practices, stigma increases and prevention and care efforts are undermined. Full respect for all human rights also means that discrimination and stigmatisation of people living with HIV, men who have sex with men, injecting drug-users, people who sell sex and LGBT people must come to an end.

Cooperation

An effective response to HIV requires collaboration with and involvement from civil society and other non-state actors. People living with HIV and key populations know more about the problems and the solutions than many other participants at the High Level Meeting, last June. Their involvement is crucial in this endeavour.

Ending AIDS in the age of sustainable development

The UN High-Level Meeting was an important step

forward. Sweden fully supports the Political Declaration adopted at the meeting and the Fast-track to End AIDS in the age of sustainable development. But much work remains.

Sweden has reached the UNAIDS targets 90-90-90. This is, however, a global agenda and Sweden will remain a strong and committed partner. I am convinced that all of us – Member States of the UN, civil society and the private sector – must work together for a fully effective approach to end AIDS. This must be based on the science, the knowledge and the tools we have, and by ending stigma and discrimination. ■

.....
Gabriel Wikström
Minister for Health Care,
Public Health and Sport

Swedish Government

<http://www.government.se/government-of-sweden/ministry-of-health-and-social-affairs>

How do we reduce HIV transmission in Southern and Eastern Africa?

Better understanding of the factors at play will enable efforts to reduce HIV transmission in Southern and Eastern Africa, where incidence rates are highest...

The global HIV epidemic peaked at 3 million new infections in the year 2000. However, since 2010 the decline has stalled at 2 million new infections and 1 million deaths per year. HIV remains extremely unevenly distributed in the world. Half of all new infections, as well as deaths, occur among 4% of the world's population living in just a few countries in Southern and Eastern Africa. New infections mainly occur through heterosexual intercourse, but transmission also varies more than ten-fold between population groups within these countries. We also see a clear feminisation of the HIV epidemic across Africa. To date, researchers still cannot explain these tremendous variations in heterosexual HIV transmission.

“Although South-Eastern Africa is way ahead of the rest of Africa in terms of treatment access, 10 million of the overall 19 million estimated to be living with HIV in this sub-region have been introduced to ART. Still, the incidence of new HIV infections remains between 3 to 50 times higher in the South-East, as compared to Western, Central and Northern Africa.”

The prevalence of HIV is increasing among teenagers in the most affected countries in South Eastern Africa and the high number of new infections rapidly adds to the growing total in need of HIV treatment. This pushes the cost of antiretroviral drugs and the



demand for care beyond the capacity of the meagre health systems.

Poverty and gender inequality can't explain all

A key issue is the high incidence among young women who carry the largest burden – over 70% – of all new infections among adolescents in the most affected countries. Over past decades we have tried to understand the high HIV incidence among women in Africa using poverty and gender inequality lenses. Both aspects are major global challenges and clearly both relate to healthcare access, education and engagement in unwanted and risky sex among young women, but this not only true in South-Eastern Africa.

Poverty and gender inequality cannot explain the manifold variation in HIV transmission, between or within

African countries. Equal or worse poverty rates and more pronounced gender inequality also exist in areas with much lower HIV incidence, such as in northern and western Africa.

We need to think outside the box to understand how historical, cultural and political factors, in combination with various modes of modernisation, may interact to create locally specific behavioural patterns of intergenerational sex, concurrent sexual partnerships and transactional sex. Sexual networks where both men and women have parallel partners fuel the epidemic because of the rapid spread when somebody in the network becomes newly infected and is unaware of his or her HIV-infection.

Early diagnosis is needed

Today's highly effective antiretroviral



therapy (ART) does not only enable long and healthy lives, but can also dramatically reduce the risk of transmission to sexual partners – so-called Treatment as Prevention, TasP. For TasP to work, people must get tested early, but 4 out of 10 are not aware they have HIV and thus cannot access ART. Late testers die untreated or only get access to ART once they become symptomatic, often a decade down the line. In the meantime, their partners are at risk of infection.

Although South-Eastern Africa is way ahead of the rest of Africa in terms of treatment access, 10 million of the overall 19 million estimated to be living with HIV in this sub-region have been introduced to ART. Still, the incidence of new HIV infections remains between 3 to 50 times higher in the South-East, as compared to Western, Central and Northern Africa. A reasonable conclusion is that many of the interventions based on testing and

treatment do not work well enough when scaled-up to local contexts.

Local variance in HIV transmission

Aside from understanding why sexual risk behaviours prevail, new ways to increase the uptake of HIV testing are also vital. HIV stigma and conventional facility-based HIV services explain part of the unwillingness to test but should be possible to change. Role models living with HIV could reduce stigma. Easily accessible information about HIV adapted to mobile phones and social media is an underemployed mode of health communication that could lessen the fear among young target populations in south-eastern Africa, the majority of whom have access to mobile phones.

More individually adjusted and less stigmatising testing services – such as mobile health units attractive for teenagers and home-testing and self-test kits that could be ordered through

the web or via SMS – should probably be explored much more, but we will never be able to entirely control the HIV epidemic through treatment solutions alone.

“HIV remains extremely unevenly distributed in the world. Half of all new infections, as well as deaths, occur among 4% of the world’s population living in just a few countries in Southern and Eastern Africa. New infections mainly occur through heterosexual intercourse, but transmission also varies more than ten-fold between population groups within these countries.”

Further expansion of conventional interventions such as promoting condom use, postponing sexual debut or using ART as prevention will not work if we cannot understand the tremendous local variation in HIV incidence between and within African countries.



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Towards the 2030 health goals: European action on HIV and viral hepatitis

European action on HIV and viral hepatitis is at a necessary turning point to meet 2030 SDGs, writes Dr Masoud Dara of the WHO Regional Office for Europe...

2030 is a milestone year for world leaders, and for all of us, as our action to end the AIDS and hepatitis epidemics will be measured by the rest of the world. These ambitious targets are part of the Sustainable Development Goals (SDGs) on health, and call for ramped up commitment.

Europe is taking a strong stance in its action to this end. On 14 September 2016, the 53 countries that make up the WHO European Region adopted 2 groundbreaking action plans on HIV and viral hepatitis. These plans boldly shift and kick off the health sector response to the two diseases. They provide a concrete road map for countries' efforts to achieve targets by 2020 towards the 2030 goals.

Critical time to reverse the incidence of HIV in Europe

While new HIV infections are decreasing globally, the WHO European Region has observed the highest number of newly diagnosed infections in one year (over 153,000), and the highest number of cumulative HIV cases ever (2 million). Over two thirds of these cases are in Eastern Europe.

On a positive note, recent achievements in the European Region furnish hopes of success. Almost 1 million people are now on antiretroviral therapy, and mother-to-child transmission of HIV is on its way to being eliminated in several countries, with just 1% of new cases reported in 2014.

The new HIV action plan builds on accomplishments of this type, and reformulates the public health response to HIV. It sets concrete actions for countries to achieve three ambitious 90–90–90 targets by 2020: 90% of people living with HIV know their HIV status; 90% of diagnosed people living with HIV receive treatment; and 90% of people on treatment achieve viral suppression.

Image: © Erik Luntang



Dr Masoud Dara of the WHO Regional Office for Europe

Viral hepatitis in the spotlight of Europe's response

Over 13 million people in the European Region are estimated to be living with hepatitis B virus infection, and over 15 million with chronic hepatitis C virus infection; two thirds of these people are in Eastern Europe. These 2 viruses account for the greatest burden of viral hepatitis in the Region and are responsible for over 170,000 deaths annually.

These tragic deaths could be prevented by halting new infections and improving testing and access to treatment for those infected. This means ensuring safe blood transfusions and injection practices, vaccinating children and healthcare workers against hepatitis B, and making sure that those most at risk get tested and receive the medicines they need to treat hepatitis B and cure hepatitis C.



their access to treatment and increasing the chances of transmission to their partners.

In most countries up to 3 in 4 people living with viral hepatitis do not know about their infection. While people show no symptoms, their liver is slowly destroyed and eventually presents as grave and deadly complications such as cirrhosis or cancer.

To expand HIV and hepatitis testing, treatment and care, the two action plans recommend that countries test all people at higher risk, ensuring confidentiality of test results, and that they provide treatment, care and prevention soon after diagnosis to all.

“While globally new HIV infections are decreasing, the WHO European Region has observed the highest number (over 153 000) of newly diagnosed infections in one year, and the highest number (2 million) of cumulative HIV cases ever. Over two thirds of these cases are in Eastern Europe.”

No more complacency, but action

We are all accountable for the implementation of these plans to our people in Europe – those people who will measure our action by the 2030 milestone. Countries now have to ensure they implement interventions based on evidence and scale up what works best in the local context.

WHO will continue supporting them with technical guidance, policy dialogue and capacity building to reach the targets. The goal is accelerating the response and halting the HIV and hepatitis epidemics for healthier communities. ■

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Europe's first ever viral hepatitis action plan steers interventions to achieve these targets by 2020. Each country should define and implement an essential package of prevention, testing, treatment and care interventions contextualised to its local epidemic.

European HIV-Hepatitis Testing Week: Test. Treat and Prevent

Safe and effective treatments exist that allow people living with HIV and/or viral hepatitis B to lead healthy and long lives. Those living with hepatitis C can be cured. Knowing one's health status, however, is the prerequisite to accessing treatment. This is why WHO strongly supports European HIV-Hepatitis Testing Week, which aims to break the silence around HIV and viral hepatitis and build momentum to stop these epidemics by 2030. The most recent campaign, between 18 and 25 November 2016, helped to raise awareness to this end.

Nearly half of the 2.5 million people estimated to be living with HIV in the WHO European Region are currently unaware of their infection. Close to half of those who test positive are diagnosed at a late stage, delaying

Malaria research aims for new milestones

Adjacent Government considers progress in malaria research by the US National Institute of Allergy and Infectious Diseases and others aiming to eradicate the disease...

The National Institute of Allergy and Infectious Diseases (NIAID) has a long-standing commitment to malaria research and is the lead agency in the US federal government supporting research and development. The key aim of the institute is to reduce morbidity and mortality from malaria, which remains one of the world's most significant public health problems. According to the World Health Organization (WHO), roughly 3.2 billion people – which is almost half the world's population – are at risk of contracting malaria. Despite substantial progress being made to combat the disease, there is still some way to go before it is eliminated altogether.

WHO reported that between 2010 and 2015, the malaria incidence rate (new cases of malaria) fell by 21% globally, with mortality rates during the same period also falling by 29%. According to the WHO World Malaria Report 2016 there was an astonishing 212 million new cases of malaria worldwide, with the WHO African Region accounting for the most at 90%.

The report also detailed trends in malaria interventions, with vector control being the main way to prevent and reduce transmission. Research conducted at the NIAID helps to develop new treatments and interventions in order to reduce the burden of the disease. The NIAID reports that "malaria is a difficult disease to control largely due to the highly adaptable nature of vector and parasites involved."

"To achieve sustainable control over malaria, health-care professionals will need a combination of new approaches and tools, and research will play a critical role in development of those next generation strategies," said the NIAID.

Applying malaria research in the field

The malaria research programme at the NIAID aims to

seek fundamental knowledge with regards to the interactions of the malaria parasite with its human host and the mosquito vectors that transmit it. They then aim to apply this knowledge to prevent disease, enhance health and improve quality of life in malaria endemic areas.

As part of the research, vaccine development is a critical tool in the fight against malaria. In 2015, researchers at the NIAID undertook a study which looked at the shape of a key malaria protein, greater understanding of which scientists believe could help improve vaccine efficacy. The parasite, *Plasmodium falciparum*, is one of the species of *Plasmodium* that causes malaria in humans, and it has developed resistance to current antimalarial drugs, making vaccine development all the more crucial.

"WHO advises that children under 5 are particularly susceptible to the malaria, with an estimated 303,000 children globally killed by the disease in 2015, of which 292,000 were in the African Region."

First vaccine licensed

It was reported by the NIAID that more than 40% of the world's population lives in areas where there is a risk of contracting malaria. The most advanced vaccine – which is RTS,S (also known as Mosquirix) – has been tested in more than 15,000 infants and children in clinical trials in Africa.

The vaccine is the first licensed malaria vaccine and was approved for use in African children by European regulators in July 2015. Clinical trials revealed that the RTS,S vaccine protected 30 to 50% of vaccinated children against malaria for roughly a year.

Researchers at the NIAID reported in their study that they aim to figure out how to make a more effective



CSP-based vaccine, due to the limited protection the current RTS,S vaccine provides.

WHO advises that children under 5 are particularly susceptible to malaria, with an estimated 303,000 children globally killed by the disease in 2015, of which 292,000 were in the African Region. Despite the mortality rate among children under 5 falling by 35% between 2010 and 2015, malaria is still a major killer in this age group.

Ambitious goals set by WHO

In order to address remaining challenges, WHO developed the [Global Technical Strategy for Malaria 2016-2030](#), and was adopted by the World Health Assembly in 2015. The strategy sets out goals in order to reduce malaria or eliminate it completely. In order to track the progress of the goals set by the WHO strategy, milestones have been put in place for 2020, which include:

- Reducing malaria case incidence by at least 40%;
- Reducing malaria mortality rates by at least 40%;
- Eliminating malaria in at least 10 countries;

- Preventing a resurgence of malaria in all countries that are malaria free.

The WHO reports that 49 countries are on track to achieve the milestone of a 40% reduction in malaria mortality, which includes 10 countries that reported zero malaria deaths in 2015.

To achieve the main goal of wiping out malaria for good, research conducted in organisations such as the NIAID is integral. In order to develop this key research like the example above, funding is needed. WHO reported that in 2015, malaria funding totalled \$2.9billion, with the US and the UK contributing 35% and 16% of total funding as the largest international funders for malaria control and elimination programmes. However, is this enough to achieve the 2020 target to wipe the disease out completely? ■

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Playing the malaria elimination game was never going to be easy

Eradicating malaria will not be easy or cheap, but it will be worthwhile in the long run, argues Professor David H Peyton of Portland State University

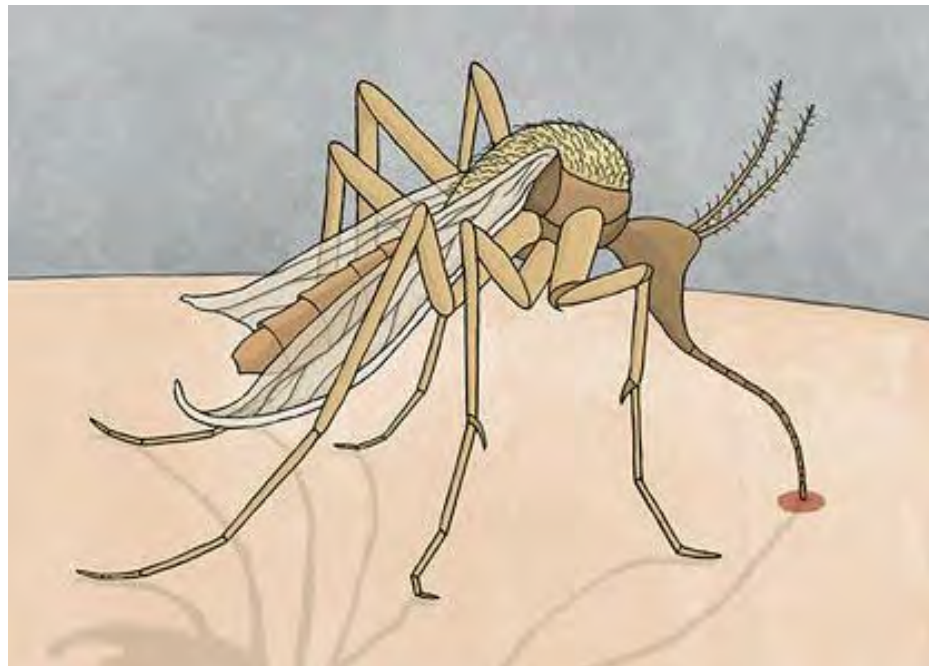
Malaria is several things: A group of related parasites, an infectious disease that is transmitted by mosquitoes (if you are a human) or by humans (if you are a mosquito), as well as a public health situation, a crisis, or a disaster (depending on who you are).

If you have been infected by malaria on a number of occasions, it can give you flu-like symptoms. However, if you are a visitor to a malaria-endemic region and did not take the preventative medicine, or a child who lives there and does not have a well-developed immune system, malaria could result in death. Or perhaps malaria seems not to touch you at all.

Partly because of the large number of parasites that develop during an infection, and their short life-cycle, the malaria parasite evolves efficiently, and so it develops resistance to all the tools (including the insecticides, drugs, vaccines) we bring to bear against it. Without some serious self-assessment, we might end up not solving the issue of malaria. And we need to.

Malaria is still a major killer

The World Health Organization (WHO) has recently published its [World Malaria Report 2016](#). This document is worthy of study for anyone trying to understand the issues behind the various worldwide programmes in malaria control.

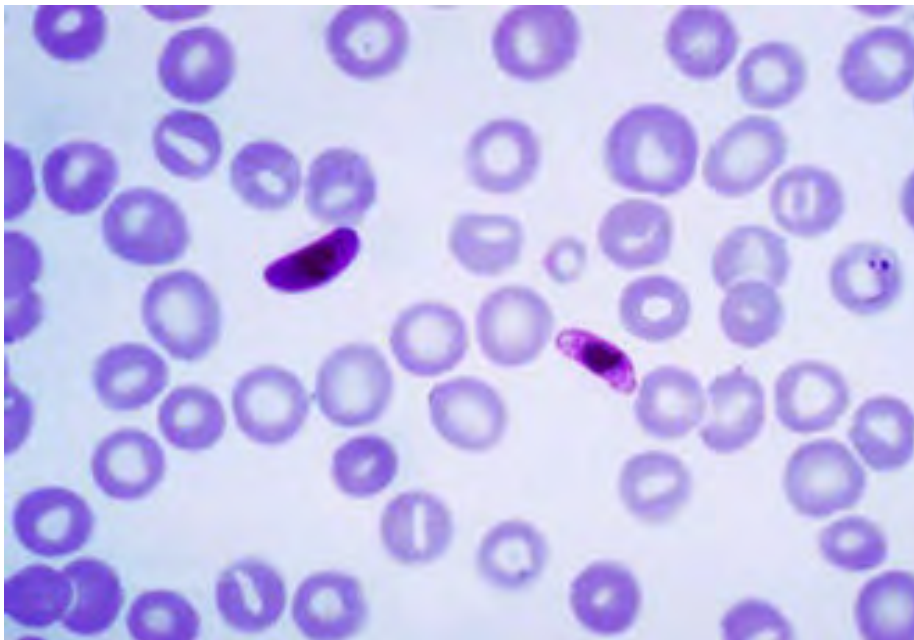


The World Malaria Report 2015 reports that the total number of malaria deaths were 429,000 (range: 235,000-639,000) in 2014. The World Malaria Report 2016 gives the total malaria deaths as 438,000 in 2015 (range: 236,000-635,000). Another statistic from the World Malaria Report 2016 is that:

“In 2015, 303,000 malaria deaths (range: 165,000-450,000) are estimated to have occurred in children aged under 5 years, which is equivalent to 70% of the global total. The number of malaria deaths in children is estimated to have decreased by 29% since 2010, but malaria remains a major killer of children, taking the life of a child every 2 minutes.” Is this enough progress?

In response to such challenges, another report has been formulated, the “Global Technical Strategy for Malaria 2016-2030” (or GTS). Quoting from this document: “To achieve the milestones and goals set out in this strategy, malaria investments, including both international and domestic contributions, need to increase substantially above the current annual spending of US\$ 2.7billion. The annual investment will need to increase to an estimated total of US\$ 6.4billion per year by 2020 to meet the first milestone of 40% reduction in malaria incidence and mortality rates.”

These are not goals that are to be ‘hoped for’. Rather, these are guides



Plasmodium falciparum malaria parasite
Source: CDC/Dr Mae Melvin

for what was projected in order to achieve the target of 90% reduction in malaria over the course of 15 years.

The latter stages of the malaria elimination game

Beyond these observations is the simple fact that some initial successes may breed complacency. Will we maintain the will to move beyond control measures into elimination strategies (in regions), in order to achieve eventual global eradication? Or will we lose focus as the rates of malaria infections and deaths drop to levels that seem insignificant?

The perverse truth here is that low transmission settings have special challenges, so the disease won't necessarily go quietly and easily as we enter the final phases. Failure at the latter stages of the malaria elimination game would mean that the parasites would have the opportunity to infect large populations with naive immune

systems. This is no theoretical speculation: We have the history of the failed campaigns of the 1960s and 1970s to look back upon.

What I'm suggesting here is that a commitment to eradicate malaria is just that: a commitment. It is a commitment to do whatever it takes, for as long as it takes, regardless of geographical and political boundaries. Eradication of malaria will probably require at least 3 decades. This effort will not be easy; it will not be inexpensive; it will almost certainly be met with setbacks. We will need new tools, both in the current pipeline and yet to be conceived.

Overcoming drug resistance

The good news is that scientific progress is presenting great possibilities, but the bad news is the significant winnowing process between scientific promise and pay-off. Likewise, the lag-time between, say, a new drug

lead and a drug that can be given to patients can be a decade or more. But the work will be worthwhile, because not to do so will be to live with a parasite that continues to evolve, and renders each generation of tools less useful. The microorganism always wins – as long as it survives.

After spending about half of my career on other scientific endeavours, I moved into working on infectious diseases, including malaria. That move was a career risk, but I thought that malaria was important. Since then, my team have been working on a drug approach that is specifically targeted at overcoming the parasite's drug resistance, and extending that approach to other microbial diseases.

It is also important that we tell the truth: Malaria elimination won't be easy. To ignore these issues is to set ourselves up for disappointment and for far worse challenges and expenses as the parasite evolves into something that we have not yet confronted.



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Italy's ageing population and the healthcare challenge

Adjacent Government examines some of the statistics around Italy's ageing population, the related health challenges, and policy action to address the issue...

Italy is currently the country with the second highest number of older people – behind Germany. In 2013, it was estimated that more than 12 million elderly people were living in Italy – accounting for 21.2% of the whole population. An increasingly ageing population in Italy, and across Europe, are leading to higher numbers of age-related chronic conditions, such as dementia and Alzheimer's disease. In 2014, approximately 1 million people in Italy were affected by dementia. This included 600,000 individuals that were diagnosed with Alzheimer's disease. These figures are expected to increase over the coming years, as they are in other European countries, due to the rise of ageing populations.

In October 2014, A National Dementia Plan was approved in Italy. The Plan was formulated by the Italian Ministry of Health, in close cooperation with the regions, The National Institute of Health and the three major national associations of patients and carers. The four main objectives of the Plan are:

- Promote health and social care interventions and policies;
- Create and strengthen the network of services for dementia based on an integrated approach;
- Implement strategies for promoting appropriateness and quality of care; and
- Improve the quality of life of people with dementia and their families by supporting empowerment and stigma reduction.

Italy was one of the first countries in Europe – or world-wide – to introduce 'memory clinics'. These are centres that are specifically dedicated to diagnosis and management of Alzheimer's and other dementias. Around 500

Alzheimer's Evaluation Units (UVA) were constituted by the Ministry of Health in 2000. These units in all of the Italian regions were designed to coordinate support for GPs in the complex process of care of individuals affected by dementia. With over 2,000 healthcare staff working in these units, including social workers, neurologists and nurses, they still play a central role in the network of healthcare services dedicated to dementia illnesses today in the country.

Italy's place in the European dialogue

In 2014, Italy took up the Presidency of the Council of the European Union. The theme of this presidency was health. Speaking about the upcoming six months of the Italian Presidency at the time, [Minister of Health in Italy Beatrice Lorenzin](#) commented: "Health is a priority for the Italian Presidency, as evidenced by the large number of expected events and goals that we have set ourselves in this field for the semester.

"Moreover, issues related to health and nature have a large impact, in terms of growth and overall development of the European Union, and thus form a central part of public policies. We intend to facilitate a constructive dialogue between Ministers and between them and the European institutions, with the aim of adding to the welfare, health and quality of life of our citizens as well as the European Union's competitiveness."

However, Italy is not the only country that is affected by this life-changing disease. In 2015, the World Health Organization (WHO) held a ministerial conference, 'Global Action against Dementia', which was attended by health officials from all over the world. The aim of the conference was to highlight evidence relating to the global burden and impact of dementia, as well as encourage governments to take action to prevent the disease and improve care services.



Dementia is a global threat

WHO expects there to be 145 million cases of dementia worldwide in 2050, but it is still not seen as a priority by most countries. Speaking at the conference, Director-General of WHO, Margaret Chan, said: "In 2010, the worldwide cost of dementia was estimated at \$604 billion per year. These costs are growing even faster than the prevalence of this disease.

"At the personal level, the costs of care are catastrophic, especially as they are often paid for out-of-pocket. Life-time savings are lost. The wages of informal caregivers are sacrificed as meeting the needs of a person with advanced dementia is a full-time job.

"I can think of no other disease that has such a profound effect on loss of function, loss of independence, and the need for care. I can think of no other disease that places such a heavy burden on families, communities, and societies. I can think of no other disease where innovation, including breakthrough discoveries to develop a cure, is so badly needed."

Dementia is a global threat and not something that affects one country more than another. Speaking at the conference, UK Minister for Health Jeremy Hunt said: "...what we need to do today is bring the world together to fight dementia. We have to do that because it is a global threat."

National Strategy Plans such as the one that was announced in Italy in 2014 are key to fighting this global problem. Raising awareness of the burden of the disease and helping European governments to develop the effective support needed to help people with dementia live day to day is vital, as well as support for friends and families who are also affected by the disease. ■

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Food neuroscience: The fascinating world of eating behaviours

Professor Raffaella Rumiati shares some insights into food recognition and eating behaviours that are emerging from food neuroscience research at SISSA...

In recent years there has been growing interest in finding out how our brain processes food cues and directs our food choices. Food is essential because it provides the energy that keeps us alive, but it is also associated with hedonic experiences.

Although some substantial knowledge has been acquired to date about the mechanisms underlying food perception and choice in humans, food cognitive neuroscience is a field that is still in its infancy. In addition to advances in basic research, this area of enquiry has a lot of translational potential. Disorders in eating behaviours have become widespread at the population level, especially in developed, industrialised countries where food availability is overwhelming. The statistics on eating disorders are such that they now constitute a growing preoccupation for public health systems and societies in general. Researchers contribute towards alleviating these concerns by providing findings that can hopefully be translated into successful treatments.

For all these reasons, food has become central to the research interests of our 'Neuroscience and Society' laboratory at the International School of Advanced Studies in Trieste, Italy. To begin with, we developed our own database – FoodCast Research Image Database (FRIDa) – that contains about 900 original pictures of food and non-food stimuli that every researcher can freely access. FRIDa has been validated



with a sample of neurologically intact participants on domain-general variables, such as valence and familiarity, but also on some domain-specific variables such as perceived calorie content, while controlling for brightness and high frequency power.

We carried out several studies using different methodologies and techniques to answer food related questions. To begin with, we asked ourselves how the intrinsic characteristics of food, such as whether it is natural food or manufactured, or its colour, influence our recognition.

Food recognition in people with aphasia and dementia

In a first study published in 2016 in a special issue of 'Brain and Cognition' completely dedicated to food neuroscience, we administered several

tasks in order to evaluate the ability of patients with primary progressive aphasia (PPA) and with Alzheimer's disease (AD) to recognise food and non-food pictures taken from FRIDa. Food included natural items such as an apple or a tomato, or manufactured items such as a hamburger or pasta, while non-food items were either tools or natural non-edible things, like a stone.

Overall, patients were less accurate than healthy individuals, with PPA patients being generally more impaired than AD patients, particularly when they named pictures. Interestingly, food was recognised more accurately than non-food items in 2 out of 3 tasks. Moreover, AD patients named transformed food more accurately than natural food. Thus, recognition particularly of transformed food tends

to be more resilient to brain damage. We think that this pattern of results can be due to the critical role of food in survival: Food is the fuel of life. Another interesting finding of this study is that the names of foods that are acquired earlier coincide with edible items that are richer in calorie content (i.e., age of acquisition). This is the first time that, in addition to psycholinguistic variables, calorie content has been considered in lexical-semantic processing.

Evolution vs the modern world

Previous evidence showed that trichromatic primates are very efficient in judging ripeness of fruits or edibility of leaves. This means that their visual system allows these animals to see the environment in colours and, more importantly, to distinguish red and green nuances in fruits and leaves that are generally associated with higher energy or protein content. This ability clearly facilitates foraging and, as such, confers to trichromatic animals an evolutionary advantage.

Thus, the aim of a second study that was published at the end of last year in 'Scientific Reports' was twofold: To establish i) whether colour plays a role also in human food evaluation, and ii) whether this strategy is viable for both natural and transformed food. To this end, we had healthy participants rate how arousing they perceived foods and non-food items to be, with arousal being defined as a proxy for wanting that also mediates preparatory behaviour. As the underlying working hypothesis was that the effect of colour on arousal and calorie content is derived from the relationship between energy-content and colour in natural food, but not in

transformed food, participants also rated the perceived calorie content, as well as the level of transformation of food stimuli.

"The statistics on eating disorders are such that they now constitute a growing preoccupation for public health systems and societies in general. Researchers contribute towards alleviating these concerns by providing findings that can hopefully be translated into successful treatments."

After controlling for all possible confounding variables at the level of stimuli or individuals, we observed very clear-cut effects: Participants are more attracted to natural or transformed food characterised by high reddish-nuances and value less the food items with higher green-colour content. These findings confirm that humans, likewise non-human primates, use colour to guide their food evaluation. But while relying on colour represented a winning strategy for our ancestors who had to search for food in an environment where it was not so abundant, in our time this hard-wired mechanism seems to bias our food evaluation, by extending this heuristic from natural food to transformed food. In fact the participants in our experiment were generally more attracted to any food that contains high reddish-nuances, irrespective of its level of transformation.

Towards sustainable eating behaviours

There are many more findings coming from our research programme on food neuroscience. One research strand has been building on the relevance of considering food not as a

unique category, by investigating for instance the level of transformation of food using other techniques such as EEG and fMRI in healthy individuals. Another explored how the characteristics of the perceiver, such as the BMI, or of the perceiver's habits, as in the case of restraining eating, may modulate food recognition and evaluation. Much attention in our lab is also being given to better understanding the food behaviours of patients with Parkinson Disease, with particular reference to wanting and liking mechanisms, as they seem altered in this population.

A conclusive message is that to nudge individuals to adopt sustainable eating behaviours we must understand better how individuals recognise and evaluate food. Even large-scale policies cannot be implemented with the hope of success if they are not scientifically guided.



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Making personal budgets dementia friendly

A sea change is needed among local authorities to make personal budgets dementia friendly, argues George McNamara of the Alzheimer's Society...

People with dementia and their families tell us of the very real impact personal budgets have had on their lives – from the 85-year old woman who returned home after being left alone in her care home room each day, with no way of communicating, to the husband and wife who are now able to go dancing in Blackpool each week.

The Care Act gives everyone who is receiving support from social services the legal right to a personal budget, offering them greater choice and control over their care and support. Unfortunately, personal budget uptake among people with dementia remains comparatively low, despite the government's aspirations for a person-centred care and support system. Less than a third of people receiving social care support for problems with memory and cognition have a personal budget.

Personal budgets hold great potential for people with dementia and their carers. In the National Dementia Declaration, people with dementia and their carers describe what they feel is most important to their quality of life. These outcomes include "I have the knowledge and know-how to get what I need", "I know that services are designed around me and my needs", and "I have personal choice and control or influence over decisions about me".

Unfortunately, many people with dementia are unaware that a personal budget is an option for them; many are hit with a brick wall of confusing or discouraging advice and a lack of clear information. Frequently, it's the dogged determination of a carer or loved one that results in them getting a personal budget in place.

Case Study: Nottinghamshire County Council

In 2014, Nottinghamshire County Council Adult Social Care and Health (ASCH) felt this was a particular prob-

lem that needed addressing. With support from Alzheimer's Society, Nottinghamshire ASCH showed that with a personal budget people with dementia and other health conditions can commission the right support to assist them with living in the community for longer, at comparable or less cost than residential care.

Working in partnership with Alzheimer's Society, the project focused on 3 key areas:

- Improving access to high quality information on personal budgets and direct payments;
- Raising awareness of dementia and dementia support services among key operational staff;
- Accurately recording performance data on people with dementia.

Together, we consulted over 60 people with dementia and their carers at an Alzheimer's Society Dementia Café to discover what information they want and need, and how they want to access it. Following this, they worked on focus groups of people affected by dementia to develop a dedicated information leaflet. The project also created links between social work teams and Alzheimer's Society Dementia Support Workers to help ensure people affected by dementia had access to quality information and advice on all personal budget options.

Personal budgets put people with dementia at the centre of their care and, likewise, they should be at the centre of improving personal budget processes. Involving people affected by dementia when reviewing your processes and information can make sure that it's accessible and right for them – little details such as using a suitable font and dementia-friendly language.



Many local authorities in England report very low numbers of people with dementia receiving a personal budget or direct payment. Nottinghamshire ASCH found that many service users who are classified as “physical frailty/older people” are not reclassified when they begin to need support for memory and cognition, or are diagnosed with dementia. As a result, they were unable to properly plan and monitor services. These simple steps, combined with a real focus on dementia, resulted in a doubling of the numbers of people with memory and cognition needs receiving a direct payment in just a single year.

Making personal budgets dementia friendly not impossible

To support local authorities to better meet the needs of people with dementia, Alzheimer’s Society has produced the [Dementia Friendly Personal Budgets Charter](#), along with a guide of easy and cost-effective actions councils can take. The Personal Choice Network provides on-going support to local authorities that have signed the Charter. Through the Network, they have access to knowledge, skills, and materials from Alzheimer’s Society and specialist partners such

as Think Local Act Personal, In Control and Helen Sanderson Associates.

To be able to consistently implement direct payments for people with dementia and offer truly personalised care, we need to find ways to improve communication and awareness of personal budgets, make the process more dementia-friendly and raise expectations of people’s right to have choice and control over their lives.

We need a sea change in the way local authorities provide personal budgets for people with dementia, but that’s not impossible. Working with local authorities, we can and will provide care and support that puts people with dementia in control. ■

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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.

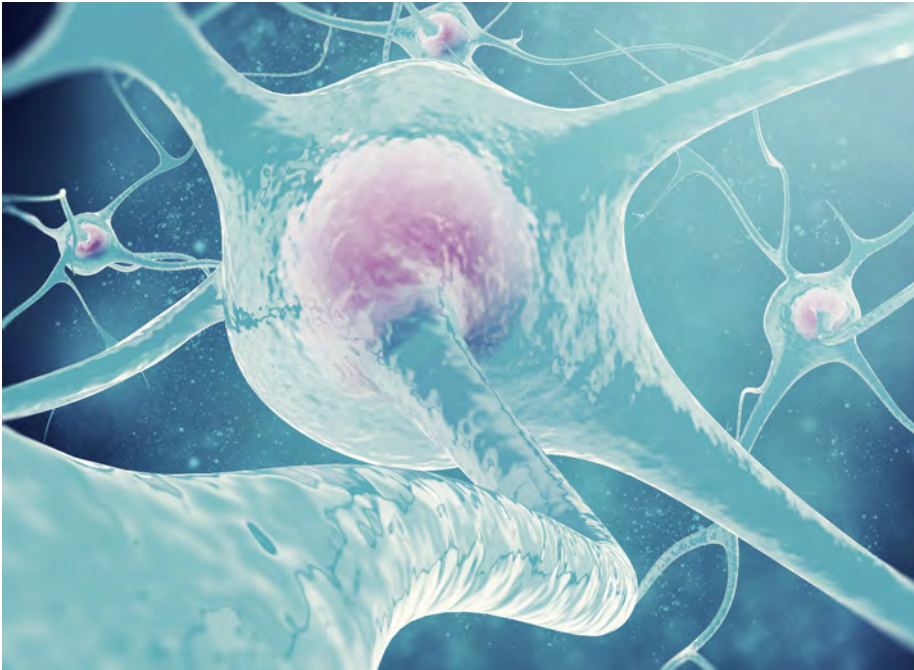
Third, timing. It may have been too late to treat the disease when patients were already showing cognitive impairments, such as memory loss. At this stage, the AD patients may already have lost brain cells, particularly in the cerebral cortex – the brain area responsible for processing thoughts and many 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-



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 population. (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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Improvements in stroke care, awareness and early detection

Frederic Destrebecq, Vinciane Quoidbach and Alison Turner at the European Brain Council discuss improvements in stroke care, awareness raising and early detection...

Stroke is a leading cause of disability and mortality among adults. It is the third cause of death worldwide and the first cause of acquired disability¹. Despite improvements in stroke care, around one third of the 1.3 million people who have a stroke in Europe each year will not survive. One third will make a good recovery, but one third will live with long-term disability. Stroke causes not only acute, but also chronic complications such as post stroke dementia, depression, epilepsy and falls that cause substantial morbidity and economic costs².

Stroke remains the leading cause of severe adult disability, so further understanding of stroke, implementation of preventive measures, and improvements in rehabilitation are vital.

Strokes are more likely to occur with ageing, with 75% of strokes happening to people aged over 65 years old³. There are currently important differences regarding stroke incidence across Europe. While Central and Eastern European countries are experiencing increas-

ing rates in stroke incidence and stroke related mortality, a decline in stroke incidence was noted in Western Europe in the last 2 decades. Nevertheless, the number of patients with stroke is estimated to rise with increased ageing. The overall incidence of stroke in Western countries is approximately 2,400 per year, per million inhabitants⁴.

With ageing of the world population and increasing incidence of vascular risk factors, the prevalence of stroke and related burden are expected to rise. Although there has been in the last decade an increased use of treatment during ischemic acute stroke, such as thrombolysis (intravenous or intra-arterial) and implementation of stroke unit care, these are available to only a small portion of the population. Resources should be directed to improve primary and secondary prevention of stroke and improve rehabilitation.

From an anatomopathological perspective, strokes are divided in 2 main groups: ischemic and haemorrhagic. Approximately 80% of all strokes worldwide are

ischemic in origin⁵. These are due to the acute occlusion of an arterial vessel. Ischemic stroke is largely a preventable condition. Primary prevention of stroke is mainly related to vascular risk factor, early detection and treatment. Vascular risk factors include hypertension, diabetes mellitus, dyslipidaemia and atrial fibrillation. High blood pressure is a main risk factor that can be changed, and it is estimated that if kept under control, around 40% of strokes could be prevented⁶. After stroke onset, time is a crucial factor in acute ischemic stroke treatment. The probability of a successful outcome is higher if the patient is treated within the first 90 minutes. Access to acute treatment depends on early recognition of warning signs, such as FAST (facial drooping, arm weakness, speech difficulties and time to call) by the patient, relative/proxy or paramedic and fast activation of the emergency medical services with priority transport to a hospital.

“Stroke remains the leading cause of severe adult disability, so further understanding of stroke, implementation of preventive measures, and improvements in rehabilitation are vital.”

If the patient is admitted within the first 4.5 hours after stroke onset and there are no contraindications, thrombolysis with intravenous alteplase should be performed⁷. The stroke unit is vital for patient treatment, evaluation, prevention of complications and initial rehabilitation. Rehabilitation and patient reintegration in society are key points to a successful outcome.

EBC Value of Treatment Research Project and stroke workshop in the European Parliament

A large body of research links early intervention to measurable health gains, such as improved survival rates, reduced complications, and lower treatment costs. However, effective implementation of early diagnosis and treatment varies widely across health systems and many European countries lag behind (with clinical practice variations even within countries). The Value of Treatment case study on stroke will address this.

Every step of the patient trajectory from onset of symptoms to the start of treatment should be optimised in order to decrease loss of time.

Value of Treatment example: identifying the treatment gap and improving care for ischemic stroke patients

An illustration of the European Brain Council approach, and one of the VoT case studies, is acute stroke care.

Intravenous thrombolysis (IVT) with recombinant tissue plasminogen activator (rt-PA) is one of very few effective treatments for acute ischemic stroke. In most centres, however, only a small proportion (2%–7%) of patients with ischemic stroke receive this treatment.

The most important factor limiting IVT administration is time: It has to be administered within 4.5 hrs of symptom onset. Even within that window, reducing ‘time-to-needle’ (the time between symptom onset and IVT administration) can improve functionality and reduce complications for the patient.

The clinical benefit from IVT declines rapidly however. Time is brain, and every minute counts^{8,9}:

- If IVT is started within 90 minutes after stroke onset, the number of patients that need to be treated (NNT) in order to achieve an excellent clinical outcome (based on modified Rankin scale – a measure of disability and dependence in daily activities) is 4;
- Within the 180–270-minute time window, the number of patients that need to be treated to achieve an excellent outcome increases dramatically to 14¹⁰.

Put simply, a shorter delay from symptom to IVT (the so-called symptom-to-needle time) can make the difference between being independent and being dependent.

Policy implications

Reducing the symptom-to-needle time is vital. Most time is lost in the prehospital period (patients waiting before they seek medical attention). Unfortunately, awareness campaigns have been found to have limited impact in addressing this.

Inside the hospital, the focus should be on decreasing the time from arrival to IVT administration – the so-called “door-to-needle time” (DNT). In most countries, national guidelines recommend that the DNT should

not exceed 60 minutes. However, 15 years after IVT was proven to be clinically effective, in most institutions, the DNT is still more than 60 minutes for the majority of patients.

Reducing DNT will also increase the proportion of patients eligible for IVT, because more patients can be treated within the 4.5-hour time window.

EBC Value of Treatment Research Project

The EBC Value of Treatment (VoT) Project (2016 – 2017) aims to provide evidence-based and cost-effective policy recommendations for a more patient-centred and a seamless care model for brain disorders including stroke ('patient-centredness' refers to shared clinical decision making). These recommendations will be released in the project's closing conference under the auspices of the EU Maltese Presidency to be held on 22 June 2017.

VoT is developing case studies analysing (i) health gains and (ii) socio-economic impacts resulting from best practice health interventions.

The benefits of best practice interventions will be compared with the current standard of care or, where appropriate, non-treatment. The comparisons will take into account the cost of burdens (including socio-economic costs) in order to assess value.

EBC workshop on atrial fibrillation stroke

EBC organised a workshop on 25 January at the European Parliament to highlight the importance of screening for atrial fibrillation (AF). One in 4 middle-aged adults in Europe will develop AF¹¹, a condition which limits the amount of blood the atrium can release into the ventricles. Some people with AF experience symptoms including tiredness, palpitations, difficulty breathing, chest tightness and sleeping difficulties. But 30% of people with AF will not have symptoms. If blood is pooling in the atrium, that blood is more likely to clot, so people with AF have a greater risk of stroke. If patients take anti-coagulant treatment (OAC), the risk of ischemic stroke (caused by clots) reduces by up to 70%¹².

The workshops key aim was to bring together stakeholders to discuss improving public awareness of AF

and recognise the social and economic burden of stroke. The direct costs of AF will increase if it is not prevented and treated before it progresses to further damage health. Speakers at the workshop included cardiologists, neurologists and a stroke survivor. ■

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Spontaneous brain plasticity brings hope after stroke

Stroke is a major cause of morbidity and mortality worldwide, but research into spontaneous brain plasticity could offer hope for recovery...

Among the main causes of brain injury, ischemic or haemorrhagic stroke burdens the life of hundreds of thousands of people each year. Approximately half of the survivors are susceptible to suffer from lifelong losses in sensory, motor, cognitive, and emotional functioning, depending on the size and localisation of the lesion. The limited degree of spontaneous recovery implies a large personal and societal burden in lost productivity, lost independence and social withdrawal. The substantial problem of long-term disability in stroke has long prompted investigation into the mechanisms of neural repair.

Facilitating the recovery processes by improving functional outcome is indeed among the highest priority in translational neuroscience. An appealing approach to this aim is augmenting the brain's normal capacity to reorganise itself after injury.

Let us see in more detail what we mean when we talk about reorganisation, i.e. spontaneous brain plasticity. Studies in humans and laboratory animals show that partial recovery of sensorimotor impairments during recovery from stroke can be attributed to adaptive changes (i.e. spontaneous plasticity) in surviving functionally homologous brain regions. To be more explicit, areas of the brain that remain unaffected by injury to some extent can take over functions formerly mediated by the damaged areas. Reshaping simultane-

ously takes place at multiple levels, involving modulation of functional and structural connectivity over many scales.

Rewiring the brain's circuits

Here, we will focus on dynamic changes in single cell shape and morphology, namely "structural plasticity". This phenomenon underlies the rewiring of the brain's circuit at the synaptic level and is mirrored by functional remapping at the cellular and network level. Reshaping at the dendritic and axonal level presumably enables areas interconnected to the damaged region to assume some of its functions.

Historically, optical imaging has been a fundamental tool for investigating physiological processes spanning multiple spatial and temporal scales. This flexibility derives from its unique properties, such as high temporal and spatial resolution within reasonable thicknesses of tissue, numerous contrast mechanisms, and the modest cost of instrumentation. Traditional optical microscopy techniques such as widefield or confocal microscopy imaging are not capable of penetrating more than several tens of micrometres into the optically highly scattering brain tissue, which significantly limits in vivo applications.

Recently developed high-spatial resolution optical imaging technologies capable of penetrating up to one

millimetre into the tissue greatly extended the range of investigation of dynamic events in vivo. In a pathological context, live imaging provides clinically relevant data on the spatial and temporal patterns of tissue injury and repair, to improve interventional therapies, and leads to the discovery of novel markers of recovery. The observation and interrogation of single cells and even their processes in real time in their natural environment, thereby preserving the complex ensemble, revolutionised our knowledge on brain plasticity and recovery after injury. With these techniques, a detailed characterisation of the events that follow stroke has been possible.

Greatest remodelling in first weeks after stroke

By real time observation with two-photon imaging, recent studies demonstrated a period of rapid synaptogenesis and circuit plasticity within the first weeks after stroke. A transient loss of dendritic spines has been reported to take place within hours of a stroke in the neurons that are destined to survive. Starting in a later phase and reaching its peak within the first 2 weeks after stroke, increases in dendritic spine number and in spine turnover rates in cortex take place within millimetres of the infarct. As shown in panel 1 of Fig.1, cells close to the infarct undergo complete and irreversible disruption of neuronal structure immediately after stroke. In the weeks that follow,

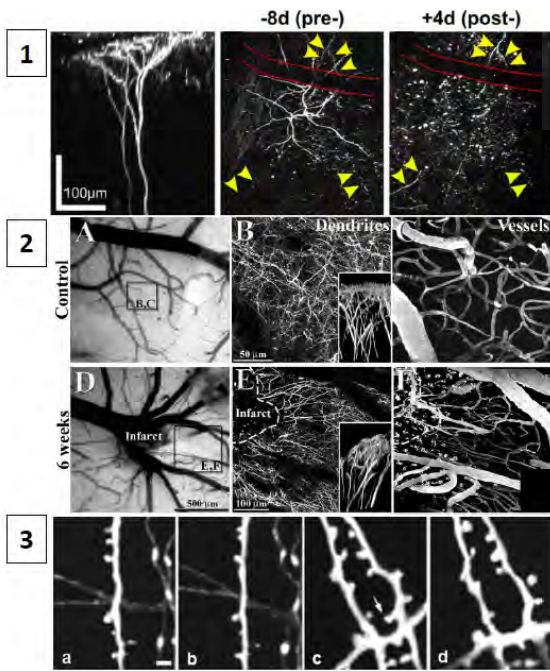


Figure 1

massive reorientation of dendrites and blood vessels takes place in the peri-infarct region (panel 2). This large-scale rearrangement obviously affects synaptic connectivity, which can be longitudinally quantified in terms of turnover (i.e. disappearance and formation) of spines and varicosities (panel 3).

Dendrites and axons remodelling takes place not only in the peri-infarct region, but also in the contralateral cortex. Structural changes at the synaptic level in the opposite hemisphere has been linked to the reliance of the animals on the unimpaired limb. Recent studies suggest that local cortical lesions result in increased dendritic branching in excitatory neurons of the undamaged, contralateral forelimb motor area and increased numbers of dendritic spines per neuron.

These changes are use-dependent: they are blocked if the animals are prevented from using the unimpaired limb, and are amplified if animals are able to use that limb to perform complex tasks. Exposing rats to an

enriched environment might also augment dendritic spine complexity in cortex contralateral to the stroke site. In parallel with structural modification of synaptic structures, profound reorganisation of axons after CNS injury has also been documented by ex vivo and in vivo imaging studies in experimental stroke models.

Strategies to improve long-term outcomes

Mapping of cortical projections allowed determination of a robust post-stroke axonal sprouting response that is responsible for remapping the

normal body representation. Longer distance axonal sprouting also occurs within the hemisphere ipsilateral to the stroke site. Massive axonal rearrangements are likewise seen in primates after brain injury. Presumably, these changes underlie the shift in functional maps described above and elsewhere. Together, these studies show that stroke, and brain injury in general, lead to the formation of new local circuits and long-distance connections.

Nonetheless, the extent of this spontaneous reorganisation remains constrained by many endogenous factors. Strategies that promote spontaneous brain plasticity like motor training can enhance rewiring and dramatically improve functional outcome in animal models of stroke or of other types of CNS injury. In animal studies, motor training after ischemic injury is most effective for restoring behavioural performance, peri-infarct neurophysiological maps and enhanced neuroanatomical changes in the ipsi- and contralesional hemisphere when introduced within the first week of injury.

By exploiting two-photon images of neuronal dendrites and axons, our preliminary investigation show how one month of light rehabilitative training stabilised the synaptic contacts of spared neurons in the peri-infarct area. The recovery of physiological turnover is flanked by the reinstatement of dendritic and axonal random orientation. We believe that our knowledge on stroke-induced plasticity and on the modalities to improve it will greatly benefit from future optical microscopy studies investigating the effect of different therapeutic strategies by combining complementary imaging modalities.



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How the retreat of big pharma leads to lost opportunities for Parkinson's drug discovery

The changing pharma landscape means opportunities for Parkinson's drug discovery are missed, but Parkinson's UK have a new strategy to redress the balance...

This will be the 200th year since James Parkinson wrote his seminal paper on 'the Shaking Palsy'. Since that time there have been major developments in the treatment of Parkinson's disease. Medications that were developed over 50 years ago, such as levodopa, are used by millions across the world to control the symptoms of Parkinson's.

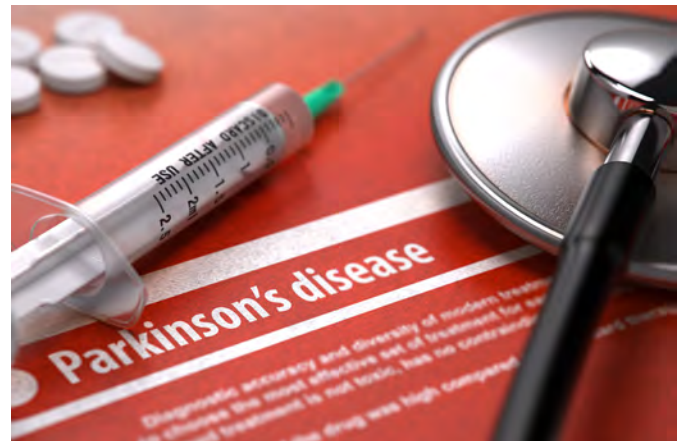
Many can expect a near complete disappearance of symptoms when they first take Parkinson's medications. But for all of their benefits, none of the medications available slow the progressive degeneration of nigrostriatal dopaminergic neurones, and, as the condition progresses, their dose must be increased to maintain their benefits. After a while, the side effects of these medications become too great to continue to increase their dose.

The devastating reality is that people with the condition face a continual decline with ever progressing and accumulating symptoms, knowing that current treatments will eventually fail them. In the advanced stages of Parkinson's, people may spend many hours every day unable to move while also struggling with a myriad of non-motor symptoms, which can include hallucinations, cognitive decline, depression and many others.

It is clear that what is needed is a disease-modifying treatment capable of slowing or stopping Parkinson's progression. But 50 years since the first Parkinson's medications were discovered, why are we still waiting for these treatments?

Failing at the final hurdle

The reasons are numerous; Parkinson's is an incredibly complex condition that affects everyone differently. It is difficult to test a drug in such a heterogeneous population and it is likely that a number of different



underlying causes are contributing to each individual's Parkinson's.

Where there has been progress in research that has led to clinical trials of medications, there have been a number of late stage failures that have impacted on investment in other Parkinson's projects.

Expensive late stage trials are required for regulatory approval of new medications but in recent years, several promising new treatments for Parkinson's have failed at this final hurdle. These disappointments have led some companies to redirect their investments into other diseases which may be perceived to be less high-risk and potentially more profitable. Without investment, progression towards a modifying treatment for Parkinson's will slow and eventually stall.

New treatments are created from scientific discoveries through a process of drug discovery and development, which feeds pre-clinical and clinical research.

Lost opportunities and the funding gap

There is a strong tradition of pharmaceutical research in the UK. Twenty-five years ago, when the sector was

booming, 15 sites were actively involved in developing and testing future treatments. The crucial early stages of developing new drugs and treatments were being led by biotech companies and big pharma.

Now, due to global pressures and a subsequent retreat of large pharma, there are just 3 active large pharma sites. To continue to survive, pharmaceutical companies have had to think strategically about where to invest and have turned their funding away from early stage drug development and pre-clinical work and focused instead on the high risk/high reward later stages of clinical testing.

“Where there has been progress in research that has led to clinical trials of medications, there have been a number of late stage failures that have impacted on the investment in other Parkinson’s projects.”

What has been left in their wake is a funding gap – an expanding desert that has become too difficult for charity-funded, academia-produced scientific discoveries to cross. While Parkinson’s isn’t the only disease area which has seen a lack of investment when it comes to developing the treatments of tomorrow, it is one of the conditions that has seen the most neglect when it comes to early stage drug discovery and development work. The little money that biotech and pharma companies still direct towards bridging this gap is more often invested in other conditions, some of which are seen as easier or more profitable.

The major hurdle in turning scientific discoveries into new treatments now occurs much earlier in the research pipeline. Academic researchers are constantly discovering new insights, which have exciting potential for developing new treatments for Parkinson’s, but without investment, these discoveries may never benefit the patient population.

Missing chances for Parkinson’s drug discovery

The changing pharma landscape is no doubt leading to lost opportunities when it comes to drug discovery and early clinical development. In the absence of large pharma we have seen the emergence of smaller commercial biotech companies and contract research organisations capable of industry standard drug discovery.

These smaller scale companies provide opportunities for charities, who would have once restricted their funding to the relatively less expensive scientific discovery phase of the research pipeline, to take a more active role in the drug discovery process. For Parkinson’s UK, Europe’s largest charitable Parkinson’s research funder, filling this gap is now a major focus in their mission to develop better treatments and a cure, within years, not decades. Director of Research at Parkinson’s UK, Dr Arthur Roach, explains:

“There are promising scientific discoveries for Parkinson’s that are not being picked up and developed by commercial companies. We believe we can step in here to bring new treatments forward faster.

“We are calling this major new programme of work the Parkinson’s UK Virtual Biotech because we’ll be acting in a similar way to a small biotech company. However, unlike a commercial company, we will be dedicated to developing new treatments for one condition – Parkinson’s; and, our primary focus is delivering better treatments that improve life as quickly as possible, instead of maximising on investor returns.”

A charity-sponsored drug discovery portfolio

Parkinson’s UK plan to work virtually, providing leadership and critical funding, and working in partnership with a range of other organisations that have the facilities and staff to carry out scientific work on a contract basis. They will encourage university researchers, who have ideas to take forward, to form single-asset spin-out companies.

With careful management of the projects, and guidance from a team of industry and scientific experts who are volunteering their time, the virtual biotech will produce a charity-sponsored portfolio of drug discovery projects – all at different stages of this process and early clinical development pipeline. ■

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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

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 Bespalov 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.

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Time for a change of tack on drug development for neurodegenerative diseases?

UCB's Duncan McHale outlines why reclassification might be a good idea to boost drug development for neurodegenerative diseases like Alzheimer's and Parkinson's...

Neurodegenerative diseases are a growing global challenge, as medical advances ensure more individuals live longer. By 2020 there will be more than 40 million people in the world with Alzheimer's disease (AD) and by 2040, without the development of disease modifying drugs, this will rise to more than 80 million. Discovering and developing disease modifying drugs is proving very challenging, with many programmes failing. November 2016 saw another phase 3 failure with Lilly's solanezumab failing at the final stages of development. Is this the end of the amyloid hypothesis or a case of too little, too late and too broad?

been thought of as a disease of amyloidosis. Multiple potential therapies targeting amyloid processing have been developed and studied, with several still in the development stages. These therapies have all demonstrated an ability to reduce amyloid load in preclinical models, but this has so far not been beneficial to humans.

Amyloid is undoubtedly associated with AD and its presence has been a core part of the diagnosis, either post mortem or, more recently, through imaging techniques. However, the amount of amyloid does not correlate with disease severity and many subjects have significant amyloid deposits

but no symptoms. Despite these anomalies, the majority of current potential therapies have been targeting this mechanism. The community eagerly awaits the results of a clinical trial using Biogen's aducanumab as the most promising agent so far, but given the failure of other admittedly less potent molecules targeting amyloid deposition, many are pessimistic about a good result.

Drug development for neurodegenerative diseases at a turning point

The failure of these therapies to date could be because the amyloid hypothesis is flawed and, despite the

"AETIONOMY is an Innovative Medicine Initiative (IMI) funded consortium established to develop a mechanistic based classification of neurodegenerative diseases, with an initial focus on Alzheimer's and Parkinson's disease."

The amyloid hypothesis

Alzheimer's disease is a chronic neurodegenerative disease which usually presents in the seventh or eighth decade of life. However, earlier onset is not uncommon. The cause(s) of AD are not fully understood but the presence of amyloid (protein) plaques in the brain was demonstrated in 1911 and since this time the disease has



association, amyloid is a downstream consequence of the disease process and not pathogenic in its own right. However, the presence of familial forms of the disease caused by genes involved in amyloid processing make this unlikely. For example, the presenilin 1 gene is part of a protein complex which degrades amyloid, creating the pathological 42 amino acid peptide.

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

It is much more likely that, for most individuals, amyloid is not the sole cause and additional pathological mechanisms are involved. Indeed we now know that the Tau protein is one of these additional mechanisms. It is therefore time to start focussing on some of these other mechanisms to find the causes of AD, which we can then target with new therapies. We need to look for mechanisms that are important in later stages of the disease process and/or can still be successfully modified once the very early symptoms appear. AETIONOMY is a consortium with the sole purpose of identifying these other mechanisms involved in AD and reclassifying neurodegenerative disease using these discriminatory mechanisms, which will help us develop new treatments.

At AETIONOMY we have been taking the totality of research in AD and, using our knowledge base, integrating this information into a common framework to search for other potential mechanisms. By looking for these other mechanisms we hope to find sub-populations of patients who can be treated by targeting the cause in



them which is present with the amyloid plaques. Success will result in a new way to classify AD beyond just the presence of memory problems and plaques. Success will also result in new mechanisms for targeting and precision medicines for AD.

AETIONOMY

AETIONOMY is an Innovative Medicine Initiative (IMI) funded consortium established to develop a mechanistic based classification of neurodegenerative diseases, with an initial focus on Alzheimer’s and Parkinson’s disease. This public private partnership is co-led by myself and Martin Hofman-Apitius from SCAI Fraunhofer. The premise behind the project is that, although large sums have been invested in research in neurodegeneration and a lot of data generated, the co-ordination and integration of this data across the community has been less well addressed. The consortium has brought together experts in

informatics, computing, engineering, mathematical modelling of disease, neuroscience and clinical neurology from leading academic centres, as well as neuroscience, informatics and neurology drug development experts from the EFPIA Industry partners.

AETIO **N|O**
M|Y

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ALS research in Italy: Deciphering the disease's complexity

AriSLA – The Italian Research Foundation for ALS, outlines strides made in ALS research in Italy over the last 10 years and work still needed to find a cure...

Amyotrophic lateral sclerosis (ALS) is the most common adult onset neurodegenerative disease, characterised by progressive loss of upper and lower motor neurons at the spinal or bulbar level. Motor neurons are the cells responsible for contraction of voluntary muscles which primarily allow voluntary movements, but also other vital functions such as swallowing, speaking and breathing. Their degeneration involves the progressive paralysis of muscles, saving the sensory and in most cases, cognitive functions, blocking the patient in his/her own body.

ALS has a median survival of 2-4 years and the worldwide annual incidence is about 1.9 per 100,000. As recently reported, the number of individuals with ALS is expected to increase by nearly one third from 80,162 in 2015 to 105,693 in 2040. This projection is due to ageing of the population, as those most at risk of developing the disease are between 55-75 years of age. (Nature Communication 2016). This scenario implies the need

for common strategies to face the impact that this increase will have on national healthcare systems.

Incredible advances in technology

AriSLA – the Italian Research Foundation for Amyotrophic Lateral Sclerosis, was born in 2009 thanks to the foresight of its founders: AISLA Onlus, the ALS Patients Association, Fondazione Cariplo, Fondazione Telethon and Fondazione Vialli e Mauro per la Ricerca e lo Sport Onlus.

The last 10 years have been, indeed, characterised by an incredible development of new technologies for sequencing and imaging that have allowed us to identify many ALS-associated genes and biomarkers, which are potentially useful for diagnosis and prognosis in relatively cheaper and faster ways, as well as the development of *in vitro* (induced pluripotent stem cells) and *in vivo* tools, that allow us to study what happens prior to symptom onset. This vividness has exponentially

increased our knowledge about the disease and radically changed the mode of operation of the research itself.

Moreover synergies between worldwide charities and associations dealing with the disease and funding research have become stronger and more productive, especially in the clinical and technological areas that have a direct impact on people affected by ALS. This explosion of knowledge has unfortunately raised more questions than answers in the field of ALS.

Lack of disease models and absence of biomarkers hinders progress

ALS is a complex disease with many different heterogeneous pathways playing a role in either its onset or progression. Although most cases of ALS are sporadic (90-95%) with no obvious genetically inherited component, about 5-10% of the cases have a family history (FALS) that occurs due to mutations in specific genetic loci. Starting from the discovery of mutations in the gene, encoding the antioxidant enzyme superoxide dismutase 1 (SOD1) in 1993, more than 50 further potential genes have been identified in association with FALS (Nature 2016).

Even if presentation of familiar and sporadic forms are very similar, the clinical course is highly variable, confirming how the pathogenesis of the disease remains mostly unknown and how complex it is to develop therapeutic approaches that are effective across the ALS spectrum. After half a century of trials and more than 150 different therapeutic agents tested in preclinical models, currently the only available drug treatment is Riluzole, which only modestly increases survival of ALS patients. Potential reasons for the negative results include both the lack of reliable disease models (two-thirds of negative studies were potentially misled by positive studies in SOD1 mice in most cases performed at the presymptomatic stages), and the absence of diagnostic and prognostic biomarkers, which makes the evaluation of the effectiveness of the treatment tested difficult (Lancet Neurol 2014).

ALS research in Italy aims to provide concrete answers

From these premises, the funding model adopted by the AriSLA Foundation aims to support the whole

process of scientific research and project development, to act as an interlocutor for the national and international scientific community working on the disease, not only as a funding agency, but particularly as a catalyst of synergies and concrete actions to understand and fight the disease.

Taking advantage of its institutional role and its established network with other international ALS funding charities, AriSLA has invested in all areas of research (basic, translational, clinical and technological), concentrating most of its efforts on the identification of innovative therapeutic solutions and supporting researchers in the creation of a clinical national platform that will help to achieve its main purpose: "Funding the best research to defeat the disease". Through a peer-review selection process, AriSLA wants to be a guarantor of the principles of objectivity, impartiality and scientific merit, using its own Scientific Committee, composed of international, annually renewed experts.

As an example of the results that have been achieved in the last 8 years of research activity, more than €10.6m was invested, with 62 research projects funded and more than 110 research groups supported, to help to produce 163 original publications and lead to the discovery of 5 new ALS causative genes.

AriSLA's effort to increase awareness about the disease is changing "the way to fight against ALS", but there is still an urgent need to implement research investments to develop an effective treatment and improve patients' quality of life.

Exploitation of the new knowledge and new technologies available, together with our investments on translational research, can give us the chance to reach the goal of providing, within the next 10 years, concrete answers to the ALS community. ■

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The role of small heat shock proteins in human diseases

Professor Serena Carra and her collaborators are investigating the important role of small heat shock proteins in age-related neurodegenerative diseases...

Cells are frequently exposed to stress conditions that can damage their proteome, with consequences for their viability. To maintain a healthy proteome and preserve cell function, cells evolved a protein quality control system (PQC). This PQC system consists of molecular chaperones – heat shock proteins (HSPs), small HSPs and co-chaperones – and degradation systems (proteasome and autophagy).

Most HSPs are constitutively expressed; however, HSPs are also induced upon stress to allow cells to respond and adapt, and are therefore referred to as “stress proteins”. One of the key functions of chaperones is to cooperate with degradation systems to limit the accumulation of aggregation-prone proteins, a hallmark of many age-related neurodegenerative diseases. Genetic and experimental evidence demonstrates a direct link between imbalances in proteostasis, accumulation of protein-RNA aggregates and amyotrophic lateral sclerosis (ALS), Alzheimer’s disease (AD), frontotemporal dementia (FTD), and motor neuropathies. Moreover, mutations in small HSPs and co-chaperones (BAG3) cause neuromuscular diseases.

Due to the increasing average age of the population, the socioeconomic burden of these disorders is incrementing, urging us to find therapies that can delay their onset and alleviate or cure their symptoms. Research

aimed at understanding the physiological functions of stress proteins, how they maintain protein-RNA homeostasis, and how their expression is regulated will be essential for the identification of drugs that will ensure a healthy proteome and healthy ageing.

The direct link of small HSPs with human pathologies and their potential as therapeutic targets to cure cardiac and neurological diseases, as well as cancer, was the focus of an international workshop organised by Professor Serena Carra and sponsored by the Cell Stress Society International (Bertinoro, 2016). Worldwide experts in the small HSP field met to discuss two main aspects: first, the importance of supporting interdisciplinary research into the regulation and function of small HSPs; second, the need to understand how mutations in small HSPs lead to disease in humans, therefore providing innovative insight for therapeutic drug design.

Understanding the implication of small HSPs in human disease represents the core of the research program directed by Professor Carra. With the support from the Italian Ministry for Instruction, University and Research, the Italian Ministry of Health, the Italian Foundation for Research on ALS and the Telethon Foundation, and together with her collaborators Professor Simon Alberti (MPI CBG, Dresden), Professor Angelo Poletti and Dr Valeria Crippa (Univer-

sity of Milan), Dr Cristina Cereda (IRCCS Casimiro Mondino) and Dr Jessica Mandrioli (University of Modena), Serena Carra recently discovered a chaperone-mediated quality control pathway called granulostasis that maintains the functionality of stress granules (Ganassi et al., 2016).

Stress granules are ribonucleoprotein complexes induced by cells exposed to stress. While stress granules are highly dynamic in healthy cells, they become dysfunctional and less dynamic in ALS, AD and FTD, ultimately accumulating and contributing to disease. Boosting the HSPB8-BAG3-HSP70 granulostasis complex might help the cells to maintain the functionality of stress granules, thereby delaying disease progression. Carra and her collaborators are synergising their efforts to identify other players of granulostasis and discover drugs that can upregulate the HSPB8-BAG3-HSP70 complex for therapeutic use.

In parallel, the research team also identified mutations in HSP genes linked to rare neuromuscular diseases that are object of current investigations.



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Living with epilepsy is hard, but there is hope

The Epilepsy Society is working to reduce stigma and improve treatments for those living with epilepsy, as Nicola Swanborough explains here...

It's easy to paint a picture of epilepsy in statistics. There are more than half a million people in the UK living with epilepsy and an estimated 50 million with the condition worldwide. Up to 75% of those live in resource-poor countries with little or no access to medical services or treatment.

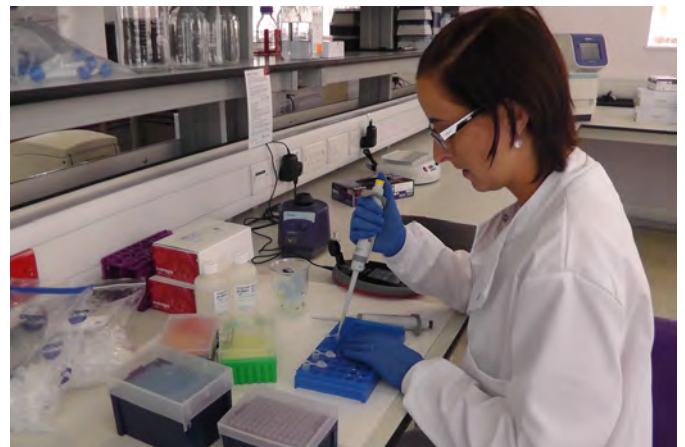
One in 100 people have epilepsy and 87 people are diagnosed with the condition every day in the UK. Surprisingly, and contrary to public perception, less than 3% of people with epilepsy are photosensitive, where seizures are triggered by flashing lights and sunlight through trees.

Up to 70% of people with epilepsy should have their seizures controlled by medication. The reality is that only 52% in the UK achieve seizure freedom.¹ The 18% treatment gap is thought to be the result of a lack of access to services including neurologists, epilepsy specialist nurses, tertiary specialist referrals and regular reviews. Lack of epilepsy awareness among GPs is also thought to be a contributory factor.

But painting a picture of what it really means to have epilepsy is far more challenging. The condition affects different people in different ways. Epilepsy is the most common serious neurological condition and is defined as a tendency to have seizures that start in the brain. It is not just one condition, but rather a group of 'epilepsies'. There are more than 40 types of seizure and each can look very different. Some people may go 'blank' for a few seconds, others may walk around in a confused state, or they may fall to the ground, unconscious and shaking.

For those who quickly gain seizure control with minimal side effects from medication, their epilepsy may not have too much of an impact on their daily lives. But for

those who live with the unpredictability of seizures and who also experience side effects from medication such as tiredness, cognitive impairment and memory loss, the picture can be rather bleak. Just one seizure means you cannot drive. You must rescind your driving licence. This can impact on employment, education, social life, shopping and independence. It can affect a person's ability to support a family.



In spite of progress in the diagnosis and treatment of epilepsy, we still do not know the exact event that will trigger a seizure in the brain and for people with uncontrolled seizures, this can be core to their quality of life. They live on amber alert, never knowing when the next seizure will happen.

Many with uncontrolled seizures lose confidence in going out, for fear of having a seizure in public, as they cross the road or stand on the platform at the train station. Young people in particular tell of being wrongly accused of being drunk, when they are staggering around and confused in the post-ictal stage following a seizure.

Epilepsy can mean never being able to have a bath on your own, only being able to swim if you have a friend



to accompany you, having to forgo the rites of passage of youth such as late nights, missed meals and drinking.

Studies have shown that people with uncontrolled seizures are twice as likely to be at risk of unemployment as those without the condition.² Around 70,000 people with epilepsy claim disability living allowance.³

The mainstays of treatment for epilepsy are anti-epileptic drugs and there are 26 to choose from. Alternative treatments, where applicable, include brain surgery, to remove the focal point of seizure, and vagus nerve stimulation. In some children with epilepsy a high fat, low carbohydrate diet called the ketogenic diet, has been found to be helpful in controlling seizures, and this is now being trialled in some adults. But people can often go through years of tests and a cocktail of medication before they achieve maximum seizure control with minimum side effects. This has to change. At Epilepsy Society, a focus of our research is to achieve a more individualised approach to both diagnosis and treatment.

For 21 years we have been mapping the brain through magnetic resonance imaging (MRI) and functional MRI. This has enabled us to look deep into the contents of the brain and understand not only its structure, but also the eloquent pathways of the brain that are important for critical functions such as language, memory, vision and movement. The knowledge we have acquired has enabled us to pinpoint the focal point of seizures for those with a structural cause and, where possible, to remove the cause, coming as close to a cure for epilepsy as is currently possible. However, this is only a possibility for a few.

Now we are turning our attention to genetic testing and looking at each individual person's DNA. Genetics

can tell us more about epilepsy in a single test than any other source. We are hopeful that genomic sequencing will help us to unravel the genetic architecture of the epilepsies and understand how genetic variations can contribute to different epilepsies. Almost 2,500 years ago, Hippocrates, the father of medicine, was able to describe epilepsy as a disease of the brain rather than as a curse or prophetic power. We have come a long way since then but people still endure ongoing seizures and they still endure stigma. In fact they often say that the stigma of living with epilepsy can be worse than the seizures themselves.

Epilepsy Society marks its 125th anniversary in 2017. We hope to make it a milestone year in improving diagnosis and treatment for everyone with epilepsy, and in tackling the stigma which still hangs stubbornly on to seizures. For more information visit www.epilepsysociety.org.uk ■

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3 In England, Wales and Scotland 69,700 people with epilepsy were claiming disability living allowance in 2009. This costs £244 million per year. JEC, 2011.

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The single seizure clinic: A paradigm shift in epilepsy care

Professor Jose Tellez-Zenteno and colleagues argue the need of a dramatic change in the way epilepsy is treated, and explain how the single seizure clinic could help

Epilepsy comprises more than 40 clinical syndromes, affecting 50 million people worldwide¹. Globally, epilepsy constitutes an unmet need and one that requires an extensive re-think on how to implement patient-oriented care paradigms that address the fundamental issues of timely access, resource allocation, and collaborative care¹. The ongoing issues regarding epilepsy care over the years are a sobering reminder of the essential groundwork that is lacking and should behoove the epilepsy community and its advocates to act.

The subject of socioeconomic barriers and infrastructure investment to aid the efficient diagnosis and management of epilepsy is vital to the frontlines of epilepsy care and must be given its due in academic, clinical, and research circles. The answers may not be easy to come by, but must be sought, in the duty of beneficence – the ability to do the greatest good for the largest amount of people.

Looking beyond intractable epilepsies

At a macroscopic level, this will require a refocus of priorities from opinion leaders, advocacy groups, healthcare systems, and key societies. For instance, firmly seared in the collective consciousness of the epilepsy community is the issue of intractable epilepsies, which together amount to 30% of the disease burden, yet appear to monopolise much of the academic and clinical discussion².



Central segment of the modern depiction of the Aztec goddess of epilepsy "Tlazolteotl" by the artist Eduardo Urbano Merino. In the picture a child is having a seizure and is held by her mother with the hope to be healed by the goddess (Full description and history in reference 5)

Intrinsically, the epilepsy community has put its weight behind this effort and the recognition of a prestigious comprehensive epilepsy centre tends to rely heavily on the ability to provide advanced, cutting edge approaches to addressing the most complex of epilepsies. While this is not without merit – indeed great progress in surgical and neuromodulator approaches attests to the tangible benefits of attempting to tackle drug-resistant epilepsy – this somewhat myopic viewpoint fails to address the basic problem of access, faced by the majority of people with epilepsy. A great majority of patients do not require epilepsy surgery or other advanced treatments, and only require guidance on the best medication and education in order to lead a productive life and steel themselves from the adverse socioeconomic,

neurobiological, and psychological consequences of untreated epilepsy. Early education can potentially deconstruct misconceptions and battle the stigma of the disease.

Regrettably, the onus of caring for their epilepsy often falls on patients themselves, who must shoulder the burden of navigating a needlessly complex series of referrals in order to attain appropriate care³. The predictable result is unacceptably long wait-times for diagnosis, tests, and treatment of epilepsy and comorbidities. One example and a major problem in patients with intractable epilepsy is the prolonged time that patients wait to have epilepsy surgery – 20 years on average³. What is clear from the outpouring of patient frustration, complemented by available data, is the need for an

PROFILE

efficient multi-disciplinary pathway that offers patients care from the onset of their first seizure to more complex management options if necessary.

While the nuts and bolts of this system may vary from region to region, contingent on expertise and resources, the inception of a time-conscious, team-based care approach is a sensible consideration.

The single seizure clinic

Our team has advocated this approach in the formation of a new model of medical attention for patients that addresses the treatment needs of patient with new onset epilepsy through a single seizure clinic (SSC)⁴. The SSC accepts any patient considered to have had a first seizure directly from primary care providers and connects them to an epileptologist. The SSC has reduced wait-times for assessment and investigations, clarified diagnoses, and affected management decisions with respect to further workup, first line pharmacotherapy, and driving advice. The SSC serves as a unified point of care for evaluating patients who experience the first seizure in life and appears to capture a patient population at high risk of developing epilepsy.

In our initial experience of 200 patients, 82 (41%) were diagnosed with epilepsy, and the vast majority of diagnoses were established at the initial visit, thereby enabling SSC epileptologists to properly stratify subsequent care and arrange appropriate follow-up, while avoiding unnecessary investigations. Patient assessments at the SSC occurred within four weeks of referral and ancillary investigations were organised more rapidly, representing a marked improvement over previous



From left to right; Dr. Hernandez-Ronquillo, Dr. Jose F. Tellez-Zenteno, RN Karen Waterhouse and Dr. Syed Rizvi

care, as wait-times were reduced by 45-89%⁴. The sooner epilepsy is diagnosed, the quicker patients and clinicians can start making decisions about treatment and management that promote seizure remission and positively impact emotional, physical, and economic well-being through the redress of issues of unemployment, loss of independence, psychiatric morbidity, stigmatisation, and early mortality. The model also provides the opportunity to advocate advanced treatment such as epilepsy surgery earlier in the course of the disease. The SSC model is now becoming prevalent in other centres in Canada.

It is understood that epilepsy care spans a continuum in which making the diagnosis is merely the first pivotal step in guiding a patient towards a positive outlook on their epilepsy and in addressing the challenges that a patient's epilepsy may pose. It is our hope that readers will take from this article the idea that there is a pressing need for early, urgent specialist input in patient care. Implicit in this recognition is the requirement to re-work institutional and health systems approaches to develop and make accessible epilepsy specialist expertise and standard of care diagnostic testing to patients as soon as they declare themselves to have epilepsy, potentially at the time of their first seizure.

This approach is a drastic re-working of the situation that exists today in which epilepsy treatment gaps are the norm, and has the potential to remove any treatment gaps and truly establish a continuum of care for all patients and all epilepsies. The upside is huge and life-affirming for individuals and societies, as care models such as the SSC can potentially mitigate the devastating social consequences and poor health outcomes resulting from untreated epilepsy.

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Open science is changing the way knowledge is made and this is how

Head of Policy Affairs at Science Europe, Stephan Kuster, tells Adjacent Government how open access promotes progress, helps society and benefits the taxpayer...

We live in a knowledge-based society in which culture, wellbeing, innovation, prosperity and social cohesion depend on the discovery, production and multiple uses of knowledge. Knowledge-based societies are highly complex ecosystems with various interconnected and interdependent parts, each with its own role and contribution to society.

The role of scientific research is to fuel the ecosystem with a steady supply of new knowledge, as well as insights into ways of applying it for different purposes. The contributions of research to society – and in particular publicly-funded fundamental research – are too numerous and diverse to list exhaustively, but they range from the discovery of new fundamental laws that

govern our universe, to solutions to societal challenges, contributions to education, and the training of the highly-skilled workforce our complex societies require.

Open access is a key element of open science

Knowledge produced through scientific research has to circulate freely in order to make these societal contributions. If it is locked up behind restricted-access rules it cannot make its contribution to society as fully and as quickly as knowledge that is free to circulate and interact, and which, most importantly, is accessible to all. This is one of the central premises of open science, which aims to change how the scientific research system produces knowledge, and how knowledge is disseminated and used.

One of the key elements of open science is open access to research publications. Open access, as defined in the Berlin Declaration, means unrestricted online access to peer-reviewed scholarly research papers for reading and productive re-use. It is not impeded by any financial, organisational, legal, or technical barriers. Ideally, the only restriction on use is an obligation to attribute the work to the original author.

Open access is based on the principle that publicly-funded research results should be publicly available, and not locked away from those who paid for it. An increasing portion of scientific literature produced today is accessible to everyone because of open access. Many research communities have long adopted open access publishing models and [a recent survey of Science Europe Member Organisations](#) (who represent a significant portion of public research organisations in Europe) showed that a large majority of research performing organisations and research funders have policies, guidelines and mandates which require and help researchers to publish in open access form. Additionally, Horizon 2020, the largest single research programme in the world, introduced an open access mandate in 2014 and today many publishers offer open access options in their journals.

Open access initiatives shake up the system

However, much still needs to be done in order to reap the benefits of open access and open science. Firstly, too much public funding is still tied up in old-fashioned subscription deals with publishers which limit access to research results to those who can afford the expensive subscriptions or are willing to pay for individual articles. Initiatives such as [OA2020](#) are shaking up the system and offer a large scale transformation from subscription models to open access.

Transparency of publishing costs and services offered by publishers is another important element needed to achieve the transition to open access. Knowing exactly how much money the taxpayer is paying, and for what services, is essential in order to determine the economic value and also the cost of open access.

While progress has been made, some aspects, which remain critical for the success of open science and open access, are only now being tackled. For example, changing the rewards system is a very difficult but necessary step towards solving some of the issues



Stephan Kuster,
Head of Policy Affairs

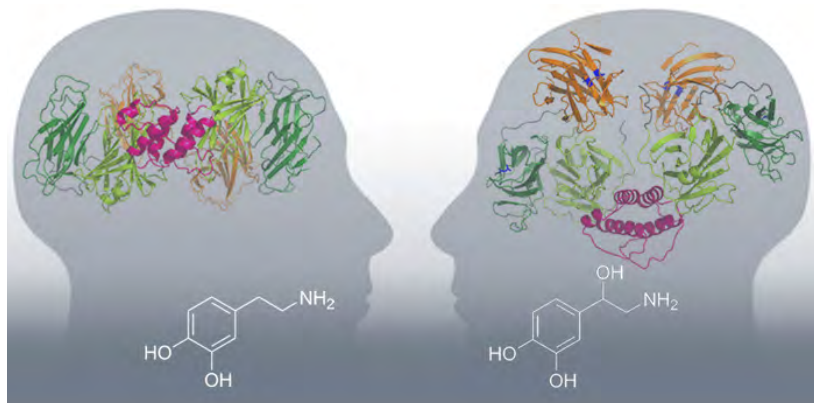
faced by researchers today. As long as researchers are rewarded on the basis of the number of articles published in highly-reputed journals, they will have strong incentives to publish only in these journals, even when they do not offer an open access option. It is essential that institutions that structure the science system (universities, research funders and research performers) change the way that they measure and reward researcher performance. Only then will open science and open access have its full impact.

“Knowledge produced through scientific research has to circulate freely in order to make these societal contributions. If it is locked up behind restricted-access rules it cannot make its contribution to society as fully and as quickly as knowledge that is free to circulate and interact, and which, most importantly, is accessible to all.”

Despite all the progress made in the transition to open access, the transformation is not yet complete. National as well as European-level research programmes, funders, research organisations, publishers and policy makers need to act decisively to achieve it. The open access mandate in Horizon 2020 and the target set for open access as the default publication mode by 2020 by the Council Conclusions of the Council of the EU in May 2016 are very encouraging and highly appreciated steps in helping research make its full contribution to society. ■

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Finally Unveiled: Structure of Enzyme that Converts Dopamine to Norepinephrine

After decades of research, scientists from DTU Chemistry have identified the first structure of the enzyme that controls conversion between two of our body's most important neurotransmitters, dopamine and norepinephrine.



A fascinating view and insight of the enzyme dopamine β -hydroxylase

The finding could lead to the development of targeted treatments for a wide range of diseases, including depression and anxiety, post-traumatic stress disorder, Parkinson's disease, congestive heart failure, schizophrenia, and Alzheimer's.

Dopamine and norepinephrine play a major role in regulating traits like memory, mood, and behavior. The enzyme dopamine β -hydroxylase – a member of a small, unique class of enzymes – plays a critical role in biosynthesis of neurotransmitters and hormones and controls the conversion between dopamine and norepinephrine, and thus the levels of these two transmitters in our body.

This enzyme has been linked to a number of disorders, including those mentioned above, yet the structure of

dopamine β -hydroxylase has not yet been elucidated. Using X-ray crystallography, a team lead by Associate Professor Hans E.M. Christensen at DTU Chemistry, report the crystal structure of human dopamine β -hydroxylase, finding that the enzyme contains two new potential binding sites.

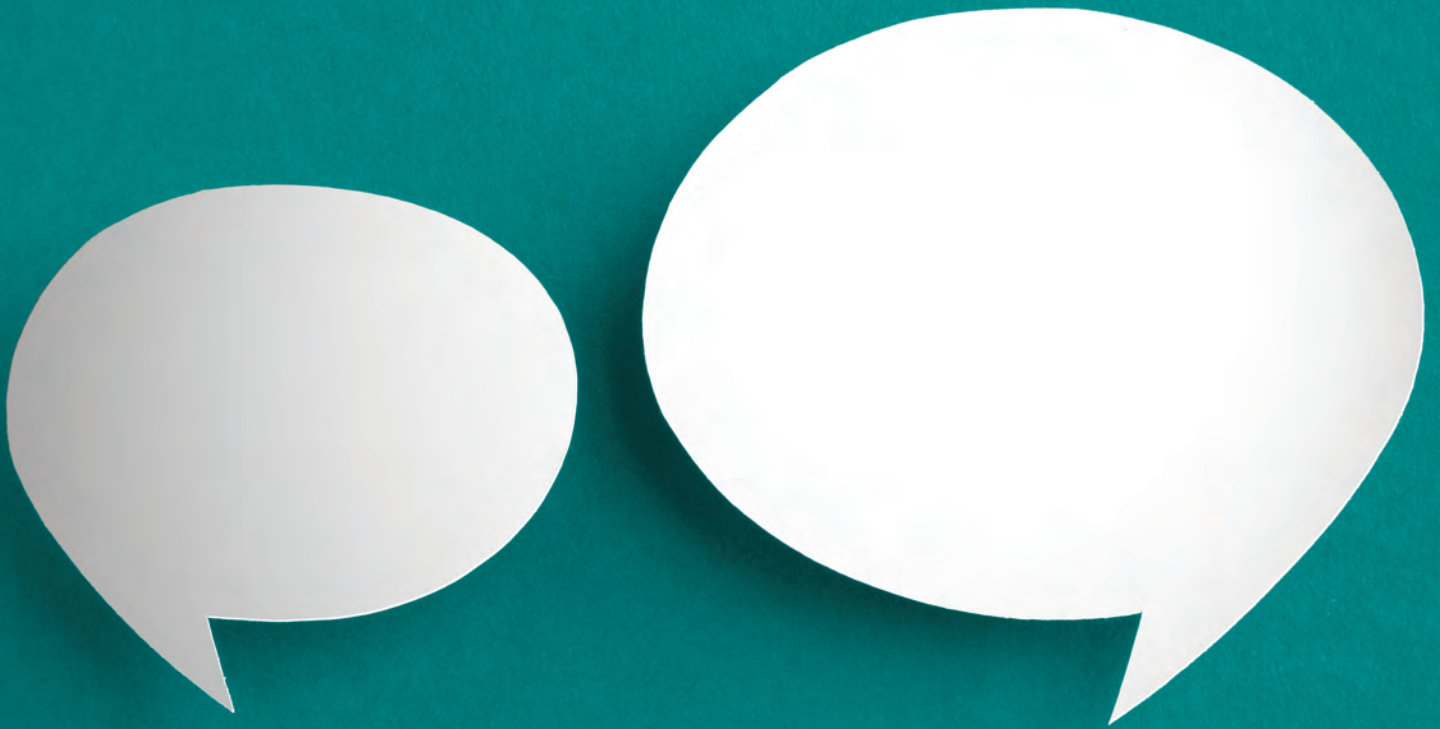


Hans Erik Mølager Christensen – foto: A.Frejberg

Together with Associate Professor Pernille Harris, DTU Chemistry, Trine Vendelboe and colleagues from the University of Oxford, the team also found that dopamine β -hydroxylase seems to function by a flip-flop mechanism, where one half of the enzyme carries out the enzymatic reaction, while the other half of the enzyme unloads the product (norepinephrine) and loads new substrate (dopamine). Then, the enzyme flip-flops and the function of the two halves of the enzyme are interchanged.

Further understanding of this potential flip-flop mechanism may provide new insights into the numerous disorders associated with dopamine.

Read more about Hans E M Christensen's research in Metalloprotein Chemistry.



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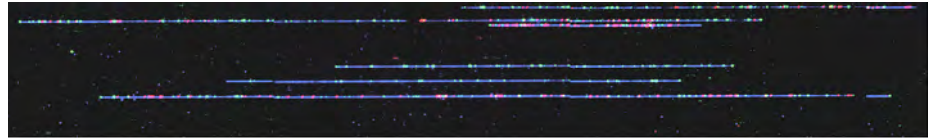
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Ebenstein lab develops new technologies for studying genomes

Researchers in the Ebenstein lab for nanobiophotonics at Tel Aviv University are using epigenetic marks to study genomic variation

Although the DNA sequence is identical in all the cells of our body, cells from different tissues look and function in a completely different form. Epigenetics is responsible for this. Epigenetic marks are small chemical modifications in DNA or to the proteins that wrap the DNA, and determine which genes should be turned on or off. The combination of our genes and our epigenetics is what makes us unique.

In the Ebenstein lab, we developed a method for labelling these epigenetic marks on the DNA by connecting fluorescent molecules to these marks. We also created a genetic barcode by labelling a specific sequence with a different fluorescent colour. This DNA is squeezed into nanochannels and visualised by a unique, powerful microscope. The result: stretched DNA fibres decorated with colourful spots, which resemble beads on a string. The genetic barcodes guide us to the genomic location of the DNA molecules, and the epigenetic marks can then be mapped to the human genome. By comparing hundreds, or thousands, of molecules to each other and to the expected locations of these genomic regions, we can study genomic variation – specifically the differences between individual cells – and perhaps track down unique cell populations with distinct genetic and epigenetic properties, like cancer cells. We can also study the mechanisms that control turning genes on or off.



Epigenetic marks are altered during the development and progress of some diseases, including cancer. In different blood cancer types, the level of the epigenetic mark 5hmC in blood cells is reduced dramatically. Therefore it can potentially serve as a biomarker for diagnosis and monitoring of the disease. Due to the extremely low levels of this mark in the blood, it has been extremely challenging to measure its level. We have developed an ultra-sensitive method for measuring 5hmC levels in the blood. Using our labelling and visualisation approach, we can detect even a single 5hmC site along a single DNA molecule. Preliminary results measuring the 5hmC levels in the blood of cancer patients compared to healthy individuals show about a 30% reduction of the mark in cancer. This implies that measuring 5hmC levels in the blood may help detect and diagnose a disease. We are now working on collecting more data and establishing this method, in addition to adapting this diagnosis tool to other diseases.

Tsilil Gabrieli, PhD student

My aim is to establish new methods that will open up a better view of our genome. By combining optical methods and biological enzymes that came from different bacteria and phages,

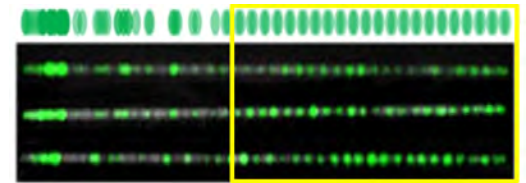
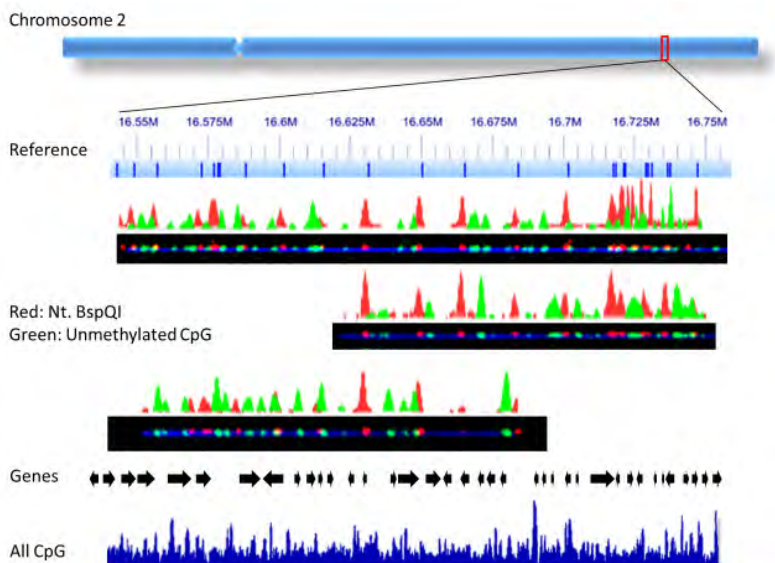
we are able to fluorescently tag specific features in the human genome and epigenome. Our epigenome is considered as the level “above” the genome; it is heritable but also affected by the environment – diet, smoking and even memory – and it is known to change in cancer cells. It affects our development and the pattern of gene expression in each of our cells.

Another exciting field I’m working on is a method we recently developed, “CaTCh”, in which we target and isolate long DNA segments (1kb-1000kb) by cas9-endonuclease digestion. By combining our epigenetic-labelling methods and CaTCh in larger genomes, as in plants, animals and humans, we are able to study population variation in large genomic regions, that may be differentially marked by epigenetic modifications. As presented in the figure, we are able to specifically detect those genomic features – in red the genetic profile and in green the epigenetic profile.

Dima Torchinsky, PhD student

In our research we develop a technique to highlight specific types of DNA damage which we detect by optical means. DNA damage occurs spontaneously and causes degradation of the genetic content of the cells,

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called D4Z4, which lies on chromosome 4 and tends to repeat itself in many copies. In the upper part of the picture you can see a reference map, simulating the relative expected locations of labels (highlighted in green) generated by the M.TaqI along part of chromosome 4 containing the pathogenic D4Z4 repeat array. Below it are images of three DNA molecules labelled with M.TaqI, aligned to each other and to the reference map. M.TaqI generates one visible label per each repeat unit, and thus counting the number of equally spaced labels allows quantification of the repeats, and diagnosis of FSHD. The repetitive region (highlighted in yellow) can be distinguished by virtue of the equally spaced labels in the images that match the size of the repetitive gene unit.

which is being associated with various medical conditions and the risks of developing different illnesses. Using naturally-occurring enzymes that are responsible for repairing damaged DNA in living organisms, and tricking them to use fluorescent labels in the repair process, results in fluorescent tags on the DNA at each damaged site. When imaged, the DNA appears as elongated lines, and the damage sites as dots along the contour. By counting the number of dots and dividing it by the total length of sampled DNA, we receive a ratio which represents the amount of damage in the sample.

Assaf Grunwald, senior PhD student

M.TaqI is an enzyme that in nature transfers a methyl group from a co-factor called "AdoMet" onto its specific DNA recognition sequence (TCGA). I manipulate this enzyme by giving it a synthetic co-factor, so that instead of transferring the methyl group, a fluorescent molecule is being covalently incorporated by the enzymes to the same recognition sites. Stretching the DNA into a linear

form and imaging it with fluorescence microscopy, results in light emission from the incorporated tags. Since the patterns of the tags are dictated by the DNA sequence, it can be used as identification for different organisms such as viruses and bacteria.

One interesting feature of the enzyme, which was discovered during my work, is that the enzyme is sensitive upon methylation of the cytosine base (C) that lies within its recognition sequence. Meaning that if a label is detected, then the site is not-methylated (an absence of labels indicates methylation). Since methylation of CG sites is a significant epigenetic mechanism in humans, responsible for gene regulation and disease, this labelling technique can provide important information regarding the epigenetic state of the cell.

A representative example to demonstrate how M.TaqI-resulted pattern can be used to gain important data: FSHD is the third most common muscular dystrophy. The genetic reason for this disease is a reduction in the number of repeats of a pacific gene

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Germany's High-Tech Strategy 2020: Setting the stage

Federal Research Minister Johanna Wanka highlights the strengths of Germany's High-Tech Strategy to Adjacent Government...

Germany is one of the world's smaller countries in terms of population size and yet we are the fourth largest industrial nation. This high ranking in global competition would not be possible without future-oriented research funding, a passion for innovation and good education.

However, Germany is not resting on its laurels. We launched our High-Tech Strategy to stimulate the whole of the innovation process – from creative ideas right through to their translation into new products and services. Strong links between science, industry, research and society provide the basis for this effort. In this way, we are creating opportunities and jobs for the future. We have learnt that focusing on individual technologies such as nanotechnology is not always the ideal approach.

Today we are looking ahead to what will be important for people in the future. We are thus pursuing a much broader approach which involves all the relevant stakeholders. New ideas thrive on lively interaction between researchers, industry and society. At the same time, we are pooling forces within the German government. Today, the Economics and Research Ministries no longer support individual ideas separately, but work together to a greater extent. We are developing joint objectives and steps towards implementation.

Spending targets already being met

Germany spends almost 3% of GDP on research and development and has already reached the target which Europe set itself for 2020. Two thirds of the overall expenditure of roughly €90 billion has come from industry. We use government funding to achieve the best possible leverage with research activities and investments. The High-Tech Strategy is the Federal Government's key instrument in this context and is

attracting increasing international attention. Awareness is growing that education and research have enjoyed high priority under Angela Merkel's chancellorship and that a great deal has been achieved in Germany with the additional money provided.

Supporting research and innovation requires constant adaptation. Looking to the future and encouraging potential developments at an early stage is a permanent task for us. This also means that we have to keep checking whether our funding instruments are still up to date. Which of them have proven their worth and should be strengthened? Which are outdated? In this context there must be scope to experiment and try out new ideas. We successfully established the Research Campus project, a new form of cooperation between companies and researchers. The Leichtbau-Campus in Wolfsburg, for example, is developing technologies for the large-scale production of hybrid lightweight components for the motor industry. We are providing funding for this development at a very early stage because resource-conserving lightweight construction has clear advantages, regardless of the type of drive technology used in future.

Coordinating national centres of excellence

People are benefiting from the quicker application of research results. For example, at the German Cancer Research Center (DKFZ), it coordinates a national network of excellent research institutions, which enables researchers to cooperate and share their findings while still competing with each other. This produces tangible progress in cancer research. We are funding 6 such health research centres which work on major common diseases. Another example is our "City of the Future" project: It involves people in 51 cities discussing their ideas about future urban life with policy-makers and researchers. The best ideas will be tested in practice starting in 2018.



Image: © Presse- und Informationsamt der Bundesregierung

Federal Research Minister Johanna Wanka

People today want to become more strongly involved. The High-Tech Strategy enables us to respond to this trend. Investigation and innovation are not only thriving in the scientific community. Everyone can contribute to research, for example by participating in citizen science projects. Participation is easy in today's digital world, using smartphones in particular. People can thus take pictures of insects which help researchers study the spread of species.

“We have learnt that focusing on individual technologies such as nanotechnology is not always the ideal approach. Today we are looking ahead to what will be important for people in the future.”

Germany's High-Tech Strategy is trend-setting

Overall, our High-Tech Strategy has clearly set the stage for science in Germany. Our efforts have been trend-setting, for example Industrie 4.0, is a concept which is now being discussed around the world. We are currently proceeding to ensure the large-scale implementation of this concept, particularly in SMEs. This is important because small and medium-sized enterprises are the

backbone of the German economy, but are often still reluctant to employ sensors to connect their equipment and products to a digital network. Data security and data sovereignty must be guaranteed. Fraunhofer is actively engaged in this effort and is developing the Industrial Data Space (IDS).

Microelectronics is another key technology in the digital economy. Three out of 4 smartphones use sensor technology made in Germany. In fact, Germany is the world leader in this field. Dresden is Europe's largest chip manufacturing site. In future, we will be providing massive support for microelectronics under the High-Tech Strategy. In this way, we are creating the conditions which enable us to remain one of the world's knowledge leaders. ■

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Johanna Wanka

Federal Minister of Education and Research

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Lighting up future materials and devices

Stefan Hecht, Professor of Organic Chemistry and Functional Materials at Humboldt-Universität zu Berlin, outlines how light-based technologies will spark innovation in material science and nanotechnology...

The emergence of life and our existence is inevitably bound to the sun as the prime energy source for our planet. Photosynthesis provides the basis for the continuous production of biomass, which has been converted over the course of a long time into fossil fuels that mankind is burning in a historically rather short time. Besides serving as the energy source, light is the ideal means to transfer, process, and store information. This is due to the fact that the speed of light is unparalleled and the achievable resolution, both in time and space, and is superior to other physical and chemical stimuli.

Technological breakthroughs, such as the advent of photography and photolithography – the mother of all current computer chips – as well as optical data storage media, photonic devices, and high-precision instruments, are clearly linked to the development of modern light sources and optics. If one considers, for example only the most recently awarded Nobel prizes, light can be considered as the central theme – from the realisation of light-emitting diodes, to the development of super-resolution microscopy and the creation of light-driven molecular machines. Without doubt, light plays a key role in today's science and technology and will continue to impact future research and applica-

tions. This has also been realised and advocated by UNESCO in their 2015 "Year of Light and Light-based Technologies".

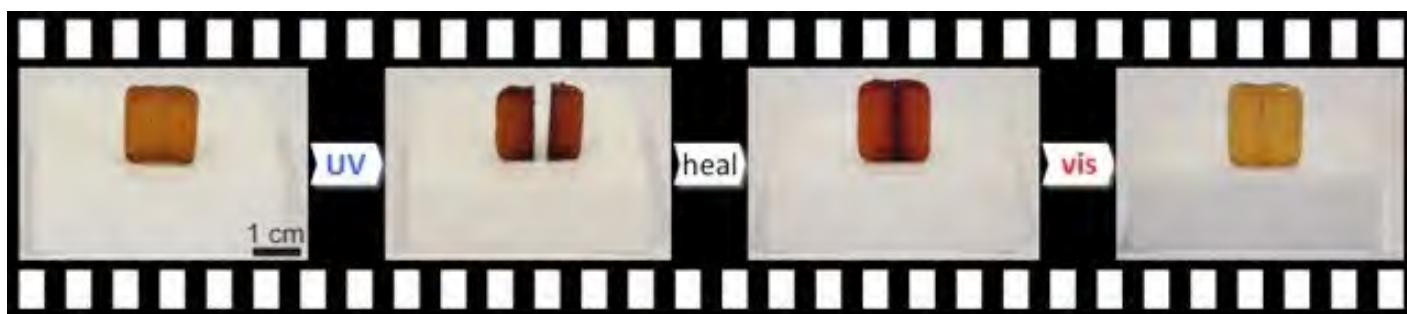
"Our work primarily involves fundamental research on designing, understanding and optimising these photoswitches. For example, we have significantly improved light-induced switching by rendering it more efficient and very reliable."

Light as remote control

Convinced of the importance of light as a driver for future innovation in materials research, our Laboratory of Organic Chemistry and Functional Materials at Humboldt-Universität zu Berlin is developing new methods to remotely, yet precisely, control materials' properties and device function with light. Within the framework of the "Light4Function" Project, funded by the European Research Council, our team is investigating the use of light as a trigger to control where and when chemical reactions and physical processes take place. Over the past decade, we have acquired unique expertise in the design of photoswitchable molecules and their use in functional systems. In analogy to Robert Louis Stevenson's famous novel, photoswitches adopt two distinct forms, which can behave very differently, similar to Dr Jekyll and Mr Hyde.

The unique feature is that they can readily be interconverted by light and hence, they are a great tool to exploit.

Our work primarily involves fundamental research on designing, understanding and optimising these photoswitches. For example, we have significantly improved light-induced switching by rendering it more efficient and very reliable. The robustness of the switching process is particularly relevant in optical devices that require many switching operations without failure. In addition, we have developed various approaches to operate our switches using long-wavelength visible light. This aspect is important in the context of emerging light-induced therapies, particularly photopharmacology, since red light can more deeply penetrate tissue. Beyond investigating photoswitches and unravelling the underlying relationship between their chemical structure and light-induced switching behaviour, our team is going one step further by putting our molecules to use. Being chemists, it is not surprising that we started by trying to control chemical connections – in other words, the process of bond-making. Just recently, we have reported on polymeric materials that allow for damage healing, as well as reversible glueing simply by exposure to (sun)light (see Figure). In addition to controlling chemistry with light, we



could integrate our photoswitches into organic the thin film transistors, which are at the heart of electronic devices like mobile phones and computers. In a fruitful collaboration with Professor Paolo Samori at the University of Strasbourg we fabricated flexible and light-weight optical memories with high storage density, low volatility (little data loss over time), and fast response. As a result, we can turn the transistor on and off at the speed of light.

Whereas typically the photoswitch serves to control chemical reactions, such as bond formation, or physical processes, such as charge transport, we are convinced that the energy stored in the photoswitch after light exposure can also be harvested to power the system. Using this concept, one could tap the energy of the sun and directly convert it to motion without the need for intermediate fuels or electricity. The main scientific challenge in this context is to translate light-induced molecular changes into macroscopic movements. Based on our team's work on new photo-switches, which efficiently change their shape under sunlight, and in collaboration with colleagues from the Technical University Eindhoven in the Netherlands, we have incorporated these molecules into a special plastic film. In this film, the photo-switching molecules are nicely aligned and hence they all change their shape and work in concert. When exposed

to sunlight, these films start to bend up and down; this oscillatory motion could be used to propel dust from a surface, thereby providing self-cleaning coatings for windows or solar cells, for example.

“Whereas typically the photoswitch serves to control chemical reactions, such as bond formation, or physical processes, such as charge transport, we are convinced that the energy stored in the photoswitch after light exposure can also be harvested to power the system. Using this concept, one could tap the energy of the sun and directly convert it to motion without the need for intermediate fuels or electricity.”

Exploring applications

At this point I want to emphasise that we always need to tailor our photo-switches for their intended application. It is similar to constructing a house, for which you naturally would want to use the best building blocks – it's the design of these building blocks from which our creative power and innovation emerges. Aware of the wider potential of our research on photoswitchable molecules, I am keen to explore applications beyond academia.

Areas in which control over where and when (bio)chemical and physical processes take place offer significant potential. These include light-controlled therapy coupled to diagnostics

(or theranostics), and advanced sensing of various (bio)analytes, as well as the aforementioned applications in remote-controlled smart materials and devices. My team and I are convinced that photoswitchable molecular systems will enable a major innovation push and future breakthroughs in material and device technologies.



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Ten years in systems biology research at BioQuant

Heidelberg University describes 10 years of successful systems biology research and education at their BioQuant Center...

Systems biology research facilitates the discovery of yet unknown principles of complex biological systems, by connecting the experimental life sciences with mathematics, bioinformatics, engineering and computation. Quantitative experimental data are translated into mathematical models in order to simulate the respective biological processes in silico. The approach aims to achieve a holistic picture of biological systems and will eventually become indispensable for biomedical research and bioengineering in the future.

In spring 2007, the BioQuant Center was established as an interdisciplinary research centre at Heidelberg University, solely dedicated to research and training in systems biology. At that time, BioQuant was the first centre of its kind for systems biology in Germany.

In the meantime, BioQuant has evolved into an internationally visible systems biology hub on the Heidelberg research campus and represents a successful platform for the development and constant refinement of mathematical models of complex biological systems, as well as for the swift validation of scientific hypotheses via experimental data.

Describing complex biological systems

BioQuant's remarkable architecture ideally promotes scientific communication and interdisciplinary research at

the interface between mathematics, experimental life sciences, and technology development. Currently, 30 theoretical and experimental research groups are affiliated with the Center. Among them are many international renowned scientists from Heidelberg University and the German Cancer Research Center, who are aiming for the quantitative and comprehensive description of complex biological systems.

Since its inauguration in 2007, BioQuant has been successfully involved in several local, federal and European funding programmes in systems biology and systems medicine (e.g. FORSYS, e:Bio, e:Med, Virtual Liver, MedSys, SysTec, SysMo, etc., as well as several EU FP7 integrated projects). Principal investigators at BioQuant are highly acknowledged by international evaluation panels as coordinators of these research consortia on systems biology.

In addition, the excellence cluster CellNetworks, funded by the German Excellence Initiative, is affiliated with the centre and has tremendously supported BioQuant's interdisciplinary research activities since 2007.

Especially noteworthy is the Center for Modeling and Simulation in the Biosciences (BioMS), which focuses particularly on the support and training of young investigators in systems biology. With support from the state of Baden-



Württemberg and the Klaus Tschira Foundation, Heidelberg University together with several local non-university research partners pioneered the setting up of the first local systems biology initiative in Germany in the year 2004. With the inauguration of BioQuant in 2007, BioMS has become one of the research programmes at the centre.

Systems biology research needs large data sets

Over time, BioQuant has created an internationally visible research community in the field of systems biology, studying various cellular processes, such as gene regulation and epigenetics, signal transduction, cell architecture, virus host cell interactions, immunity, cancer biology, and cell adhesion and mechanics.

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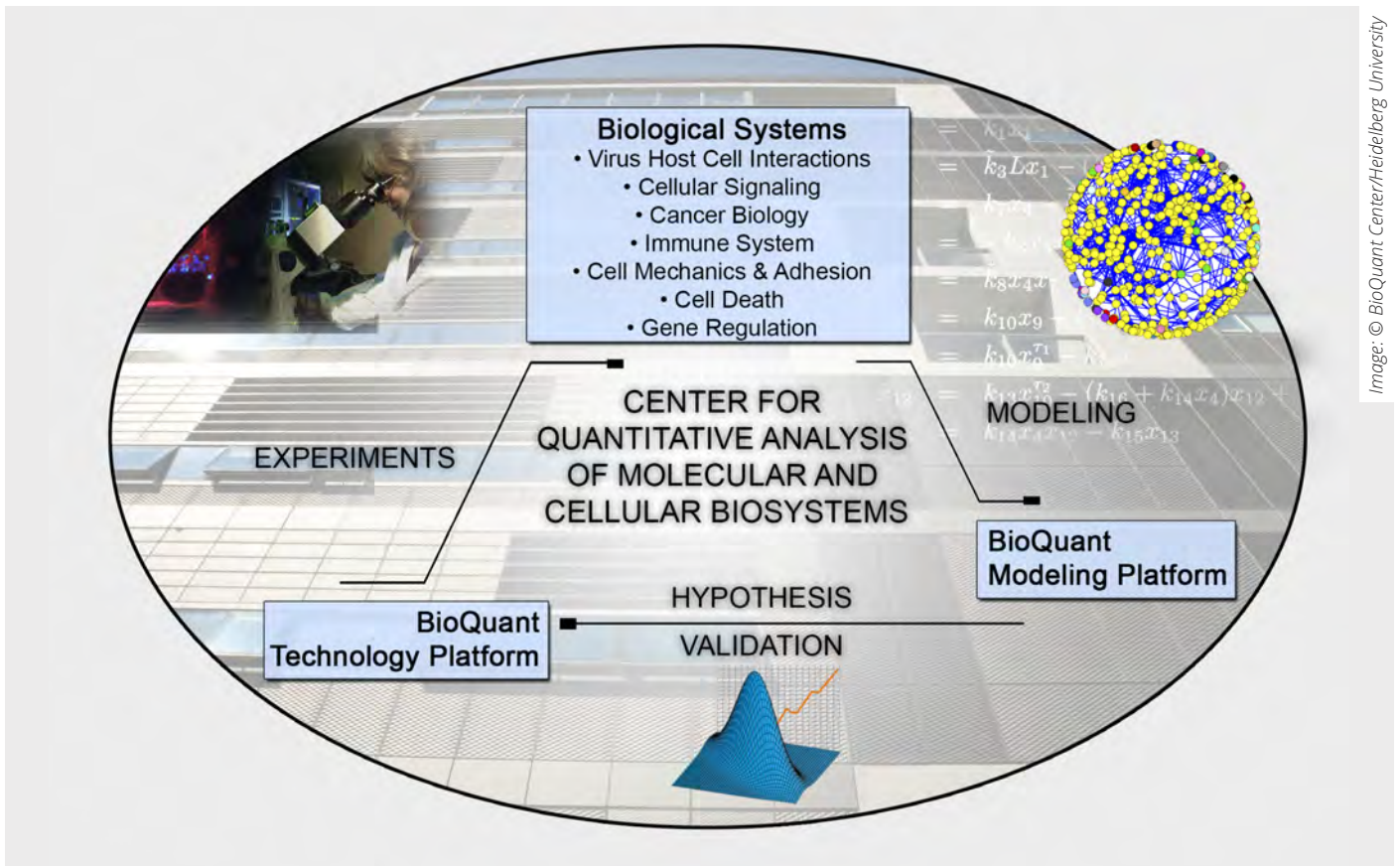


Image: © BioQuant Center/Heidelberg University

Systems biology requires large and complex data sets of biological processes, preferably resolved in space and time. Here, BioQuant hosts advanced imaging technologies together with extensive IT capacity for the analysis, processing, and management of large-scale data sets.

We have established a number of technology platforms for systematic functional and quantitative live cell imaging, as well as genome-wide screening approaches that are rarely found elsewhere.

The imaging systems range from high and ultrahigh resolution microscopy (dSTORM, STED, light shed microscopy among others) to cryo-electron microscopy, which combines the latest cryo molecular images with physical phase plates. Furthermore, the NIKON Imaging Center and the Hamamatsu TIGA (tissue imaging and analysis) Center are both integral parts of BioQuant.

Unique opportunities in research and education

Interdisciplinary training is essential for successful systems biology research. In the context of the BioQuant Center, a highly interdisciplinary major curriculum for systems biology has been established as part of the international master's programme in Molecular Biosciences at Heidelberg University. It covers fundamental topics in bioinformatics, computational analysis, network reconstruction and dynamic pathway analysis, as well as multi-scale modelling.

Since 2008, BioQuant undergraduate student teams have successfully participated in the international iGEM competition for synthetic biology at MIT (e.g. grand prize winner in 2013 and 2014). Most recently, the research training group "Mathematical Modelling for Quantitative Biosciences" has been launched at BioQuant, which offers a structured curriculum in systems biology at the PhD level.

For 10 years the BioQuant Center has offered unique opportunities in systems biology research and education. It is committed to continue its successful programme in order to advance systems biology approaches to cellular processes in the context of tissue and heterogeneous cell populations.

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Engineering workflow: Challenges and methods for improvement

Prof Dr Alexander Fay, Head of the Automation Technology Institute at HSU Hamburg, describes how methods, models and tools can support engineering workflow...

The engineering of huge and complex technical systems, such as buildings, production, transportation and energy systems, requires the coordinated contributions of different crafts and organisations over a period of several months or even years. The envisaged systems are usually one-of-a-kind, and the design and implementation has to be right first time, as the schedules and budgets do not allow expensive iterations. Such engineering projects tend to miss their deadline for several reasons, especially:

- Inefficiency during the execution of single engineering tasks;
- Loss of (a) time and (b) information at the handover from one craft to the next.

At the Automation Technology Institute at Helmut Schmidt University, Hamburg, Germany, a set of methods has been developed to cope with

these challenges. These methods have been developed in cooperation with industrial partners, from SMEs to global market leaders in automation, and have been successfully transferred into industrial practice. In the below sections, some of these methods are outlined. In addition, during operation, maintenance and modernisation of complex systems, the need for manual retrieval of engineering information increases costs and impairs quality, and scientific methods can also be of advantage here, as pointed out in section 3.

Methods to increase engineering efficiency

Engineering involves creative development of new ideas, but also the careful execution of repetitive tasks, such as the selection of suitable system components and their specification and configuration, according to given requirements¹. The latter can be supported by knowledge based methods² and design patterns³. Based

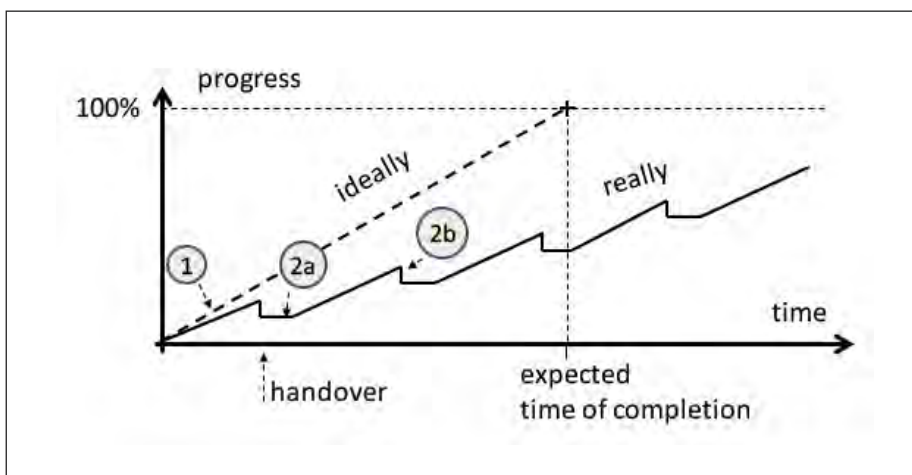
on a formal specification, e.g. GRAFCET (IEC60848), software code can be generated automatically to safely run the system⁴. Semantic Web Technologies have recently successfully conveyed engineering knowledge^{1,5}. The systematic re-use of proven solutions can speed up engineering⁶. Model-based approaches provide support in the time-critical phase of system commissioning^{7,8}.

a) and b): Methods to ease the seamless handover to avoid the loss of (a) time and (b) information

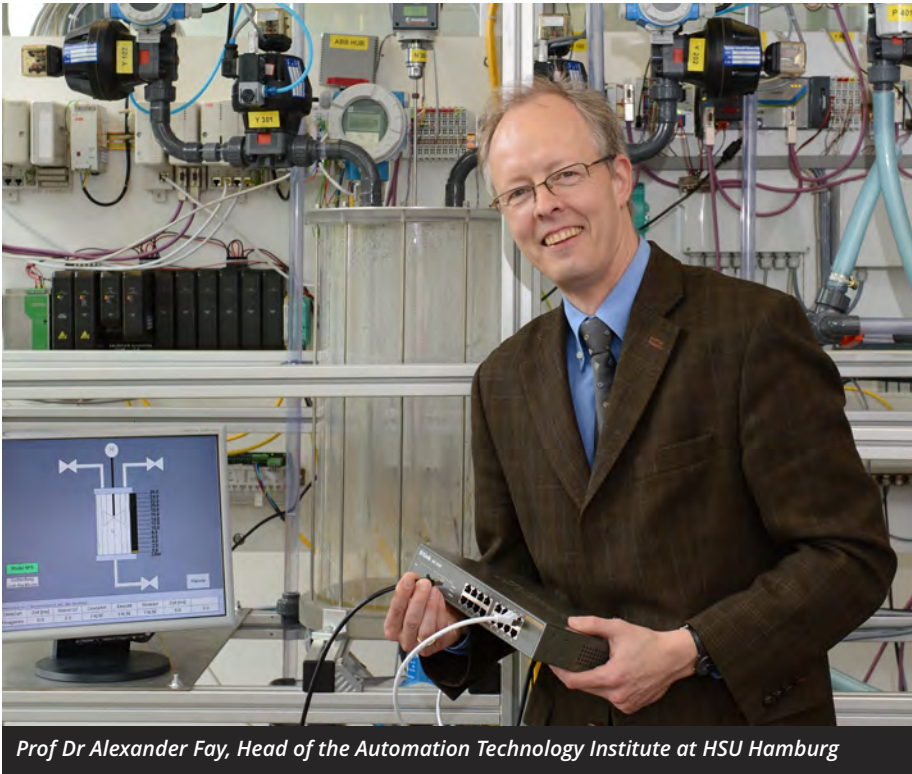
We foster the use of the meta-model concept of IEC62424 which supports interdisciplinary information collection and transfer in engineering projects⁹. Our industrial partners have applied this successfully to the automatic generation of simulation models¹⁰, for the integration of process modules into the process control system¹¹, and throughout the complete engineering process of a building automation system¹².

Methods to retrieve information from earlier engineering phases

Engineering documents hold valuable information to support engineering tasks during operation, maintenance, and modernisation, but to retrieve the information manually is cumbersome. We have developed methods to automatically retrieve such information from scanned and vector-graphic-



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Prof Dr Alexander Fay, Head of the Automation Technology Institute at HSN Hamburg

based PDF documents¹³, from legacy control system information¹⁴, or from monitoring the behaviour of a system to create a discrete-event model of it¹⁵. Information models, according to IEC62424, can ideally serve to hold the system's structure and can be exploited e.g. to group and filter alarms, during plant operation¹⁶.

Though several methods have been developed, and model-based engineering has made significant progress during the last few years, there are still further challenges for the engineering of complex technical systems, especially regarding the software that controls these systems¹⁷⁻¹⁸. A combination and further development of methods from systems engineering, software engineering, artificial intelligence and related disciplines offers promising improvements, as is currently being explored in the framework of the "Industry 4.0" initiative to cope with increasing flexibility demands¹⁹. In the future, we intend to continue to collaborate with companies and research institutes, and establish new research

connections for joint research on the challenges of engineering.

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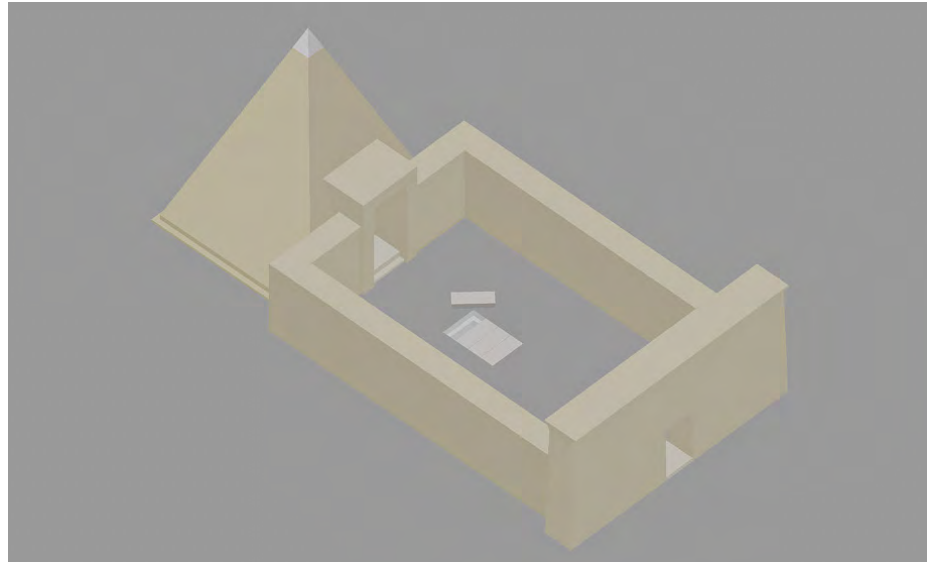
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Death on the Nile: Burials on Sai Island

Professor Julia Budka considers the potential of funerary archaeology for reconstructing life in New Kingdom Nubia, particularly on Sai Island

A well preserved Pharaonic settlement like Sai Island offers rich data of various quality and character to recreate a snapshot of everyday life in New Kingdom Upper Nubia (c. 1539–1077 BC). Most importantly, not only the town of Sai is exceptionally well preserved, but in addition, several cemeteries of the New Kingdom period are located close by. Combining data from settlement and funerary archaeology has much potential, not only for reconstructing daily life, health and diet, but especially for understanding the ancient population, which is one of the main goals of the European Research Council (ERC) AcrossBorders project for Sai. In addition to the analysis of finds and architecture from the settlement, the mortuary evidence helps investigating the coexistence of Egyptians and Nubians on the island.

The location of Sai in a territory of strategic value with changing boundaries and alternating ruling powers in the Second Millennium BC (Egypt and Nubia) allows for the addressing of questions of ancient lives across borders and cultures. In general, there is still no common understanding regarding the social interconnections and power hierarchies of Egyptians and Nubians in Egyptian towns in Upper Nubia like Sai. Entanglement, mixture and appropriation are currently thought to be highly relevant to understand the occupants and their complex identities.



Following the Sai Island example

Archaeological studies dealing with ethnicity, groups and identity have markedly increased in recent decades, reflecting the general popularity of these issues and current social debates. Theoretical models and the terminology used in archaeology were largely absorbed from sociology and anthropology, but in many cases the archaeological evidence provides no clues on essential questions like the self-determination of individuals. At neighbouring sites of Sai, for example Tombos and Amara West, studies of biological identities of New Kingdom people buried there were carried out recently (see Buzon 2008, Binder and Spencer 2014).

On Sai itself, the major New Kingdom cemetery SAC5 lies approximately 800m south of the Pharaonic town

and was partly excavated by a French Mission. Some of the owners of the Pharaonic style tombs with rock-cut chambers, mud-brick chapels and mostly pyramidal superstructures are known by name thanks to inscriptions on funerary objects. These persons bear administrative or religious titles and appear to be Egyptians and/or Egyptianised Nubians.

The funerary equipment is of classic New Kingdom style and comparable with finds from other contemporary Nubian sites (e.g. Aniba, Tombos). Nevertheless, possible processes of adaptation and/or appropriation of the people buried in the New Kingdom tombs on Sai still need to be assessed. The ERC AcrossBorders project is therefore currently investigating whether projected images of the identity of the occupants of Sai differ, or are consistent in life and death.



AcrossBorders and Hornakht's pyramidion

In 2015, a new Egyptian-type shaft tomb was discovered by AcrossBorders in the elite cemetery SAC5. This burial monument, Tomb 26, probably once had a pyramidal superstructure. The pyramidion (a capstone for a small mudbrick pyramid) of a high official of the Egyptian administration of Dynasty 19 with the name Hornakht was discovered in the shaft.

It remains open as to whether Tomb 26 was actually built by Hornakht, but the pyramidion with his name and title clearly attests his near-by burial. The burial monument was investigated further in 2016; remains of more than 10 individuals were excavated in the burial chamber, accompanied by typical Egyptian-style burial items, like scarabs and stone vessels.

However, we still cannot say whether we are dealing with Egyptian or Nubian individuals – but they all seem to have had an Egyptian cultural identity or were at least buried in an Egyptian way. That this is not necessarily

reflecting the complete, complex picture of the past occupants of Sai may be illustrated by the example of Hornakht whose pyramidion was found in Tomb 26. According to textual data, he was likely to have been born in Nubia and probably belonged to a native community on Sai.

Completely Egyptianised by Dynasty 19, this family was on top of the local hierarchy and held the most important offices within the Egyptian administration. Consequently, as a high Egyptian official, Hornakht was buried in an Egyptian pyramid tomb, most likely with fully-Egyptianised burial equipment, which we still hope to partly recover in our currently ongoing 2017 season in Tomb 26.

The importance of studying material culture

Combining data from settlements and cemeteries promises a better understanding of past occupations and their cultural identities. The study of material culture and, here especially, of ceramics is of prime importance, as are the human remains themselves.

Scientific analyses of bones and dental tissue may represent additional tools to explore the origin of people and their migration along the Nile.

AcrossBorders is presently analysing the systematic variation in the isotopic composition of strontium in the environment of Sai, a method now widely used in archaeology, especially for tracing human and animal migration. The isotope map of the island will provide a basis for further interpretation of the autochthony or allochthony of the skeletal remains from Tomb 26.

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Ireland's Horizon 2020 funding target is on track

Ireland's Horizon 2020 performance target is on track to be met, and the country's commitment to the EU is strong, says Innovation Minister John Halligan...

Ireland has been investing assiduously in its national research and innovation capacity for almost two decades. As a consequence of this sustained investment, Ireland is now host to a vibrant research ecosystem that spans higher education, public research institutes and industry. The success of this strategy is reflected in Ireland's continual rise through the global scientific rankings to a position of 10th for overall quality of scientific research, based on citations per paper published. International research collaboration and, in particular, participation in the EU Framework Programmes for Research and Innovation (Horizon 2020) and its predecessors, has made an important contribution to our success.

In order to demonstrate Ireland's commitment to the EU framework programme, and to make the most of the opportunities available, in 2013 the government adopted a national strategy for participation in Horizon 2020. The strategy incorporates a target of securing €1.25 billion in competitive EU funding over the lifetime of the programme. This is an ambitious target as it will involve a doubling of Ireland's performance relative to the previous framework programme, FP7.

Ireland is a Horizon 2020 top performer

The most recent data reveal that Ireland won €336.6m in EU funding from Horizon 2020 between 2014 and September 2016. Higher Education Institutes accounted for 59% of the total and companies 31%. These results indicate that Ireland is on track to achieve its national target, based on the proportion of the overall Horizon 2020 budget committed to date.

Irish SMEs play a vital role in the growth of the Irish economy: They employ almost 70% of those engaged in business. Irish SMEs have enjoyed particular success in Horizon 2020 and have received over two-thirds of



**John Halligan,
Innovation Minister**

the funding that went to companies. Irish SMEs achieved the highest success rate in the SME Instrument in Horizon 2020 at 16%, compared to the EU average of 6%. See below for examples of SME success stories.

SME success stories in Horizon 2020

Eirecomposites has secured funding from the "Fast Track to Innovation" call for their POWDERBLADE project. POWDERBLADE aims to gain rapid market acceptance and take-up of an innovative materials technology involving carbon/glass fibres in powder epoxy for the production of larger wind-turbine blades (60+ metres). [See FloTEC project.](#)

[SirusXT](#) has secured €3m from the SME Instrument to bring their highly innovative soft X-ray tomography technology to market. This technology has applications in disease research and drug discovery and could reduce the cost of the microscope assembly by a factor of over 200.

[Fleming Medical](#), the [Tyndall National Institute](#) and the [Holst Centre/TNO](#) (Eindhoven) are collaborating in the ECSEL InForMed project to commercialise a smart dressing for wounds. The smart dressing, called 'DermaTrax', contains sensors that monitor conditions in a patient's wound, including its temperature, moisture and pH.



The importance of participation in Horizon 2020 extends far beyond the monetary rewards, particularly for a small, island nation. Horizon 2020 provides a mechanism for researchers and companies in Ireland to network and collaborate with the best researchers and leading companies across Europe.

“The success of this strategy is reflected in Ireland’s continual rise through the global scientific rankings to a position of 10th for overall quality of scientific research, based on citations per paper published.”

Important bilateral ties with the UK

Ireland and the UK also have strong bilateral research links and the government is keen to see a continuation of this relationship after the UK’s departure from the EU. In recent years, Irish research funding agencies, Science Foundation Ireland and the Health Research Board, have put in place a series of bilateral partnership agreements with leading UK research funders: The Biotechnology and Biological Sciences Research Council, the Royal Society and the Wellcome Trust.

These arrangements are independent of the EU and will help ensure future research ties between the two neighbours.

Participation in Horizon 2020 has increased the internationalisation of Ireland’s research and helped ensure that it is of world-class standard. These benefits have carried over to the enterprise sector where they drive the creation of high-quality, sustainable employment.

For these reasons and many others, Ireland remains steadfast in its commitment to the EU. ■

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John Halligan T.D.

Minister of State with Responsibility for Training, Skills and Innovation for Ireland

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DCU's new research centres reflect the university's enterprise engagement drive

Dublin City University established 10 new emerging research centres in 2016, all valuable vehicles for research and enterprise engagement

“**D**ublin City University (DCU) is a young and dynamic university which aims to have an impact on Irish society, not only by placing education, research and innovation at the hearth of its strategy, but also by ensuring that the knowledge generated by our students and staff is translated into tangible benefits.”

The University has a strong track record in a number of areas represented by established research centres. These centres are a vehicle for enterprise engagement, and numerous schemes involving co-funding between National Funding Agencies and enterprise have enabled fruitful collaboration and the translation of results. These centres perform research and innovation in the following areas: Information and communication technologies, biotechnology and healthcare technologies, novel materials and sustainability, innovation in services and processes, security, democracy and education.

During 2016, the University supported the establishment of 10 additional emerging research centres, both in natural sciences and engineering, as well as in humanities, social sciences, business and education. These centres aspire to become international leaders in areas of key societal importance, and a common denominator of these interdisciplinary hubs is their drive to engage with enterprise.



Water management and sustainable supply

The DCU Water Institute represents the efforts of nearly 30 Principal Investigators who collaborate to translate research into solutions for global water problems. “By 2020, The DCU Water Institute will be Ireland’s Centre of Excellence for the development of technical solutions for water management and sustainable water supply, and for contributions to water policy developments,” Centre Vision, Prof. Fiona Regan, Director of DCU Water Institute.

In 2016 Enterprise Ireland collaborated with the DCU Water Institute to set up the first national cluster of companies in the water space, with many collab-

orative projects already underway. The centre is currently collaborating with an international food manufacturing company, to discover sustainable, environmentally friendly and cost efficient ways of treating waste water in meat processing plants.

Technology solutions for the manufacturing industry

The DCU Advanced Processing Technology Research Centre (APT) focuses on providing solutions to companies in the areas of production technology, micro/nano systems, product design and sustainability, and advanced materials engineering. Members of the centre are a multidisciplinary group who collaborate on both fundamental and applied research, across busi-

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ness, materials processing, chemistry, biotechnology, and physical science, as well as being embedded in national and international collaborations with both industry and academia.

“By 2020 APT will be the national leader in providing processing technology solutions for the manufacturing industry in a variety of sectors. The Centre will continue to grow its international network in order to position APT as the go to entity for processing technology development and collaboration in Europe and internationally,” Centre Vision, Prof. Dermot Brabazon, Director of the DCU Advanced Processing Technology Research Centre.

The centre is currently collaborating with national, international and industry partners in the development of metal and polymer materials for additive manufacturing and advanced manufacturing technologies.

Supporting the Internet of Things

The [DCU Entwine Centre](#) focuses on the design of platforms to enable the scalable machine-to-machine communications required for the Internet of Things and its applications.

“By 2020, the DCU Entwine Centre will be recognised internationally by academia and industry as a leader in the design of the architectural framework to support the Internet of Things, and will have contributed significantly to standards development in this space,” Centre Vision, Dr. Martin Collier, Director of the Entwine Centre.

Researchers at the centre are coordinating an ambitious €6.5m funded project, which aims to redesign the future of technology enhanced learning. The project uses gamification,



multisensory and multimodal learning, interactive augmented reality teaching assistants and a virtual experimental fabrication lab to ensure students stay engaged on multiple levels. This technology has the potential to attract students to STEM education and improve access for students with disabilities.

Computational modelling and simulation

The [Advanced Research Computing Centre for Complex Systems Modeling](#) (ArcSym) focuses on the investigation of interdisciplinary and complex data-intensive problems that can be modelled computationally.

“By 2020 ARC-SYM (previously SCI-SYM) will become the go-to National Centre of Excellence in ‘research computing’ for a range of generic and specialised services, capabilities, and resources which are necessary for modelling, simulation and predictive analytics. These services will be complementary to those available in the hubs and existing research centres in this emerging, vital and to-date nationally unrecognised area. With

this centre, DCU will enhance its reputation nationally and internationally as a research-intensive University of Enterprise,” Centre Vision, Martin Crane, Director of ArcSym.

ArcSym members are working on the development of an Enterprise Architecture model for the city of Limerick that will enable the modelling, measurement, optimisation, control and monitoring of complex interdependent systems of urban life.

Advice and research on family business

DCU [Centre for Family Business](#) (CFB) was established in 2013 and is already a centre of excellence in the management and sustainability of Irish family business for future generations. The centre supports family business with leading management advice based on best industry practice and leads national and international research in the area of family business.

“The Centre will be the first research centre of excellence in the management and sustainability of Irish family business. We will support multi-generational Irish family businesses to grow and sustain opportunity for future generations, based on leading national and international research,” Centre Vision, Dr. Eric Clinton, Director of the DCU Centre for Family Business.

Over the past three years the DCU CFB has had a comprehensive engagement programme with over 1,500 family firms. In 2016, the centre won a prestigious research award from the Institute for Family Business (UK) and became a finalist in the US-Ireland Research Innovation Awards for the ground-breaking research on civic wealth creation in Irish and USA family firms.

The crossroads of society and law

Research at the [DCU Socio Legal Research Centre](#) interrogates the impact that law has on society and how society can impact upon the evolution of law. Their research is driven by the symbiotic relationship of society and law, as well as the synergies and creative capacity at moments of collision between them. The variety of research topics are linked by 5 core themes: Social justice, human rights, ethics, constitutionalism, and governance and regulation.

“By 2020, the DCU Socio-Legal Research Centre will be Ireland’s leading authority in investigating and studying the operation and effects of law on societal, economic and political environments. The DCU Socio-Legal Research Centre will be distinguished by its inter-disciplinary framework and legal research that contribute to transforming the lives of people for the better,” Centre Vision, Dr. Tanya Ni Mhuirthile, Director of the DCU Socio-Legal Research Centre.

In September 2016, the centre hosted the biennial Law and Society Interna-

tional Conference on the theme of “State Accountability for Vulnerability”. Current stakeholders engaged with the Centre including the Law Reform Commission of Ireland, the Department of Justice and Equality, and the Department of Communications, as well as the Citizen’s Assembly.

A European centre of ethics

The DCU [Institute of Ethics](#) (IOE) was established in September 2008 with the mission to create ethical awareness in relation to all fields of the university’s activities. It also aims to play a leading role in raising public awareness of, and stimulating debate about, ethical issues. In 2016 it was endorsed by the University as a leading research organisation.

“By 2020, the IOE will be recognised nationally and internationally as an important European centre of ethics, distinguished by its research activities and its focus on the translation of ethical theory into societal benefit. This increased recognition will be measurable in terms of increased engagement in funded research and increased output of international publications,” Centre Vision, Bert Gordjin, Director of the DCU Institute of Ethics.

The IOE satisfies an urgent societal need for ethical reflection on the analysis of emerging challenges in science, technology, healthcare, business, media and government. Ethical analysis of these challenges is necessary for the development of solid regulatory frameworks that can guarantee the responsible development of these arenas. More specifically, the IOE currently contributes to ethical analysis of challenges in:

- Cybersecurity;
- Personalisation technologies in ICT;
- Assistive technologies for people with autism, dementia and/or intellectual disabilities;
- Integrity of science and research; and
- End-of-life care.

Within the last couple of years, the Institute has succeeded in attracting research funding in excess of €1.2m, as well as being a partner of choice in H2020 projects by many academic and enterprise collaborators.

Centre of excellence in bullying research

The [National Anti-Bullying Research and Resource Centre](#) (ABC) was launched by the Irish Tánaiste and the Minister for Education & Skills in 2014, and endorsed by DCU as a leading research organisation in 2016. Researchers at ABC were the first in Ireland to undertake research on school, workplace, homophobic and cyber bullying. ABC leads the field of research, resource development and training in this area in Ireland and is an internationally recognised centre of excellence in bullying research.



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"By 2020, ABC will be the pre-eminent research centre in Europe for anti-bullying research, resource development and training," Centre Vision, Dr. James O'Higgins Norman, Director of ABC.

ABC has contributed to the development of the National Action Plan on Bullying (2013) and researchers at the centre are currently developing resources and training for use in bullying prevention and intervention in schools, workplaces and cyberbullying. In partnership with colleagues at the University of Stavanger in Norway, they have launched an on-line train-the-trainer module in bullying prevention and will start a Master's programme on bullying at DCU, in September 2017.

Educational quality and equity

The Centre for Evaluation Quality and Inspection (EQI) seeks to enhance quality and equity in educational systems.

"By 2020 EQI will be the leading national and international research agency for teacher professional development in the areas of culturally responsive school evaluation, quality assurance and inspection. This will be

achieved through the engagement and dissemination of high quality research, and innovative practice in the linked fields of evaluation and inspection," Centre Vision, Prof. Joe O'Hara, Co-Director of EQI.

In 2016 EQI created a 'Research Partner Network' in Ireland, dedicated to enhancing the capacity of schools to generate, use and communicate data relating to educational quality. There are currently 168 schools in the Republic of Ireland and 220 schools in Northern Ireland in this network.

Addressing the challenges facing news media

FUJO was established in 2015 to safeguard and advance the future of news media through research, training, and innovation. With wide-ranging industry partnerships and combined expertise in journalism, data science, engineering, political economy, and ethics, Fujo is uniquely placed among European institutes to take a leading role in responding to the challenges facing news media.

"By 2020, Fujo will be recognised as one of the leading international institutes

driving research, innovation, and training in digital media and journalism," Centre Vision, Dr. Jane Suiter, Director of Fujo.

Fujo is the Irish partner for the annual Oxford Reuters Digital News Report and is currently undertaking funded projects on non-linear video and hate speech on social media. Fujo has brought leading industry conferences to DCU – The News Impact Summit and GEN Editors' Lab – and is a founding member of the Google News Lab University Network.

In supporting these multidisciplinary centres the university aims at creating a future picture of DCU research activity that can address the economic and societal challenges that are of current concern to society and enterprise today.



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Irish Micro Mouldings: Breaking The Mould For Success

Irish Micro Mouldings are specialists in injection moulding, who have become key players in the Irish plastics industry...

Located just 20 minutes away from Galway City Centre, Irish Micro Mouldings (IMM), are one of the key players in Ireland's plastics industry. The company has been trading from Galway for just over 30 years and has been operating under the present owners for a little over 10 years. "Being so well established means that the management and the technical staff, our core team, is very solid. We have very little employee turnover and everyone is involved in the development of the business," explained Pat Whyte, Managing Director of Irish Micro Mouldings.

Strong Core Technical Team

"We have a very strong core technical team who are very passionate about what they do," said Pat, "Over the years the present staff have refined and improved the processes and structure. The people involved are very loyal to the area and to IMM and that is the main reason it is successful. The strong focus on having a design, tool room, cleanroom and quality marks, makes the difference."

The plastics industry is one that requires a strong workforce with highly skilled individuals; as a result of this many companies will work in tandem with local colleges and educational facilities. IMM are one such company who do this. They have a close working relationship with many training and educational institutions in particular 'First Polymer Training'.



This particular institute has been a very important resource to IMM as their core technologies are based on polymers/plastics.

"IMM are very fast at R & D and have ways to fast track development of new products."

"In the future we hope to see more interaction with the third level colleges and also hope to take on more practitioners and hands on people in polymer processing and toolmaking. We have just started an Innovation partnership with Professor Denis Dowling UCD on surface treatments of polymers."

Innovative Processes

IMM like to take a very 'hands on' approach to the products they develop. They are involved in all aspects of the process from design to prototype and then onto manufacture. "We produce

initially in small quantities and scale up to higher demand when needed. Because we do all the R & D we know the products very well and we are able to add value to the product and take out cost in the manufacturing process," said Pat.

They produce a low to medium volume of most of their products, approximately 100,000 per year. This is a typical volume for the medical device manufacturing industry. However they have also filled orders for as little as 20 parts and they also make a small number of their products in the million per year. Because of this variance they have to be both flexible and be adequately staffed. Their employees need to be highly trained and multi-skilled.

IMM use innovative processes in over-moulding, micro over-moulding, bio-absorbable and specialist tooling

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Part of Irish Micro Mouldings Cleanroom

and bonding techniques. They have their own R & D department, part and tool design, and mould and tool manufacture. According to Pat; "IMM are very fast at R & D and have ways to fast track development of new products. Our target market is: minimal invasive devices, cardiovascular, bio-absorbable and generally difficult things in this area."

At The Forefront of Technological Advancement

IMM are dedicated to remaining at the forefront of technological advancement in their industry. This is why they have been continually investing in the latest equipment for moulding and the tool room. "We have spent approximately three hundred thousand Euro on equipment in the last year as well building a new cleanroom," said Pat.

So what next for Irish Micro Mouldings? Currently they are consolidating their new clean room and they have already started on a new design and prototype centre office and new tool room. On this Pat said: "This is tied in with our plans to become a go to resource for the medical device and related industries for R & D in our area of expertise."

Sustainability, Lean And 5S

Lean manufacturing has become an important part of many manufacturing processes and IMM have been implementing it with some success. They have obtained some good results with lean and 5S, which is a workplace organisation method that describes how to organise a work space for efficiency and effectiveness by identifying and storing the items used, maintaining the area and items, and sustaining the new order. According to Pat, the implementation of lean and 5S is a constant journey.

"We have a very strong core technical team who are very passionate about what they do."

Another key element in many manufacturing processes is the practice of sustainability. It has become more and more important to many companies that they are actively minimizing the negative environmental impact that their manufacturing process has. It is also important to create their manufactured goods through economically sound processes while also conserving energy. IMM are working on their sustainability on a constant basis. "We work on sustainability all the time, and

are currently working on it at a very high level. This includes succession planning and putting in place structures and plans to keep IMM ahead of the curve. A company our size needs to be doing something different and better than anyone else. We have advantages due to our size but also challenges. As we spend a lot of resources on R & D we are safe guarding our future."



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Nanomaterials for energy storage: Powering our world

Nanomaterials offer significant advantages for energy storage applications, as Professor Valeria Nicolosi's research is demonstrating...

Energy storage will be more important in the future than at any time in history. Climate change and the decreasing availability of fossil fuels require society to move towards more sustainable and renewable resources. As a result, we are observing an increase in renewable energy production from sun and wind, as well as the development of electric vehicles or hybrid electric vehicles. Because the sun does not shine during the night, wind does not blow on demand and we all expect to drive our car with at least a few hours of autonomy, energy storage systems are starting to play a larger part in our lives.

Batteries and supercapacitors are two very complementary types of energy storage devices. The first stores energy electrochemically, whilst the latter electrostatically. Compared to batteries, supercapacitors have much longer lifetimes and cyclabilities (charging/discharging). Batteries so far have secured the biggest slice of the energy storage market, being able to deliver much higher energy densities; supercapacitors, on the other hand, hold one tenth of the electricity per unit of volume or weight, in comparison, but can achieve much higher power densities. This means that they can be charged and discharged extremely quickly. Together these are the power technologies of choice for consumer electronics, traction, automotive and industrial needs.

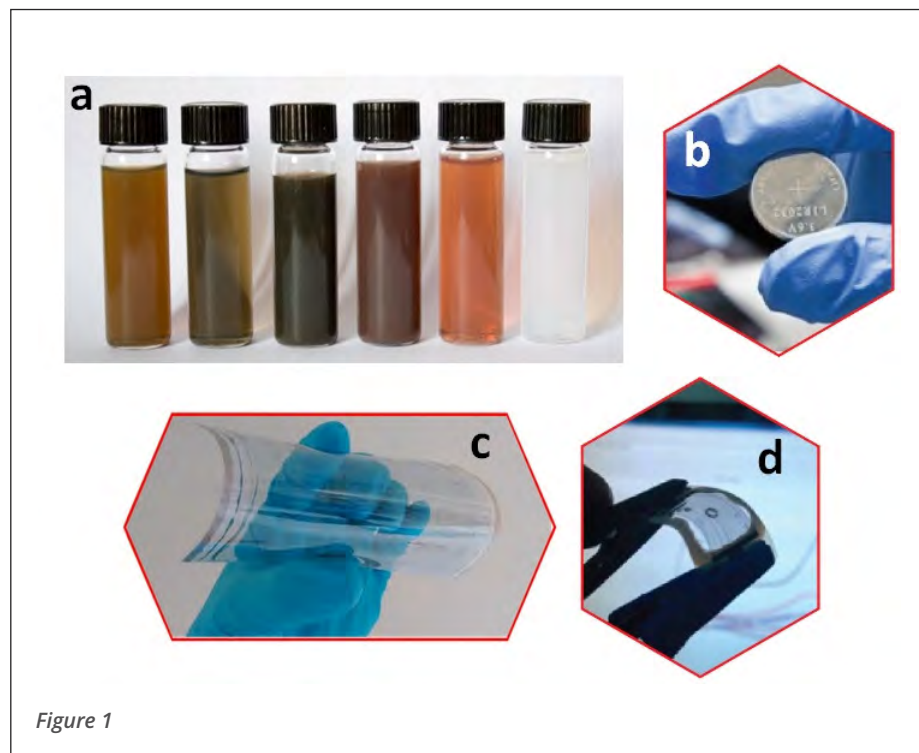


Figure 1

Apart from the mere optimisation of the parameters involved in the operation of these devices, one of the most crucial challenges that scientists are facing is the poor mechanical and thermal stability of the materials used in the current technologies. In fact, the accommodation of ionic species in the charging/discharging process is usually accompanied by enormous volume changes and structural failures in the host electrodes.

Nanomaterials for energy storage garnering more interest

To meet the ever-increasing requirements for such a variety of very demanding applications, Prof. Nicolosi at Trinity College Dublin is developing

new materials and chemistries to achieve higher energy density, higher power density, and longer lifetimes. Moving from classical bulk materials to nanoscale can in fact significantly change properties, and consequently the performance, when used in energy storage devices. Within this context, 2D nanomaterials have attracted considerable interest in the last few years, offering significant advantages towards more classical bulk materials.

While graphene is the most well-known 2D system, hundreds of other inorganic layered materials exist, all displaying a wide range of properties. These materials can commonly be exfoliated in liquids producing semi-

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Professor Valeria Nicolosi

Prof. Valeria Nicolosi is internationally regarded as a leading expert in the field of processing of low-dimensional nanostructures and high-end electron microscopy.

She received a BSc in Chemistry from the University of Catania (Italy) in 2001 and a Ph.D. in Physics in 2006 from Trinity College Dublin. In 2008 she moved to the University of Oxford with a Marie Curie IEF. She was

awarded a UK RAEng/EPSRC Fellowship later the same year. In 2012 she returned to Trinity College Dublin, becoming ERC Research Professor at the School of Chemistry and principal investigator in CRANN nanoscience centre. Today she is the Chair of Nanomaterials and Advanced Microscopy in Trinity College Dublin, she is a PI in the Science Foundation Ireland funded Advanced Materials and Bio-Engineering Research Centre (AMBER) and she is director of CRANN's Advanced Electron Microscopy.

To date, prof. Nicolosi has published more than 150 papers in high-profile international journals and delivered more than 90 invited/plenary presentations at major conferences/institutions/public events. Since her arrival to Ireland in 2012 she has been awarded more than €12 million of funding for her research.

She has won numerous awards: RDS/Intel Prize for Nanoscience 2012, World Economic Forum Young Scientist 2013 at the Meeting of New Champions in Dalian China, WMB Woman in

Technology Award 2013, SFI President of Ireland Young Researcher Award (PIYRA) 2014, Science Foundation Ireland Early Stage Researcher of the Year 2016.

To date Prof. Nicolosi has been awarded 5 European Research Council Awards, a Starting grant in 2011, a Consolidator grant in 2015 and 3 Proof-of-Concept grants in 2013, 2014 and 2016 respectively.



conducting, metallic and insulating inks, figure 1(a) that in turn are the building blocks for manufacturing a wide range of energy storage device typologies (classical coin-cell batteries (b) and ultra-thin, transparent, flexible supercapacitors produced by conventional roll-to-roll technologies (c) and by simple ink-jet printing (d)).

Most importantly 2D nano-sheets have offered the unique possibility of manufacturing conductive, tem-

perature resistant, robust, thin, easily assembled highly flexible and all-solid-state devices for the portable electronics industry. This opportunity is particularly relevant from the industrial point of view, especially in relation to the temperature at which these devices are usually exposed to in the application (-60°C-+120°C) and the flammability issues of the electrolytes used for commercial energy storage devices at present.



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Good news for transformative manufacturing

Transformative manufacturing and other areas will gain from the government's new industrial strategy, as Innovate UK's Simon Edmonds explains...

The support for business-led innovation announced by the Chancellor in the Autumn Statement was potentially game-changing. The national productivity investment fund will provide an additional £4.7bn by 2020-21 in R&D funding.

The new industrial strategy challenge fund in particular is a substantial increase in the amount of grant funding available to businesses through Innovate UK, which is very good news for businesses across all sectors developing transformative manufacturing and materials capabilities. It will also bring value and benefit to the UK economy where the UK ranks as the 9th largest producer in the world, representing 2.7 million jobs.

This significant increase in funding will mean that we can achieve even greater impact from our support for UK businesses. I am always pleasantly amazed at the sheer depth and variety of projects that Innovate UK

supports, and most importantly the impact they are generating on the economy and their sectors. Some firms have grown dramatically, or entered new markets. Some have attracted major new investment or floated their business.

Over the last year it has been a privilege to meet with many of these companies, and see the impact and results from our support.

At last September's Low Carbon Vehicles Show, the Industry and Climate Change Minister Nick Hurd MP unveiled Delta Motorsport's new low-cost micro-turbine technology that can help electric cars match petrol or diesel-powered equivalents for range. This was developed in a £3.1m collaborative R&D project, co-funded by the Office for Low Emission Vehicles (OLEV) and Innovate UK. Moreover, the Minister saw a large variety of Innovate UK funded projects on display at the event.

The Delta project demonstrates the potential for UK SMEs to develop game-changing new technologies in the low carbon vehicle sector. Another good example is our support for automotive manufacturer Jaguar Land Rover on their REALCAR project which enables lightweight automotive body structures to be built using aluminium sheet derived from lower cost, energy efficient, recycled sources. [The videos](#) we produced with JLR and its partners last year illustrate this project excellently.

These are just some of the 7,600 innovative companies Innovate UK has helped since 2007 to bring new ideas, products and services closer to market. We support businesses wanting to innovate in 2 main ways – by funding their ideas, and by connecting them.

Over the last year our approach evolved to provide, in each of our 4 sector groups, a single innovation funding stream with competitions which are much broader in scope than we have previously organised.

Our first manufacturing and materials competition of this type provided £25m in funding to UK manufacturers. Sixty four projects involving around 170 partners were successful in this competition. The quality of applications from manufacturers across the country was of exceptionally high standard, which shows the appetite of our businesses to innovate and grow.

The competition was particularly focused on helping SMEs in the manufacturing and materials supply chain, supporting them to scale up and become more productive.

Successful projects included:

- The Distributed Factory – developing a system for distributed manufacture of office furniture using manufacture-on-demand to enable local producers to compete with global competition;
- Medical Wireless Sensing Ltd – developing a metamaterial to enhance the signal from MRI scanners to speed up diagnostics or improve resolution;
- REALCAR 3 or the REALITY project – follow up to JLR's successful project mentioned above;

- West of England Textiles Ltd – development of a novel process to improve the quality and competitiveness of British woollen cloth. The aim is to increase the market share of British woollen cloth against imports.

Funding excellent projects like these is only part of what we do. We connect entrepreneurs, researchers, investors and our partners in government to help firms identify longer-term high value manufacturing and materials innovation and export opportunities. So we can help these businesses bring their ideas to market more quickly.

We also provide sources of expertise, equipment and investment for manufacturing innovation and commercialisation through the High Value Manufacturing Catapult – our world-class network of seven technology and innovation centres throughout the country.

We are also a key delivery partner; the government is heavily supporting automotive and aerospace research, development and technology through the following partners:

- [Office for Low Emission Vehicles \(OLEV\)](#);
- [Advanced Propulsion Centre \(APC\)](#);
- [Aerospace Technology Institute \(ATI\)](#);
- [Centre for Connected and Autonomous Vehicles \(CCAV\)](#).

Our aim is very clear: To enable UK businesses across all sectors to develop transformative manufacturing and materials capabilities that are flexible and resource efficient. This will ensure leading-edge products are manufacturing-ready and that the value of UK manufacturing and materials innovation benefits the UK economy. ■

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Simon Edmonds

Manufacturing and Materials Director

Innovate UK

www.gov.uk/government/organisations/innovate-uk

www.twitter.com/innovateuk

Accreditation: The SMaRT way forward in testing and academia

Specialising in accredited mechanical testing, SMaRT is building on its links with research, academia and industry from its Swansea base...

Swansea Materials Research & Testing Ltd (SMaRT Ltd) is a specialised supplier of mechanical test data to industry and academia. It was established in 2009 as a spin out company by Swansea University, and SMaRT's three staff initially focused on the aerospace industry in a small stand-alone facility outside Port Talbot. Today, the company has grown to encompass blue chip companies from the aerospace, power generation and petrochemicals industries, served by 12 staff from a new purpose-built facility at the heart of the new Swansea University Bay Campus, with a turnover of around £1m a year. It also has strong links with many other leading UK universities.

The concept behind SMaRT is to co-locate a commercial test house, specialising in bespoke testing of metallic and ceramic materials, alongside the Swansea University Institute of Structural Materials, who specialise in developing the understanding of mechanical behaviour. The aim is to achieve a holistic approach to the generation and interpretation of mechanical data.

The model is unique in the UK and is mutually beneficial for both parties, as Colin Small, Chief Operating Officer at SMaRT explains:

"The commercial test house draws on the co-located academic expertise to develop and mature novel test methods and techniques while also



providing the routine, robust testing required by our customers. At the same time, the academic team can carry out research supported by mechanical testing in an accredited environment. This makes the research data very valuable to their sponsors as it has a certified history and pedigree. In addition, there is also a route to transfer new test techniques directly from the research environment into the commercial setting, which benefits the sponsor as it reduces the cost and the time it takes to do this".

In addition to holding approval certificates from its main customers, SMaRT has been accredited against ISO17025:2005 General requirements for the competence of testing and calibration laboratories, which offers a range of tensile, creep, fatigue and

crack propagation testing methods. Outlining the importance of accreditation, Colin said:

"Customers regard ISO 17025 accreditation as a critical factor in placing mechanical testing – without it they would not use SMaRT. It assures them that the work is being carried out by competent staff to recognised standards and that there is an effective quality and management system to manage, report and deliver the results in a timely and cost effective manner. Accreditation also generates confidence in the customer that the novel, bespoke forms of testing we design and perform are subject to the same overall quality system."

Accreditation is an absolute must

In addition to being 'business critical',

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the recognition and reputation offered by accreditation has been invaluable in developing both new customers and testing areas.

"Our major customers demand that we hold the appropriate ISO 17025 accreditation, so without it, we would not gain their business," Colin explains. "It has opened doors to new customers, who have found us while searching for test facilities that can perform a test type to accredited standards. Similarly, it has opened new opportunities with existing customers, since it is not unusual to find that there are other, more bespoke or unusual tests, that they are interested in and that SMaRT is uniquely placed to help design. Our accreditation means that there is a recognised system for development of novel test types from initial idea through to commercial implementation which again gives the customer confidence that what is required can be controlled and delivered."

ISO17025 accreditation is a continuous and robust assessment process that operates over a four-year cycle. The process starts with the existing company quality and management system. Once this is in place the accreditation process can start by approaching the accreditation body, in the UK this is the United Kingdom Accreditation Service (UKAS). After a pre-assessment visit, to help get the quality and management systems into the right form, the process starts with an initial accreditation visit to review the company systems against the ISO17025 standard.

Out of this visit comes a series of actions and recommendations which need to be closed in an agreed

timescale before accreditation is awarded. From start to finish these initial steps took approximately 18 months. Once accreditation is awarded, an annual surveillance visit is carried out by the accrediting body. Whilst this may appear to be an onerous or time consuming task, the long-term benefits to the company go beyond an increased customer base, to include how the company operates on a day to day basis.

"The concept behind SMaRT is to co-locate a commercial test house, specialising in bespoke testing of metallic and ceramic materials, alongside the Swansea University Institute of Structural Materials, who specialise in developing the understanding of mechanical behaviour. The aim is to achieve a holistic approach to the generation and interpretation of mechanical data."

Applying lessons more widely

Colin says: "The benefits of going through the accreditation process can take time to materialise, as there is a preconception of it being a challenge; accreditor versus the company. However, this is only because you are so busy 'getting ready', drafting the necessary documents and systems, that you do not have enough time to stand back and absorb the lessons the process is teaching you. Once you do recognise this need and review the outcome of the initial accreditation/follow up surveillance visits, you see how the lessons can be applied in their widest context and start making changes based on those outcomes."

Amongst the benefits SMaRT derived from the accreditation process, the most important relate to improved

efficiency and quality, as Colin explains. "Accreditation forces you to look at your systems and practices, ensuring that they are streamlined and fit for purpose. It also has a positive impact on the quality of your outputs as the better control means that you produce a higher quality output in a timelier manner."

Highlighting the important role that assessors can play in the accreditation process, Colin concludes: "The assessors have a wealth of experience and it pays to listen carefully to what they are saying during their visits. Whilst they are not allowed to give you direct advice, what they say can often point to things you had not thought of that actually needed improving."



Colin Small

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Assessing the risk to engineering materials from water impact

Mark Gee, Fellow at the National Physical Laboratory, is exploring new ways to assess and reduce erosion in engineering materials from water impact

It seems to be contrary to common sense that the water which we drink can cause failures in key technological applications, simply from the impact of droplets against the surface of components. Major issues occur in a number of areas, from turbine blades in steam generating plants to wind turbine blades.

In the first case, erosion is caused on the leading edge of a turbine blade by the impact of water droplets that condense from the steam that is driving the turbines. This is compounded by the length of the blades and hence high peripheral speed, which can be supersonic (up to 600 ms^{-1}) in a modern efficient generating plant. Hardened stainless steel is typically used for these blades, but the ends of the blades suffer major erosion damage leading to loss of the correct aerodynamic form and loss of function and efficiency, so that the generators require costly maintenance and repair with consequent loss of generating capacity.

In the second case, erosion is caused by the impact of rain drops on the wind turbine rotor blade. Large turbine blades operate with a peripheral tip speed up to about 100 ms^{-1} . The blades are manufactured from polymeric composites and are treated with low energy polymer coatings to reduce the effects of weathering (icing), erosion and bio-fouling (insects). All these factors change the profile of the

blades, leading to significant loss in power generation capability. Currently, although the design requirement is for a 25 year lifetime, these coatings only last about 10 years before the blades need refurbishment.

Protecting engineering materials from water impact

For both of these applications new materials solutions are required. The National Physical Laboratory (NPL) has designed and manufactured a

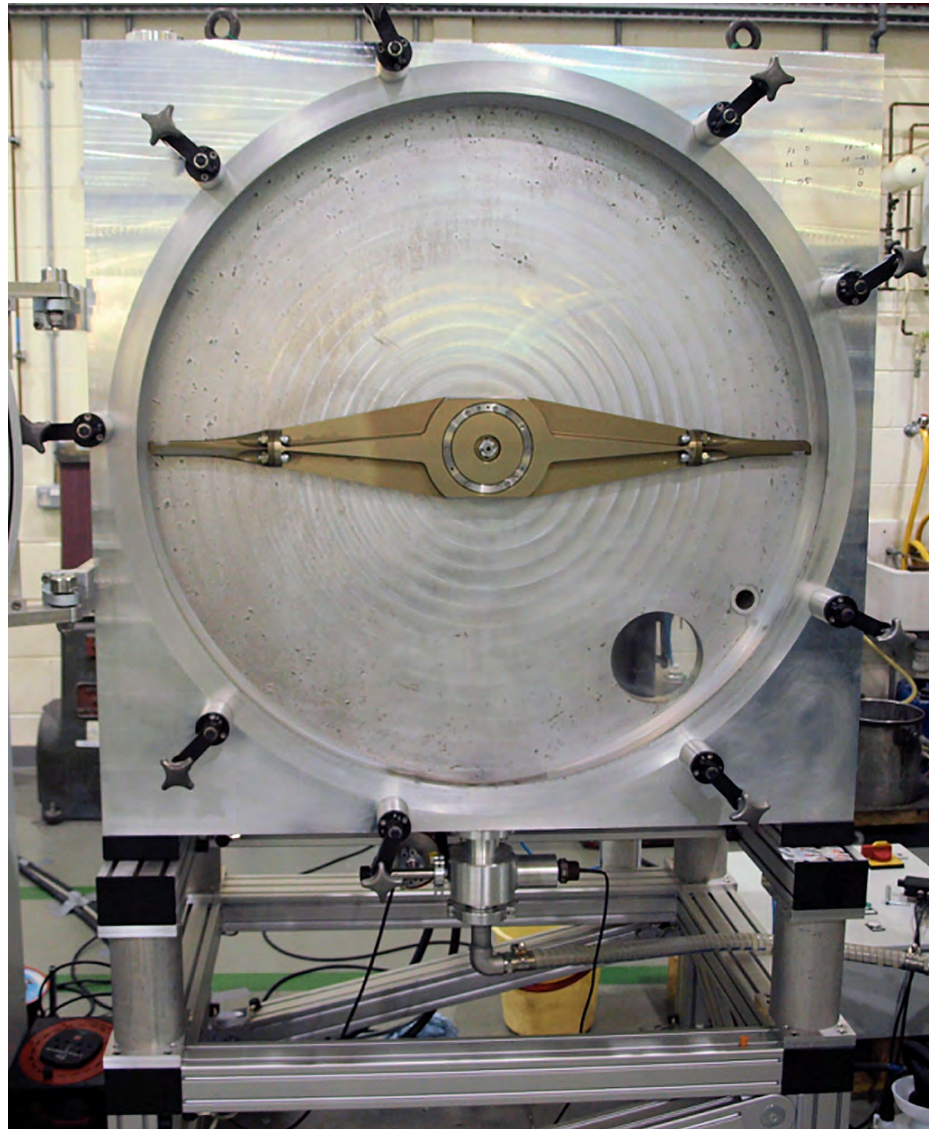


Figure 1, Water drop erosion test system showing rotating arm with samples at the end of arms enabling water droplet erosion testing at speeds up to 500 ms^{-1} . The water droplet nozzle is in the smaller orifice in the lower right quadrant of the chamber (next to a larger observation port)

PROFILE



Figure 2, 3D optical image of wear scar in 15-5 stainless steel with a ground surface finish. The depth of the wear scar was about 500 μm . The length of the wear scar is 8 mm

rotating arm test system to test new material systems (Figure 1). The test system consists of an aerodynamically shaped rotating arm which has samples clamped a metre apart. The arm is rotated at speeds up to 10,000 rpm to give the necessary sample speed in a chamber which is evacuated to reduce heating from friction with the atmosphere. A jet of water droplets is injected into the chamber across the

path of the samples, causing erosion from the impact with the droplets. The damage is monitored by measuring the progression of mass loss throughout the test and the mechanisms of wear are assessed by optical and scanning electron microscopy.

The test system has been used in collaborative projects looking at the development of new material systems.

One of these projects was funded by the Technology Strategy Board (now Innovate UK), where new coatings were designed, deposited and tested for steam turbine blade applications. Damage that was obtained on a hardened stainless steel sample is shown in Figure 2. Good progress in extending the durability of the coatings was obtained (Figure 3). The lifetime of some of the candidate coatings was ten times the original lifetime of the uncoated steel.

A second project was funded by the EU Framework project on the development of nanostructured coatings. Again, the NPL test system was used to evaluate the effectiveness of the new coatings that were developed in this project.

Much further work is required to determine the relationship between the make-up of new advanced materials and their water droplet erosion performance. This will be carried out using high speed imaging to look at the details of droplet impact on surfaces, combined with advanced microstructural characterisation techniques to evaluate the materials' response.

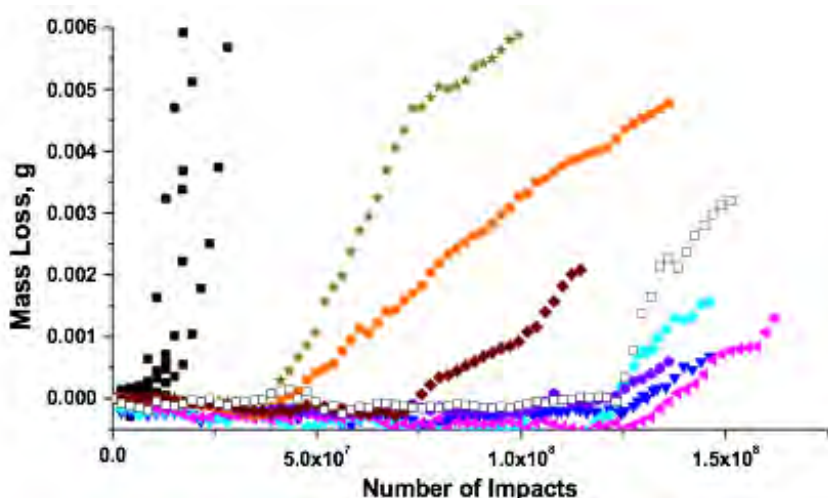


Figure 3, Comparison of results for uncoated hardened stainless steel (black squares) compared with samples treated with different candidate advanced coatings. The lifetime is essentially defined by the incubation time before the upturn and increase in mass loss

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Cities are at the heart of European democracy

Daniël Termont, Mayor of Ghent and current EUROCITIES President, outlines why cities are central to European democracy and how they can solve modern problems...

The European Union is going through difficult times. People are feeling disconnected, and we are seeing conflicting visions giving rise to extremist ideas.

We must acknowledge and try to understand the concerns of Europeans; we need to look for solutions together. Together this is our opportunity to rethink Europe, to re-invent it, not from the top down but from the bottom up. As mayors, we know that democratic power stems from local communities. Through the EUROCITIES network, we represent 130 million engaged European citizens in over 135 cities, in which government still works and the social contract still holds.

I am convinced that the future will be created in and by cities.

“Cities have so much experience of dealing with such a variety of needs and challenges. We also still share enough common ground to move forward together. This is because cities are focused on getting things done, on the content, and on working together.”

How can cities help remodel (European) democracy?

We need to start by involving citizens in the debate on Europe. Not just before elections, but at all times. The European Commission should be doing that too. Democracy isn't simply about words, debate and discussion, it's also about actions and results. It's about working together to achieve our goals.

Europe needs to realise that the EU institutions are not a goal in themselves. Indeed, the institutions should be modest and understand that their role is as facilitators



to make things happen. The EU institutions need to get around the table with cities, not just the member states. The European Commission has to start recognising cities as an important level of governance; taking city authorities into account when developing its policy.

The EU needs to make more of urban data and monitoring to shape its policy and governance. The Urban Agenda for the EU, launched in May 2016, is a very important step in the right direction. We urge the EU to give cities direct access to the Commission and to all relevant EU institutions. This would allow us to work together on some of the most pressing societal needs in Europe, such as the challenge of integrating refugees.

EUROCITIES could play an important role in shaping the future of European governance by encouraging the Commission to set up – and by playing an active role in – a taskforce to shape a new European vision and policy. As the new EUROCITIES president, I want to get things done in Europe.

At various levels, people have discussed the best possible way for cities to gain more governmental power.



One example is Benjamin Barber's Global Parliament of Mayors. EUROCITIES would be ideally placed to take the lead on this within Europe. Back in 2014 the Committee of the Regions proposed setting up a 'European Senate of the Regions'. This is an idea that dates back to the 1960s, when Walter Hallstein, one of the architects of European integration alongside Robert Schuman, and first ever chairman of the European Commission, already thought that, within Europe free regions should be able to influence decision making, based on a principle of equality. Should cities be part of such a senate? As far as I am concerned, it certainly deserves our consideration.

Cities have so much experience of dealing with such a variety of needs and challenges. We also still share enough common ground to move forward together. This is because cities are focused on getting things done, on the content, and on working together. For this reason, during Ghent's presidency of EUROCITIES, I would like to organise a series of festivals on European democracy in all EUROCITIES member cities, and

any other European cities wishing to join. We should reach out to everyone looking to build a better Europe, a more efficient Europe, and a more social Europe.

"EUROCITIES could play an important role in shaping the future of European governance by encouraging the Commission to set up – and by playing an active role in – a taskforce to shape a new European vision and policy. As the new EUROCITIES president, I want to get things done in Europe."

So let's do it! ■

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Daniël Termont

President

Mayor of Ghent (Belgium)

EUROCITIES

www.eurocities.eu

[www.twitter.com/EUROCITIESweet](https://twitter.com/EUROCITIESweet)

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

The case for Cohesion Policy: A better Europe will emerge

The case for Cohesion Policy beyond 2020 in creating a better Europe, according to the President of the European Committee of the Regions, Markku Markkula...

These are testing times for Europe. The worst of the economic crisis may have passed, but the economies of many regions are still far too weak. The migration crisis has led to too many tragedies in the Mediterranean, which has strained cooperation between Europe's states. This has caused an increasing sense of disillusionment in the EU which, as the vote for Brexit highlighted, has been blamed for not doing enough. Yet as President of the European Committee of the Regions, I can testify that the EU has been and continues to be strongly focused on delivering for its regions and cities.

The EU, which was founded on a commitment for a better Europe and prosperity for all, has contributed to counter top-down growth policies. This commitment towards balanced and inclusive economic growth is demonstrated in its Cohesion Policy, worth €351.8 billion between 2014 and 2020. With one-third of the overall EU budget devoted to regional development and cohesion, this policy shows the European Union does decentralise policy and spending. The investment funds are managed in partnership with national and local governments, and they are tailored to meet the specific needs of local communities. It is the largest commitment in the EU's budget and supports less-developed regions, creating local jobs, supporting innovative companies and strengthening the single market, which benefits everyone in Europe. Nevertheless, we need to go further, cutting red tape and allowing local and regional authorities to be free to make decisions on spending in their towns, cities and regions.

The European Commission has shown that for every €1 invested through cohesion funds, €2.7 is created. Cohesion funds and membership of the single market are helping poorer regions: Based on per-capita GDP, 16 of the 20 fastest-growing of the EU's 276 regions come

from the countries, most of them less well-off, which joined the EU in 2004 or 2007. The EU's Cohesion Policy – like the single market – benefits both richer and poorer regions. That is why the relatively prosperous region of Lower Austria is leading a formidable alliance of almost 200 regions from 22 countries, representing over 70% of the EU's population, in a campaign to maintain and strengthen Cohesion Policy.

The case for Cohesion Policy

The case to maintain, strengthen and reform Cohesion Policy is stronger now than ever before, especially due to the alarming drop in investment at the local level, since the start of the economic crisis. Investment levels in Europe have dropped by 15% over the past decade, with government expenditure half the level it was. Last year, a Europe-wide survey conducted by the OECD (Organisation for Economic Co-operation and Development) and our Committee found that since 2010, public investment had fallen in over 40% of local and regional governments. The EU's Cohesion Policy has helped soften the impact of this fall in investment, but regional disparities continue to rise.

In 2017 the critical challenge will be for the EU's regions and cities – and so for our Committee – to persuade authorities at all levels to increase investment. Public funds will never be enough, which is why public authorities must strive to work even more with private investors. We therefore support the European Commission's new European Fund for Strategic Investment (EFSI), which uses EU money and aims to trigger private investment, with the objective of unleashing €500 billion of investments by 2020 in our regions and cities.

This year, we are developing our proposals for the future of Cohesion Policy beyond 2020. We want the EFSI and Cohesion Policy to be simplified. Cohesion



*President of the European Committee of the Regions,
Markku Markkula*

Policy and the EFSI are complementary but we need them to work even more in synergy. We want to see the EFSI's money spread more widely: The EFSI is primarily used by the 15 richer countries, leaving the poorer behind. We are advocating investment that accelerates the EU's drive towards a smarter greener economy, so we see investment in energy, transport and the digital economy as strategic priorities. We are stressing the need to invest more to build up our human capital. We are championing policies that foster open innovation ecosystems. We are facilitating cross-border cooperation.

A better Europe will emerge

A better Europe will only emerge through stronger partnerships. Many of the regions and cities that send representatives to the European Committee of the Regions

are taking the lead. Our European Entrepreneurial Regions Award has led, for example, to EU funding for collaboration between ten regions and cities to support young entrepreneurs and start-ups. In another policy field, bioeconomy, the region of Łódź – led by a CoR member, Witold Stępień – decided to use €10m of its cohesion funds to launch the collaboration with regions across central and Eastern Europe.

A better Europe will also emerge from a clearer understanding of the role of cities and regions in economic growth. Cities and regions are not only investors. They are providers of services such as transport, education, and health care. They are planners, through development strategies, for example. They are regulators. And they are investment partners. Europe's investment gap cannot be bridged without them.

“In 2017 the critical challenge will be for the EU's regions and cities – and so for our Committee – to persuade authorities at all levels to increase investment.”

Back in 1950, when he proposed the creation of a European Coal and Steel Community, the forerunner of the EU, Robert Schuman said: “Europe will not be made all at once, or according to a single general plan. It will be built through concrete achievements.”

Many of those achievements must – and can – be built by working with the EU's cities and regions. ■

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Markku Markkula

President

European Committee of the Regions

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www.twitter.com/CoR_President

Pursuing growth with Innovation Exeter

Exeter City Council is aiming for growth in one of the UK's foremost regional economies through the Innovation Exeter programme, as Richard Ball explains

Independent studies have identified Exeter's economy as outperforming larger cities in the UK, confirming its positive regional economic impact. As the powerhouse of its own sub region, the city – and its wider economy – is looking to build on that success to create higher quality and better paid employment, benefiting both businesses and residents, and attracting and retaining talent and investment. The acknowledged characteristics of Exeter's city-based economy are:

- High levels of economic success;
- High-level research and education institutions;
- Knowledge-based activity;
- Effective transfer of knowledge to business;
- A diverse industry base.

Equally important are the nationally acclaimed education sector, vibrant cultural and extensive leisure opportunities, and good communication, infrastructure, air, rail and road transport links to other economic hubs. All also reinforce the wide engagement and impact of the success and growth of the city and the wider region. Working with strong leadership from a number of individuals and organisations around an economic vision, Exeter is supported by proactive networks and partnerships.

At the centre of the next stage in driving the growth of Exeter's economy is Innovation Exeter, a programme aiming to create opportunities for new business formation and growth and higher paid employment through innovation, and developing existing and potential business clusters.

Innovation Exeter – establishing Exeter as a leading, attractive, knowledge based economy

Exeter is a major economic engine in the south west of England with a credible track record of growth, even through recent difficult times. In the top 10 of growing cities and with its workforce having the lowest proportion with no qualifications in the UK, Exeter has seen a step change in its economic performance. Growth is being pursued hand in hand with major housing, infrastructure and leisure projects to ensure successful and sustainable development of the city and its interdependent hinterland. What has been clear is the importance of agility and of public and private partners agreeing and working to a clear, comprehensive, proactive and responsive plan with frequent monitoring and a focus on risk mitigation.

The overall growth programme is geared to the creation of some 26,000 jobs over the next 10-12 years. It is building on the area's strengths in environment and data science, agri-tech,

health and professional services. The programme will also aim to improve the working and living environment to support and enable transformational growth and raise productivity.

Innovation Exeter has six themes:

- a brilliantly located science park with incubation and business support services and access to investment funds;
- research excellence to support and promote innovation from the global top 100 University of Exeter and other organisations, such as the Met Office;
- a focus on the area's strengths, data analytics and exploitation of data including the Exeter City Futures initiative establishing the city and its surrounding area as an ideal test bed for evaluating the problems and challenges facing urban areas and their interdependent hinterland;
- strategic investment in skills to support innovation with data analytics a central theme for addressing these skills in schools, colleges and universities, as well as in the workforce;
- investment in the local environment to support growth through coordinated housing, transport and local infrastructure development including the recently announced new Garden Village near the city;



- maintaining a strong supportive partnership with an aligned investment strategy to sustain and improve the environment for business growth and investment.

Exeter University – placed 35th in global influential rankings

The University of Exeter has reinforced its position amongst leading universities both nationally and internationally, according to the latest influential global rankings. The Leiden University World Rankings 2016 position Exeter 35th internationally, 8th in Europe and 6th in the UK. The rankings provide a measurement of the scientific impact and performance of more than 800 major universities worldwide and their involvement in scientific collaboration. According to the latest rankings, the University of Exeter is:

- 16th in the world in life and earth sciences (2nd in the UK);
- 35th in the world in biomedical and health sciences (8th in the UK);
- 43rd in the world for physical sciences and engineering (2nd in the UK);
- 69th in the world in social sciences and humanities (10th in the UK).

Exeter Science Park – to be at the centre of the next phase of growth

Exeter Science Park is set to be the cornerstone of this knowledge based economy which has been achieving unprecedented growth rates. The new park caters for the full spectrum of organisations from start-ups and spin-outs to second stage funded companies through to the largest multinational. Located on Junction 29 of the M5 and the A30/303, the park occupies the perfect location in a grassland campus setting with immediate access to the motorway and trunk road networks, rail lines to London and the Midlands and Exeter International Airport.

The most recent major investment relating to the park includes the new Met Office computer, part of a £97m project. The first two phases are now operational at the Met Office's HQ on the nearby Exeter Business Park. Taken together, they are six times faster than the previous high performance computer and represent the largest operational supercomputer platform in Europe. The final phase takes the enhanced processing power of the 'supercomputer' to three million calculations per second for every man, woman and child on the planet.

Adjacent to the main computer hall is a "collaboration building" aimed at working with businesses to develop commercial applications for data. The location of the most powerful weather computer in the world in Exeter is a huge vote of confidence, both in the Met Office and in the city, as the place to do high performance computing and big data analytics.

If you would like to know more about this exciting programme and the success of the city then please contact Richard Ball – r.ball@exeter.ac.uk



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Storytelling will keep the EU stars shining, says van Nistelrooij

Lambert van Nistelrooij, MEP and EPP Coordinator for the Committee on Regional Development (REGI), shares a new approach for raising awareness of EU added value...

In September 2016, the EPP Group Conference in Bucharest was a unique opportunity to reflect upon the future of cohesion policy and the European Structural and Investment Funds (ESIF), the financing instrument in the field of regional policy. The ESIF have a long history and stem directly from the cohesion articles of the Treaty. After Brexit, the Regional Innovation Funds will still serve the purpose of inclusion and connection throughout the European Union.

As rapporteur for the mid-term review of the funds, I have paid attention to the lack of appreciation of European funds. In this period of upcoming nationalism and populism, there are hardly any positive reactions on European projects in the cities and regions. We get hardly any answer from the partners involved in the EU projects: Silence is dominating the scene. Factless communication fills the void. Personal narratives therefore get more important. Thousands of Erasmus students and farmers in the LEADER Projects have their own stories. As I articulated in my report on the mid-term review:

“Key communication on cohesion policy projects should focus on European added value, solidarity and the visibility of success stories”.¹

The consequences of poor communication

Out of sight is out of mind. We saw this during the UK referendum. It illustrates too well the consequences of a lack of communication. EU contributions are hidden once the EU funding has been received. On 23 June, a majority of the people of Wales voted in favour of the UK leaving the EU. This was a bitter pill to swallow, as Wales has greatly benefited from the ESIF over the last few years. The Welsh example raises therefore many questions about the way citizens throughout Europe perceive the EU and its instruments, including the ESIF.



Mr van Nistelrooij cleaning an EU plaque as proof of EU contributions

To increase the visibility of the ESIF, we must reboot our methods of communication. The years of applauding Member States and recipients have gone. In these times where social media are gaining importance, the brochures we used to make are outdated.

As chairman of the jury of the 2016 RegioStars Awards, I translate my own words into action. This event not only rewards creative and innovative projects funded by the EU. It also serves as an inspiration for other cities and regions. However, many of the European Commission's communication initiatives are top-down and old-fashioned.

Raise the profile of EU added value

I propose a part of the ESIF to be reserved for those who do more on storytelling and “tour guiding”. These so-called tour guides or ambassadors will be citizens who have been supported by the funds and want to share their experience. It constitutes additional action



during and after the project's closure. They are voluntary possibilities to do more than we have done up until now. Special times call for special measures. Now we see that when projects have ended, the communication is immediately fading away. Isn't it the aim of the EU Structural Funds to bring the results in due time?

It is for this reason I will launch a campaign in the Netherlands 'Laat de sterren fonkelen' ('Let the stars twinkle') to raise more awareness of EU investment and to provide citizens with examples of the EU's added value and its positive contributions. It is an experiment I wish to pursue with a direct participation intake. For the power of Europe is partnership: Working together and sharing what can be achieved with EU support. Moreover, this bottom-up approach would deprive Eurosceptics the blatant lie that the EU is trying to dominate every aspect of the lives of its citizens.

I therefore would ask you to come forward with your ideas. In my approach, the citizens themselves are the true stars of the EU. It is a politician's task to offer them the spotlight they deserve so that their story be heard.

Give them an opportunity to show their fellow citizens how they truly benefit from the cohesion policy and other EU initiatives. For together, we can make the stars of the EU shine bright again. ■

¹ Report on investing in jobs and growth – maximising the contribution of European Structural and Investment Funds: an evaluation of the report under Article 16(3) of the CPR (2016/2148(INI), Committee on Regional Development, p6.

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Karmenu Vella, on the left, and Nelly Palmeris, senior warden of Nairobi National Park, looking at the remainders of a pile of burned tusks of illegally killed elephants – a decision taken by the Kenyan authorities as a symbol for the fight against poaching

The EU Action Plan against Wildlife Trafficking: One year on

The EU Action Plan against Wildlife Trafficking sees member states working together to close loopholes used by criminals, writes EU Commissioner Karmenu Vella...

In a few weeks from now, on World Wildlife Day, we will be marking the first anniversary of the EU Action Plan against Wildlife Trafficking. The past decade has seen a dramatic surge in poaching and illegal trade of wildlife products, fuelled by a sharp rise in global demand for products such as elephant ivory, rhinoceros horn, tiger bones and skins, reptile skins and luxury woods.

With the Action Plan built around three pillars – prevention, stronger enforcement, and global partnership – the EU has stepped up the fight against such crime.

CITES is our best weapon

During this first year we have made good progress in all three areas. Undoubtedly the biggest milestone on the international front was the September CITES

summit in Johannesburg. CITES – the international convention regulating trade in endangered species – is the best weapon we have for dealing with wildlife trafficking. It forces countries to work together, to follow up with practical action, and when countries don't play fair, it can impose trade sanctions.

All the signatories agreed to trade restrictions and bans on a large number of species which are in need of greater protection. These include rosewood, pangolins (the world's most trafficked mammals) and a number of other species that are traded as exotic pets particularly in North America and Europe, such as geckos, lizards, parrots and fish species. A growing number of shark species, like the thresher or silky, are now protected. Under severe pressure and targeted for their fins, there is hope that their numbers can grow.

EU-28 working together as a bloc

An EU proposal for tighter controls on hunting trophies was also endorsed, not just for lions but for other emblematic species too: Polar bears, hippos and zebras. Importantly, international trade in ivory remains banned for all African elephant populations. The EU opposed all attempts to reopen trade in ivory or rhino horn. Additionally, all parties agreed that domestic ivory markets should be closed if they are found to be contributing to illegal trade.

The fact that we got so much done was largely thanks to the way the EU was united behind common positions. The 28 Member States worked together as a bloc for the very first time. Participating in CITES and voting in unity made it much easier to get the EU's proposals through.

Illegal wildlife trade is fuelled by corruption, inadequate governance, poverty and poor enforcement, as well as rising demand in some world regions. The good news is that our partners in the Far East are becoming more open to extending CITES protection to new species. They are committed to working closely together to tackle the roots of the problem, targeting organised criminal groups. They are also looking at ways to reduce demand for illegal products, from rhino horn to pangolin scales. These are the positive messages I brought back from my visits to Vietnam and China in November last year.

We also showed that we are just as serious about getting our house in order. Endangered eels are smuggled at huge prices from Europe to Asia. There are networks in Europe that specialise in trafficking live birds. Although international and EU rules on wildlife trade exist, EU Member States implement and enforce them differently. Organised criminals exploit these loopholes.

Strong start for the EU Action Plan against Wildlife Trafficking

Under the EU Action Plan, improved cooperation between agencies will make checks and enforcement in cross-border cases more effective, with the two EU agencies, Europol and Eurojust, playing a major role.

There have already been many good examples of effective police cooperation. The Operation COBRA III in 2015 saw seizures in Europe of 11 439 specimens, living and dead, and almost 2000 parts and products of timber, plants and animal parts. Law enforcement teams and agencies from 62 countries in Europe, Africa, Asia and America participated.

Recently, some great achievements were reported from our newest Member State. The Croatian customs authorities seized live turtles worth €400,000. A number of other Member States have recently made important confiscations of ivory, seahorses and glass eels. This goes to show that our customs and enforcement officials are extremely vigilant against illegal trade in protected species.

So the implementation of the EU Wildlife Trafficking Action Plan has got off to a strong start, and will continue with full force. In 2017 we will increase scrutiny against ivory trafficking to make sure that the EU market is not used for illegal ivory trade. We will also strengthen our cooperation with the business sector trading animal and plant species to promote best practices against illegal trade. On the international front, we will work with our partners to implement CITES decisions. And finally, with Europol, we will facilitate joint operations of police and customs officials in Europe and internationally to crack down on wildlife criminals. ■

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Karmenu Vella

Commissioner for Environment, Maritime Affairs and Fisheries

The European Commission

http://ec.europa.eu/commission/2014-2019/vella_en

Progressive zoos and the fight against wildlife trafficking

As the European Association of Zoos and Aquaria's David Williams-Mitchell stresses, progressive zoos play a crucial role in halting illegal trade in wildlife

The European Association of Zoos and Aquaria (EAZA) is the largest regional zoo and aquarium association in the world, with nearly 400 members, as well as a remit to coordinate cooperation between zoos and aquariums on conservation, education and research. This makes our community a strong player in the fight against wildlife crime. Animals are not only illegally caught and traded from the wild, but also from our member institutions.

Since our inception over 30 years ago, we have been continuously building on our foundations to maintain self-sustaining populations within EAZA zoos. We built our managed breeding programmes on the concept that animals should not be bought or sold, but should instead be held in common ownership for effective conservation. We also set strict standards on the sourcing of animals and record-keeping to ensure complete transparency on the movement of animals within our community.

The progressive zoos and aquariums of EAZA care for some of the most endangered species on the planet, and work closely with organisations such as IUCN and national governments to provide ex situ and in situ support for highly coordinated programmes of protection. With the acquisition of wild animals becoming more challenging for criminals in range states, zoos are sometimes targeted by criminals as

an alternative source, and while EAZA standards and guidelines require members to provide security measures against theft, there is no failsafe method of prevention. Any theft of endangered animals adds pressure on global populations, and buyers of stolen animals are contributing directly to their extinction.

Success in tackling the bushmeat trade

In the wider context, with over 140 million visitors to EAZA collections annually and a global network of governmental and non-governmental organisations, EAZA is well placed to help combat wildlife crime at both ends. From the demand side, educators working in our institutions contribute strongly to public understanding of the effects of buying wild animals or animal products, and have lobbied successfully for the implementation of measures to severely restrict the trade of illegal wildlife products.

This has been done primarily through a series of EAZA conservation campaigns aimed at raising awareness of issues including poaching, the bushmeat trade, and the demand for exotic species as pets and tourist attractions. The 2000-2001 EAZA bushmeat campaign, a collaboration between EAZA and the International Fund for Animal Welfare (IFAW), led to one of the largest petitions ever submitted to the European Parliament, with 1.9 million signatures gathered.

This led in 2004 to all applications for EU funds being screened for their bushmeat impact – a major win.

From the supply side, conservation programmes supported and coordinated by EAZA members work to raise communities' awareness of wildlife issues and help to encourage an end to animal capture. There are several approaches being trialled, such as the establishment of a breeding center in Bali to flood the market with critically endangered Bali starlings, while breeding genetically valuable birds for release. EAZA members are also active in helping reduce human/wildlife conflicts, for example working to reduce conflict over water source access between communities and chimpanzee groups in Tanzania.

The Silent Forest campaign

EAZA recognises that the most effective measures against wildlife crime address all the factors influencing it. EAZA will launch a new conservation campaign at the end of 2017 aimed at securing a future for twelve species of Asian songbirds. The Silent Forest campaign will aim to raise awareness of the scale of the traffic in these species, which are prized commodities for bird collectors both in Asia and, more worryingly, in the European markets. The campaign will also work scientifically to ensure that bird species are correctly classified taxonomically, encouraging a higher level of protection from CITES authorities

PROFILE



and ensuring that the threat against them is reflected in the IUCN Red List of Species – a key tool for assessing environmental risk for bodies providing governmental and private investment.

Finally, the campaign will aim to assist communities to live sustainably alongside their local birds and, where necessary, help them to breed more birds for release and possible legal sale. It will also, where appropriate, help them to identify alternative sources of income. Working with other key stakeholders such as TRAFFIC, the NGO responsible for the eradication of the illegal wildlife trade, EAZA aims to help establish solutions that can also be translated to other species and habitats.

EAZA also recognises the value of genetic analysis of wildlife, and it may be that this new tool will help radically in the identification of animals to confirm that they have come from sustainable sources. The work of scientists conducting research in EAZA institutions may make a huge contribution to the eradication of the illegal wildlife trade over the medium to long term. They will also assist national authorities with establishing analysis

protocols to help them identify and prosecute offenders. There will be no grey area for animal dealers to inhabit and, at least in the western world, no excuse for the sale or purchase of illegally sourced animals.

Progressive zoos can make a significant contribution

EAZA recognises that the illegal trade in wildlife cannot be eradicated overnight. Our institutions will continue to suffer from animal theft despite advances in security technology, and the demand for animals and animal products will continue to thrive over the short and medium term. The European Commission's Action Plan on the Illegal Trade in Wildlife, approved by all EU institutions following lobbying by a coalition including TRAFFIC and EAZA, should lead to stronger union action against the illegal trading of animals in Europe and beyond. However, the Union and all other stakeholders must be clear that the threat of imminent extinction hangs over many species, and that public education to reduce demand in all markets is needed urgently.

Progressive zoos and aquariums can support this mission, and EAZA calls

on the Commission to make use of our network of educators, conservationists and researchers to help fulfill the Action Plan, as well as utilizing our expertise in the sustainable acquisition of animals and the use of record keeping systems to ensure compliance. Our members have the expertise, reach and experience to make a significant contribution, but cannot act as effectively in isolation, compared to a united front.

Biodiversity is under threat everywhere from those wishing to exploit species for financial gain. Each species plays a role in its own ecosystem; the extinction of one will undoubtedly lead to the extinction of many – with consequences for human life and prosperity as well. There is little time and much to play for; progressive zoos and aquariums stand ready to play our part in protecting nature. Use us.

For more information please contact EAZA's EU Policy Manager Daniel Nuijten at info@eaza.net



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We need tougher action on wildlife trafficking: Catherine Bearder

The tide may be turning but there is still much more to be done in the fight against wildlife trafficking, Catherine Bearder MEP argues...

Last year marked the start of the European fightback against wildlife crime. The EU's new comprehensive anti-wildlife trafficking action plan presents us with a golden opportunity to turn the tide against the mindless poaching and destruction of our natural environment that is decimating some of the most vulnerable parts of the planet.

For too long, organised criminal gangs have been making massive profits by trading illegally in plants, animals, skins, bones, tusks, medicines, food and adornments. The risk of detection is low and the financial rewards are high. Criminal wildlife traffickers launder money, destabilise communities and fund their other illegal activity.

The EU's action plan was pretty solid but it needed some tightening. Which is why I included in my parliamentary report new suggestions on how to strengthen enforcement and ensure governments take the action they are signed up to. This report got overwhelming support from the MEPs which shows their commitment to this issue – only five voted against!

Now the paper work is done in both the Commission and the Parliament, I will crack on with ensuring that EU governments and the Commission deliver the action.

Europol powers on wildlife trafficking

For a start wildlife crime must be included in Europol's 2017 Serious and Organised Crime Threat Assessment (SOCTA). Only with the support of national governments will Europol have the authorisation to arrest wildlife traffickers as they do with human and drug traffickers.

Also we must have minimum penalties for this crime right across Europe. Criminals must face prison time, not a slap on the wrist for these most serious crimes.



Catherine Bearder, MEP

There are already many pressures on our law and enforcement agencies, but with the political will and financial support to stop wildlife trafficking we can really begin to turn the tide.

We need an EU Wildlife Trafficking Coordinator to ensure a joined-up effort by different Commission services and the Member States in tackling wildlife trafficking. This works well with our human trafficking work. We should repeat it here.

We must close the loopholes that wildlife traffickers exploit. Some species are illegal to seize in source countries, but are not part of the CITES framework, so they can actually be freely trade in the EU. This is a legal gap.

MEPs have asked the Commission to consider introducing US style "Lacey Act" legislation at an EU level. The 1900 US Lacey Act states that if a protected species in a source country has been illegally harvested from the wild, it is also illegal to trade it in its destination country too.



Ban the ivory trade now

Last but not least we need a full and immediate ban on the European ivory trade. The issue of antique ivory can be addressed but until we have clear and irrefutable ways of determining the source and age, all ivory trading should halt. In the past decade alone 110,000 African elephants have been slaughtered as a result of poaching and the massive global demand for ivory tusks.

Pressure is growing on EU countries to act. 500,000 EU citizens signed a petition calling for a total ban on ivory. Which is why it is fantastic news that MEPs voted for a full and immediate ban on the trade, export and re-export in EU and to destinations outside the EU of ivory, including 'pre-Convention' ivory, and rhino horns in my parliamentary report.

Protecting the planet

At the end of the day, the fight against wildlife trafficking stands or falls with the EU's Member States. They must make this plan an urgent priority. The public is with us on this, the politicians must now act.

This is about fighting crime, but also protecting the planet and its wondrous gifts for future generations.

“Only with the support of national governments will Europol have the authorisation to arrest wildlife traffickers as they do with human and drug traffickers.”

As the Lib Dem MEP I will spend 2017 campaigning to get these actions delivered by speaking to government ministers both in the UK and rest of the EU to ensure the fightback against wildlife trafficking is delivered by those who say they care. ■

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Catherine Bearder Member

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Scotland's draft climate change plan: Roseanna Cunningham sets out ambitions

The Scottish Environment Secretary, Roseanna Cunningham MSP, sets out the key aims of Scotland's draft climate change plan for Adjacent Government...

The publication of our new draft Climate Change Plan represents an opportunity to build on the ambitious approach that has seen Scotland gain recognition in the international community for its work on reducing greenhouse gas emissions.

Seven years ago the Scottish Parliament unanimously passed the most ambitious climate change legislation anywhere in the world, and more recently, by exceeding our 2020 climate change targets and achieving a 42% reduction in emissions 6 years early, we cemented our reputation as world leaders.

Our draft Climate Change Plan will build on this momentum by setting out how Scotland can reduce emissions by 66% by 2032, using 1990 emission levels as a baseline. The proposals show a new level of ambition in our work to build a prosperous low carbon economy and a fairer, healthier Scotland.

This reduction takes us into truly transformational territory. Wide-ranging changes in transport, buildings, heating, power, and land use will help us meet these targets.

By the 2030s we expect to see dramatic reductions in emissions from buildings – both residential and non-domestic – through energy efficiency measures and the decarbonisation of heat.

We expect to have electricity generation almost entirely decarbonised by 2025, through a mix of energy generation technologies and we will increasingly rely on electricity to heat our homes and power vehicles.

Scottish households should save hundreds of millions of pounds on their fuel bills over the lifetime of the Plan, and thousands of jobs will be supported through the

development of energy efficiency, as well as renewable heat services and technologies.

We will do all we can to make our shops, offices, schools and hospitals warmer and easier to heat. If we can reduce energy demand we can help businesses improve their energy productivity and competitiveness, and it will offer savings in the public sector for frontline services.

Reducing emissions and improving air quality

Clearly transport plays a crucial role in tackling climate change. Our draft plan sets out our vision for the transport sector to be significantly decarbonised by 2032, with emissions dropping by a third compared to 2014. We want to see widespread low emission cars and vans, and low emission HGVs commonly found on our roads.

We are committed to freeing Scotland's communities from harmful vehicle emissions and will continue to invest in public transport and active travel, and in low carbon technologies like electric cars and vans, hybrid ferries, green buses and the infrastructure they require.

Next year we will also introduce our first low emission zone and we will evaluate the more extensive use of low emission zones and associated changes to freight logistics and public transport, as it's important that we improve air quality.

An important opportunity for debate

In agriculture, our draft Climate Change Plan sets out our ambition to be among the lowest carbon and most efficient food producers in the world. We will support farmers so they can cut their emissions and costs.

Enhancing our natural carbon sinks is critical.



**Roseanna Cunningham
MSP**

By 2030 we will have restored 250,000 hectares of degraded peatlands against 1990 levels – an improvement of valuable soils in around 20% of Scotland's land mass. This represents a step change in our ambition and is also fundamental for biodiversity, water quality and our own enjoyment of Scotland's spectacular natural environment. We will also increase our tree planting rates over time up to 15,000 hectares by 2024/25 with a view to having 21% of the Scottish land area in wood cover – an increase of around 3%.

The transition to a low carbon economy offers important opportunities for Scotland – thanks to our highly skilled workforce, the strength of our research institutions and, of course, our natural resources. The Scottish Government's ambitions are clear, but we have now reached a point in our journey where future progress will require the support of individuals, organisations and businesses across the country.

The publication of our draft Climate Change Plan provides an important opportunity for debate about the policies which should be implemented and the proposals which should be considered.

That debate will help ensure the final version of the Climate Change Plan provides us with a blueprint for a fairer, greener, more prosperous nation. ■

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Delivering on Germany's 2050 Climate Action Plan

Germany's ambitious 2050 Climate Action Plan is now well under way, as Adjacent Government found out from Federal Environment Minister Barbara Hendricks...

Germany is pressing ahead with climate reduction targets following the Paris meeting at the end of 2015. Through their Climate Action Plan 2050, the German government is committed to reducing greenhouse gas emissions and contributing to the overall EU target.

In April last year, Federal Minister for the Environment Barbara Hendricks outlined to [Adjacent Government](#) how their previous Climate Action Programme 2020 highlighted Germany's commitment to reducing the impact of climate change. In 2007, the government set a goal to reduce greenhouse gases by at least 40% by 2020, which is seen as an ambitious target.

Speaking to Adjacent Government, Federal Minister Hendricks said: "Projections published in 2013 show that with measures adopted and implemented so far, Germany would achieve a reduction of around 32 to 35% by 2020."

[The Climate Action Plan 2020 was adopted](#) in December 2014 to ensure that the remaining 5 to 8 percentage points were achieved. The 2050 Action Plan is a follow-on from the 2020 Plan in light of the Paris Agreement. The government intend to update the 2050 Action Plan regularly to monitor whether the adopted actions are effective.

Aiming for GHG neutrality

The 2050 Plan is said to be the first government document which maps out a route for extensive greenhouse gas neutrality in Germany. The plan is based on the guiding principle of extensive greenhouse gas neutrality by the middle of the century. It is also said to reinforce the overall target for 2030, namely a greenhouse gas reduction of at least 55% compared to 1990. For the first time, this overall target has been broken

down for individual sectors, which helps to provide clear guidance for all.

Minister Hendricks commented that this particular Action Plan (2050) reveals what implementing the Paris Agreement means for Germany.

She said: "We are consciously thinking ahead to 2030 and 2050 now, to ensure that all stakeholders have enough time to respond to the new challenges. It is important to me that by taking action early we avoid structural breaks. By laying the right foundations now, we can make climate action the driver behind the modernisation of our economy.

"This will create jobs and strengthen our role on the global market. This Climate Action Plan is something we can be proud of at an international level. We will be following the guiding principle of extensive greenhouse gas neutrality by the middle of the century. For the first time, we have defined target ranges for individual sectors.

"As of today, no one can fool themselves into thinking that climate action only affects others. I firmly believe that this plan is a historic turning point for climate policy in Germany. Several ministries have been constructively involved in the drafting of the plan and will be making important contributions. I would like to express my gratitude to them for their cooperation."

The 2050 Climate Action Plan in action

Action programmes such as these are crucial in order for countries to contribute towards EU targets and bring down greenhouse gas emissions. Within various sectors, the German government hopes to see reductions across a number of key areas. For example, a reduction in buildings-related emissions is expected to



be achieved at a rate of 66-67% by 2030, and a 40-42% reduction in the transport sector is expected by the same year.

In order to reach this target for the transport industry a series of strategies have been planned, which include a climate strategy for road transport. The government have outlined how alternative drive technologies, public transport, rail transport, cycling, walking and a digitalisation strategy will also play an important role in this.

With regards to agriculture, Germany are aiming to significantly reduce nitrous oxide emissions from over-fertilisation. Further to this, Germany will advocate in Brussels that EU agricultural subsidies take EU climate policy decisions into account. A reduction of 31-34% is expected within this sector by 2030, compared to 1990 levels.

A reduction target of 49-51% has been set for industry, and the government is set to launch a research, development and market introduction programme in order to achieve this. The aim of the programme will be to

reduce climate-damaging emissions from industrial processes that are currently considered unavoidable.

Minister Hendricks added: "The Climate Action Plan provides individual branches of industry with a concrete framework for strategic decisions in the coming years. I am confident that these prospects will inspire great creativity and innovative energy.

"The Climate Action Plan provides guidance that businesses, trade unions, the scientific community. The creative industry and also politicians can and will use to make Germany more climate-friendly by the middle of the century." ■

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Developing and serving the climate services market

Professor Dr Daniela Jacob and colleagues at GERICS seek a better understanding of the climate services market and how to contribute to its development...

Responding to the challenge posed by climate change involves both climate mitigation to rapidly reduce global carbon emissions, as well as adapting to current and future climate impacts that affect a wide range of economic sectors, and human activities. Policy action to address climate mitigation and adaptation goals, benefits greatly from the use of climate information.

To help in this regard, recent years have seen the development and growth of a range of climate services. Climate services provide science-based and user-specific information relating to past, present, and potential

future climate, and address all sectors affected by climate at global, regional, and local scales (WMO 2016).

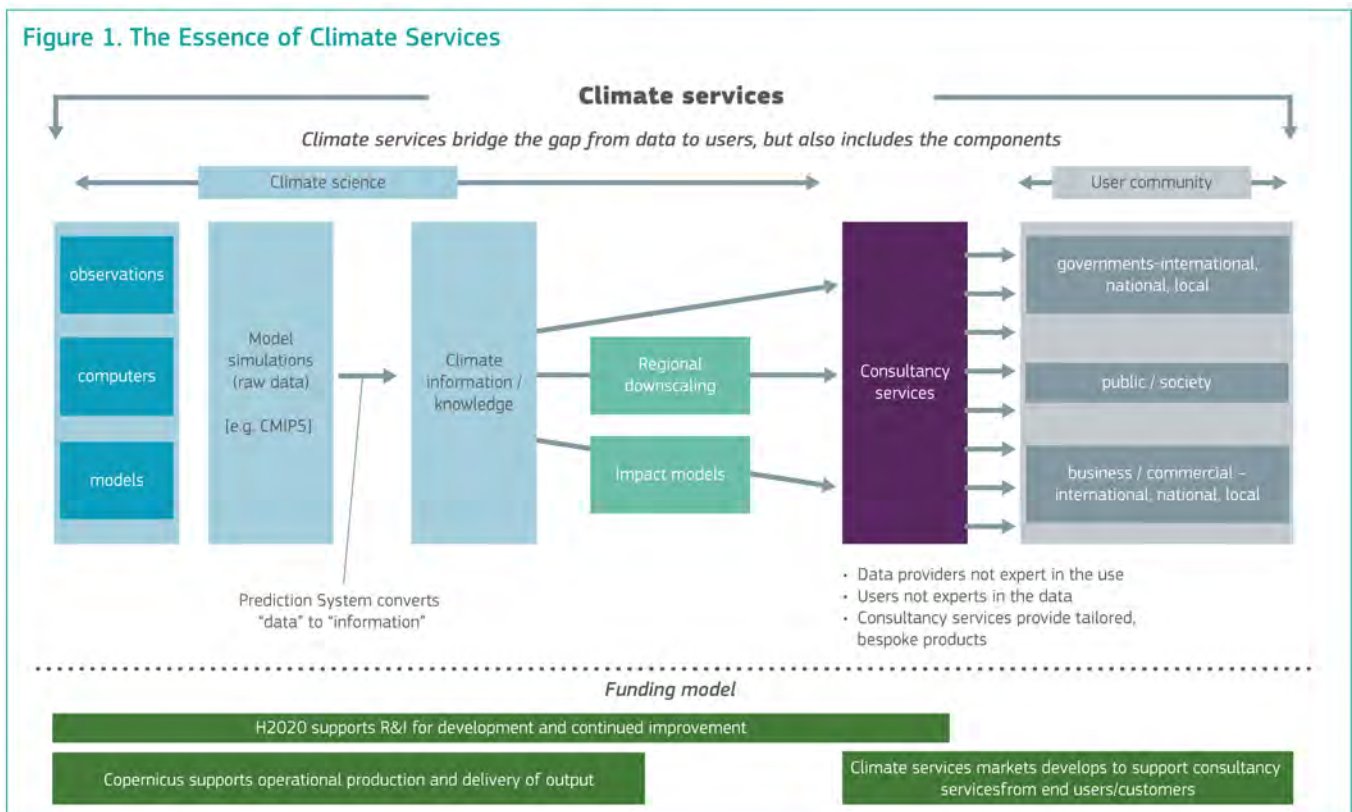
The climate services market is regarded by the European Commission as one of the most important future markets, possessing enormous growth potential and holding the promise of significant future employment opportunities (EC 2015). The market, however, is currently in a nascent stage of development, and clearly requires further development.

In order to help facilitate this development, a better understanding of the market is required in a range of different

areas. These include: knowledge of the current market structures and stakeholders; knowledge about possible barriers to the development and use of climate service products, and how these may be overcome, or at least reduced; and an inventory of the current supply and demand for climate services, together with knowledge of user requirements for climate services in different economic sectors.

In possession of a better understanding of the market, focus and investment can be placed in areas where it is most needed, and holds the most promise for delivering targeted, high quality, and innovative climate services.

Figure 1. The Essence of Climate Services



In doing so, not only will stakeholders have better information on which to base their climate-related decisions, but the market potential that climate services possess, may actually be realised.

The Climate Service Center Germany is actively engaged in contributing to this better understanding of the market for climate services on an ongoing basis. However, this contribution is currently focused on three major European funded projects, two of which are Horizon-2020 projects, EU-MACS and MARCO; and the other is a Copernicus Climate Change Service (C3S) project, SECTEUR. These projects will significantly contribute to a better understanding of the market structure (MARCO), user needs (SECTEUR), and barriers hampering market uptake of climate services (EU-MACS). Here we provide a short overview of these projects.

MARCO – MARket Research for a Climate services Observatory

The MARCO project aims to provide an assessment of the market for climate services. The current market is analysed using various quantitative and qualitative methods. The market involves, on the one hand, the providers – who they are, what kind of services they offer, what business models they employ, and what core competencies they possess.

On the other hand are the users – what they need, where they obtain their climate products, and what competencies, skills and resources they have. The findings will be further developed in case studies. The analysis will be carried out for different providers and users, as well as different sectors, product categories, spatial locations, and high value societal assets. This will be followed by a gap

analysis and innovation modelling to reveal the untapped market. A foresight exercise will then outline market growth until 2030. Finally, recommendations for market observation and facilitation will be expressed.

EU-MACS – European Markets for Climate Services

The EU-MACS project investigates the fundamental barriers in the climate services market as well as ways to reduce or avoid them. Considerations include the entire value chain of climate services (Fig. 1). There are many potential barriers in the climate services market, and these will be analysed and categorised into political, economic, social, technological, ethical, and legal. In addition, the business models, data infrastructures, and quality requirements will be investigated. In so doing, potential approaches for eliminating or removing the various barriers can be explored, such that the supply of climate services can be better adjusted to the needs of the market. In general, the analysis is grounded in economic and political science theories on how service markets with public and private features can develop, and how innovations may succeed.

SECTEUR – Sector Engagement for the Copernicus Climate Change Service: Translating European User Requirements

The SECTEUR project is engaging and interacting with a wide number of stakeholders across six sectors. This is done through surveys, workshops and interviews, to establish an inventory of existing policy needs and user requirements, with respect to the use of essential climate variables, and climate impact indicators. The sectors covered are: agriculture and forestry, coastal areas, health, infrastructure, insurance, and tourism.

The project will establish the current size of the market for climate services in Europe and, working closely with users in each sector, will explore issues relating to the technical feasibility of delivering on user needs, and implementing them in the Copernicus Climate Change Service (C3S) climate data store. In addition, any gaps in current service provision will be identified in order to inform future research and investment priorities. The aim of the project is to help inform the development of the C3S Sectoral Information System.

GERICS, through its contribution to these and other projects, together with the wide range of other activities that it is engaged in, continues to play an instrumental role in the development of the climate services market.

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The future of UK flood policy

The Flood Re scheme may have bought some time, but UK flood policy needs to adapt fast according to the Institute and Faculty of Actuaries' Catherine Burtle...

As we reflect on the year since storms Desmond, Eva and Frank caused the 'most extreme floods on record', the UK is slowly coming to terms with the fact that extreme floods are no longer the freak '1 in 200 year' events we once imagined. We are witnessing climate change in action.

As a consequence of global warming, extreme weather events are becoming more frequent and more extreme, and in the UK this means an increase in the frequency and severity of flooding. This is a major issue for the UK, with homeowners and businesses placed at an increasing risk of experiencing a flood.

The insurance industry has historically acted as a crucial safety net for those whose homes and businesses are affected by flood events. However the recent increase in flood risk caused by climate change, alongside population growth, which has resulted in increased building on flood plains and problems with crucial infrastructure, has had serious implications for the UK's flood insurance market.

The current method of pricing has arisen as a result of:

- advances in flood risk modelling, meaning insurers are increasingly able to pinpoint a property's specific risk of flooding; and
- increased competition in the household insurance market, meaning insurers are no longer able to absorb the costs of high flood risk properties by using profits from low flood risk properties in years which experience a notable flood event.

As such, both homeowners who have been flooded before and those who insurers believe to be at high risk of flooding in the future, have been subject to large premiums and high excesses, meaning those with the greatest need for flood insurance cover may not be able to afford it.

A short-term solution

The Flood Re scheme, a joint government and industry initiative, was introduced in 2016 in order to provide a

solution to this problem, in the short term at least. Flood Re is a scheme funded by a levy on insurers which reinsures their customers' flood risk, allowing them to offer flood insurance to those homes at risk at a more affordable price.

Flood Re has offered those living in high flood risk areas a lifeline, and its introduction has meant that many households previously unable to obtain affordable insurance have become insurable again, offering peace of mind and a financial safety net to those affected.

Flood Re can only be a temporary measure

It is important to understand that whilst Flood Re offers a short-term safeguard for these homeowners, the scheme does not reduce their risk of flooding. What it does buy us is time.

Flood Re is intended to be operational for 25 years, during which central and local government, the insurance industry, environmental organisations, housing providers and homeowners are afforded time to tackle flood risk at its core. After 25 years, if enough is done to tackle these problems, the UK insurance industry should, in theory, be in a position to return to operating on a risk-reflective basis.

As well as providing a period of breathing space for industry and policymakers, Flood Re also intends to provide a point of focus for the next 25 years, to continue the debate about addressing the root of the environmental and planning issues.

However, in the [IFoA's policy paper](#) we argue that more needs to be done to ensure that flood defences are strengthened and that resilience is improved whilst the Flood Re scheme is in place. Flood Re provides valuable breathing space, but all parties should remember that it is a temporary measure rather than a long term solution and that, as long as high flood risk persists, an affordable market based on risk-reflective pricing is unlikely to be achieved.

A strategic policy approach

The government has committed to spending £2.3bn on building and maintaining flood defences over the course of this Parliament, a move welcomed as a step towards improving the UK's resilience. However this is only one part of what is required to ensure homes and businesses are sufficiently equipped to cope with future flooding.

The IFoA has added its voice to the many others in the UK calling for a workable, proactive and long-term strategy for dealing with flood risk, which involves national and local government, environmental organisations, planners, homeowners and the insurance industry to be executed in time for Flood Re's transition plan to be a success for industry and customers. This means dealing with the root causes of flooding, and implementing a strategy that recognises the changing nature of flood events and the potential further impact of more frequent and extreme weather events.

Achieving an affordable market based on risk-reflective pricing by 2039 is only likely to succeed if the risks themselves change. Where the risk remains high, this will be reflected in household insurance premiums and action at all levels will be essential if customers are to benefit from an affordable insurance market over the next 25 years. ■

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Local councils' flood preparedness: How technology can help

Used proactively, technology can help local councils with flood preparedness and resilience in a number of ways, as Intermedix's Ian Carr describes...

It is no secret that flooding has been a challenge that communities in the UK have faced time and again over the last few years. Ensuring their communities are protected and prepared, local councils bear the burden of disaster preparedness and resilience with reduced funding.

Despite the challenges of decreasing budgets, technology can provide a solution. By using a range of technologies both proactively and reactively, local councils can plan and execute responses to flooding that will save lives as well as money.

Communication tools during an emergency

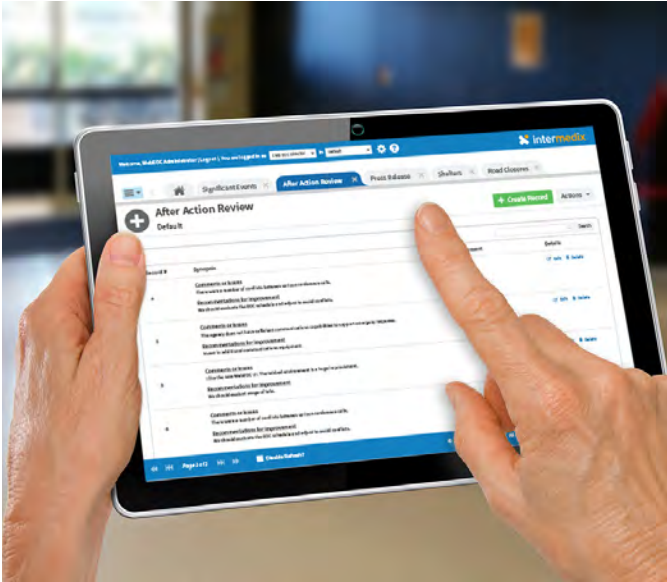
In the midst of a crisis, emergency managers and public officials must quickly and efficiently communicate crucial, life-saving information to ensure the safety of residents. Communicating using social media outlets

is now one of the most effective tools, posting concise and relevant information across the various social outlets.

Social media is becoming increasingly important between crisis events, as councils can encourage residents to stay updated with important information by following local weather advisors and emergency managers. Citizens can increasingly be kept updated in real time using smartphone messaging apps like Facebook Messenger and WhatsApp, as a crisis develops. These services save precious seconds in their immediacy, enabling councils to better protect lives and property.

Finding shelters and planning ahead

When a flood occurs, the most important consideration for any council's response is to ensure community members are safe in reception centres around the local area that can be activated immediately. These



centres are often public buildings such as fire stations, libraries, schools or community centres. However, organising these can't be left to the last minute. Technology such as incident management software needs to be used well in advance, to draw together crucial information such as the location of rescue centres to make sure that when the worst happens, councils are in possession of a clear, streamlined plan that includes all the variables. A comprehensive plan that is kept up to date and accessible is critical to properly coordinating and executing rescue efforts, ensuring residents are safe, accounted for and that resources are properly used.

When the general public may be looking for information, ensuring the locations of these reception centres are available on a council's website and other outlets is essential. By making sure that residents and emergency managers are familiar with shelter management processes and procedures, a flooding event can be handled with resilience and the best possible outcome.

Practice scenarios and mapping software

An effective way of ensuring an efficient and immediate response in the event of a real crisis such as flooding is to regularly run practice scenarios. These are designed to enable team members to work together, managing a response plan to a hypothetical emergency. It also helps team members become familiar

with how incident management software can be used in the event of an emergency, and allows emergency managers to check that the plan they have created will work.

Mapping software enables emergency managers to test various scenarios by adding or taking away different factors. Personnel, vehicle shifts, calls and hotspots, for example, are all factors that create situational variations. Emergency response teams can best prepare for any event if they understand exactly which resources are needed to deal with different crises. Mapping historical data for emergency vehicle locations and emergency calls from previous events can also help to better inform future emergency planning. Using mapping technology can help to identify faults in an emergency plan before a crisis like a flood unfolds.

Technology key to local councils' flood preparedness

As we have seen increasingly over the past few years, flooding has become an unfortunately regular occurrence across the UK. Local councils are faced with a growing need to protect their communities and develop better disaster preparedness and resilience, as they endeavour to prevent damage to property and significant loss of life.

While it is not a one-stop solution, technology has a significant part to play in preparing for and alleviating the biggest problems brought on by flooding. By adopting these tools to effectively communicate with the general public, coordinate and manage resources like rescue centres, and support planning and preparation beforehand, councils can do more and go further in protecting their communities. ■

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Ian Carr
VP EMEA
 Intermedix

Circling around business waste

Liz Allen, Environment Consultant at Hosking Associates, explains why a circular approach to business waste could benefit the environment and your bottom line...

We have become used to the idea of recycling. We do it at home, and more businesses are recognising the financial benefits of waste segregation and recycling in the workplace. But is this enough? What 'matchmaking' could you do for your business waste? Could your unwanted waste material be just what someone else needs?

Each time a material is recycled, its quality is generally reduced leading to a higher demand for virgin raw material. According to Friends of the Earth, humans today extract and use around 50% more natural resources than 30 years ago – that's about 60 billion tonnes a year. If we continue in the same way, the amount could be 100 billion tonnes of raw material by 2030. It's not just the environmental problems associated with resource extraction, there are often social problems, such as human rights violations and poor working conditions linked with these industries which we should be taking into account.

“We are great at accumulating ‘stuff’, and apparently up to 80% of the products made are thrown away within the first six months. As a society, we have gotten used to wanting the latest trend and another bit of kit, but this cannot be sustainable.”

There is nothing wrong with recycling, and we should all keep up the good practice, while looking out for opportunities to think a bit wider and add an extra loop into a products' life cycle. The challenge is to move away from the 'take-make-dispose' linear route, and move to a circular model where the life of products and materials are extended before they are repurposed, reused or reprocessed to provide new or different services.

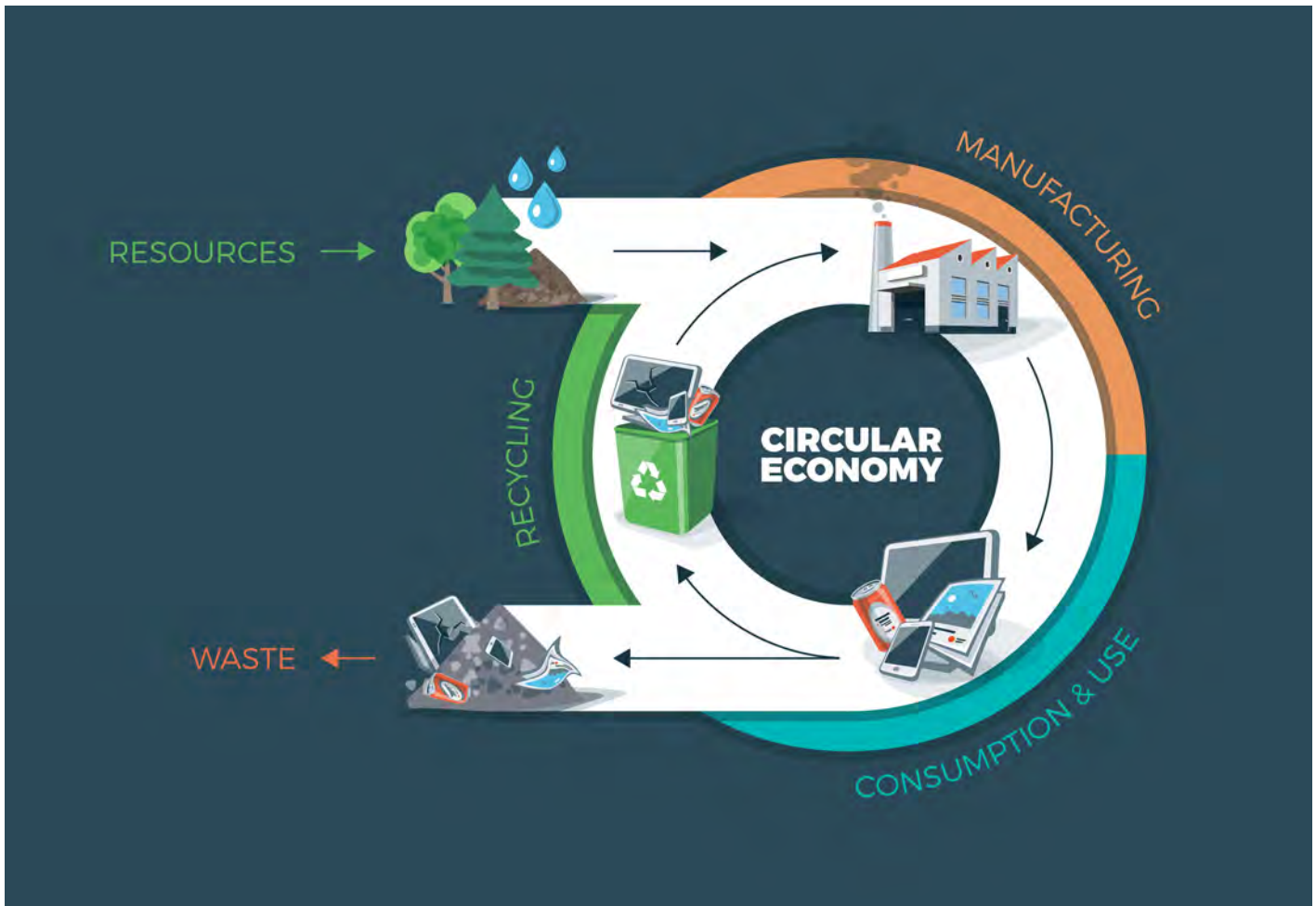


Liz Allen, environment consultant at Hosking Associates

New business models tackling business waste

The beauty of a 'circular approach' is that it can be tackled at any point of the value chain – anywhere from extraction of raw materials, design and manufacture, through to use and disposal. This affects everyone and is providing the inspiration for all kinds of new business models which appeal to the millennials, who are less materialistically-minded, and environmentalists alike.

All kinds of organisations are piloting new business models to try and rethink waste. These range from



product leasing – where you hand it back for someone else to use, to improving product performance by building in upgradability, through to remanufacturing. All these approaches try to keep the original material in use for as long as possible, to get the best out of it before recovering or regenerating products and materials at the end of their useful life.

Organisations such as WRAP and the Dame Ellen MacArthur Foundation are championing approaches to support innovative business models. These are popping up all over the place including a company in Holland called Mud Jeans which lets you lease a pair of jeans for a year. After that, you can return them for repair, get a different style or purchase them. St Albans-based office furniture specialist JPA will collect, repair and refresh your office furniture, rather than it going to landfill, while businesses in the FMCG market are looking at ways to redesign products so they can minimise the use of virgin material.

We are great at accumulating ‘stuff’, and apparently up to 80% of the products made are thrown away within the first 6 months. As a society, we have gotten used to wanting the latest trend and another bit of kit, but this cannot be sustainable. All these products have used other materials to make them and there is not an inexhaustible supply. Think about the opportunities; we are happy to download music and no longer own CDs, therefore eliminating (or at least significantly reducing) the production of plastic discs. So what else could we do? ■

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Liz Allen
Environment consultant

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THE EVOLUTION OF YIELD IN CORN

*Dr. Ronnie Heiniger
North Carolina State University*

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.

Why we should all get off the banana shortage bandwagon

Reports of an imminent global banana shortage are overblown and self-serving, writes the International Institute of Tropical Agriculture's Rony Swennen and James Legg...

Western consumers purchase standardised agricultural products as this seems to be the guarantee for high quality. Commercial agricultural companies therefore cultivate large fields with one single variety of a crop. The exposure of a single variety over large areas and during many years, is not just ecologically unsound, but the platform for the fast spread of a disease and/or pest. Typically this is then controlled with pesticides, often efficient in the short term only. And when the disease gets out of control, the press (trained as they are) write horrific stories as if all is lost and famine is at our front door.



The \$11 billion industry of exporting bananas is a typical case of how one disease affecting the single export variety in some regions gets worldwide attention, and how a group of scientists and the press, in an alliance to serve their own interests, tell a story that doomsday is tomorrow and bananas are about to become extinct. In their story, they ignore the huge diversity of banana varieties and different banana cropping systems maintained by smallholders as a staple crop. So, while the export trade is in danger, as well as some of the locally consumed dessert bananas, there are no facts to show that bananas that serve as a staple food are susceptible and will go extinct.

Panama disease threatens Cavendish bananas

About 145 million metric tons of bananas are produced annually in over 130 countries and on more than 11 million hectares. Banana is the sixth most important starchy crop in the world after maize, rice, wheat, potato and cassava. Only 15% are exported, consisting of one single type of varieties belonging to the Cavendish group. These Cavendish varieties, all genetically similar, are cultivated almost in every country by smallholders but the large export plantations are based in a few countries in Asia, Latin America, and Africa.

Almost 70% of the entire export market is in the hands of only 10 countries and about 5 companies dominate the banana export trade. It is this Cavendish and linked business model that is threatened by Panama disease. This is caused by a soil-borne *Fusarium* fungus of which there is a severe strain called race 4 that kills the Cavendish plants and therefore destroys entire plantations.

An essential dietary component

Bananas are a staple food for 400 million people. Depending on the variety, they are cooked, boiled, steamed, fried, pounded, and even processed into a beverage. It has been estimated that nearly 400-500 varieties are cultivated by smallholders in their home gardens or small fields in association with many other food crops. In Eastern Africa, nearly 70 varieties of cooking and beer bananas are cultivated covering 50% of the permanent crop area, equivalent to around half of the total area under banana cultivation across Africa and representing 20% of the global banana production.

Bananas are therefore an indispensable part of life providing up to one-fifth of total calorie consumption per capita in Eastern Africa. The average daily per

capita energy consumption from bananas in this region is 147 kcal: 15-fold the global average and 6-fold the Africa average. In West and Central Africa nearly 120 varieties of plantains are cultivated, providing a staple food source to more than 20 million people. None of these cooking, beer, and plantain bananas are exported.

Panama race 4 started to affect banana export production in the 1990s with a major impact on the production in the Philippines, Indonesia, and Malaysia. In the meantime, the Taiwanese developed a set of Panama race 4 resistant Cavendish lines. Panama race 4 was inadvertently introduced to Mozambique, in the south-eastern part of Africa. It spread rapidly through 2 large commercial banana plantations where it occurred. Efforts to remove infected plants failed to control the spread of the disease within the plantations. A lack of resources together with insufficient political will to apply stringent containment measures, mean that Panama race 4 will continue to spread through susceptible Cavendish plantations in Africa, and the disease does therefore pose a threat to the future production of commercial dessert bananas in Africa. However, it is important that banana researchers, the media, and other banana stakeholders do not overstate the scale of this threat, not least since there is no current evidence to show that this disease will cause significant damage to Africa's most important banana crop, which is the food staple produced by non-Cavendish types.

Developing and integrating new varieties

The yield of plantains and cooking bananas in Africa is much lower than that of Cavendish bananas. These staple food banana types do not receive any pesticides as smallholders cannot afford it. However, the International Institute of Tropical Agriculture (IITA), in collaboration with different national and international partners, developed a successful plantain and cooking banana breeding program, reducing the impact caused by the major pests and diseases, which are nematodes, insects and fungi.

Several high-yielding resistant plantains (called PITA) and cooking bananas (called NARITA), jointly developed with the national banana program of Uganda's National Agricultural Research Organization (NARO) have been developed with yield increases between 200 and 400%.

These high-yielding varieties have now been distributed to 10 countries in Africa and 5 countries in Latin America. In addition, varieties with high yield in vitamin A have been selected.

In several locations, these new varieties have been integrated into the existing multi-cropping systems. The sustainable production of these plantains and cooking bananas is now based on linking high yield to better soil nutrient supplies, production of virus-free material and the large-scale distribution of improved planting material via the private sector. Part of this work received the Al-Sumait Prize for Food Security in 2016.

“About 145 million metric tons of bananas are produced annually in over 130 countries and on more than 11 million hectares. Banana is the sixth most important starchy crop in the world after maize, rice, wheat, potato and cassava.”

It is indeed true that the production of export bananas is under threat, as the Panama race 4 disease has devastating effects on the Cavendish variety that dominates the current banana export industry. It is also true that while this variety remains an important component of global banana production systems, we need to do the maximum possible to prevent race 4 spread between countries and continents. However, banana production systems are much more diverse and robust than the monoculture of industrial Cavendish, and with the dynamic breeding successes that have been achieved by using the wide diversity of the banana crop, particularly in sub-Saharan Africa, the future role of the crop in our food systems remains bright. Bananas are here to stay, and we should look forward with relish to many more days, months, and years of eating this wonderful, healthy yellow fruit. ■

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Rony Swennen
Banana Breeder

James Legg
Plant Health Specialist

International Institute of Tropical Agriculture (IITA)
www.iita.org

Exeter University tackles banana supply chain threat

The future of the UK's favourite fruit hangs in the balance, but researchers from Exeter University are tackling the threat to the banana supply chain...

Researchers at the University of Exeter have been awarded £1.2 million to investigate the resilience of the UK's banana supply. Bananas are the most popular fruit in the world by production. More than five billion bananas are purchased in Britain each year, and the UK accounts for around 7% of the global export market. Bananas are so important to the global economy that the EU and USA have fought trade wars over them.

Now, the impacts of climate change, emerging plant diseases, and economic uncertainty threaten the banana supply chain, potentially impacting diet and nutrition in importing nations, as well as the livelihoods of producers in the developing world. The University of Exeter project brings together biologists, ecologists, economists and social scientists with the UN FAO, NGOs and businesses to address the resilience of the banana supply chain from plantation to fruit bowl.

Bananas serve as an example of a major, wholly-imported commodity to the UK. Whatever the long-term result, the immediate impact of the UK's decision to leave the EU has seen a rapid drop in the value of the pound, leading to concerns over the costs of imports to the British consumer. The Consumer Price Index, stable from 2014 to the beginning of 2016, has risen sharply since the beginning of the year.

Food price rises are of particular concern because of the impact they can have on poorer families. Consumers have benefited from food price deflation since the summer of 2014, but this could well change. Justin King, former CEO of Sainsbury's, has suggested that supermarket prices will rise by at least 5% over the next six months, as retailers eventually pass on price rises. As pointed out by Mike Coupe, Sainsbury's current chief executive, we live in a globalised world from which cheaper alternatives can be sourced. Hence, the shock of our reduced purchasing power could reverberate through our trade networks.

Global Food Security: Bananas on the agenda

Economic resilience refers to the ability of an economy to absorb sudden changes, or shocks, and quickly return to normal. Resilience of the food system has been high on the policy agenda since the global financial crisis of 2008, which doubled food prices in the space of a few weeks. Global food prices declined again at the beginning of 2016, but have since increased. The danger of rapid price fluctuations is that planning becomes difficult; either producers are impoverished by unexpectedly low revenues, or consumers are faced with expensive food.

The negative impacts of non-resilient food systems are so severe that the UK government has launched a major research initiative, the Global Food

Security programme, to tackle the issue. The programme is funding projects that bring together academics, non-governmental organisations, businesses and policymakers, to provide the knowledge and guidance needed to strengthen food supply chains against future shocks. Recognising the interconnected nature of food supply, the programme will address the resilience of the UK food system in a global context.

"Our team of ecologists, biologists, economists, and social scientists will work closely with the United Nations World Banana Forum, the UK charity Bananalink, and major retailers, to address diverse threats facing bananas. Our aim is to determine how emerging diseases and other factors like changing climate will affect banana production, and to test new methods for disease control."

My colleagues and I at the University of Exeter are fortunate in leading one of the first projects within the Global Food Security programme. We have decided to look at a food that, while being incredibly popular, bears all the signs of being highly vulnerable to production shocks: the banana.

The UK is highly dependent upon imported fruit and vegetables, which make up 80% of the market. This compares with half of cereals and one sixth of meat and dairy produce. Fruit and vegetables are a key component

of a healthy diet, yet are often overlooked in studies of global food security, where the focus is on the major grains. Reliance on imported fruit and vegetables makes the UK vulnerable to instabilities in international production and supply, so jeopardising the resilience of the UK food system.

A cheap and healthy snack

This vulnerability is epitomised by the banana, the most popular fruit in the UK by consumption, and the most important fruit in the world by production. Bananas have significant health benefits, particularly in comparison with alternative 'snack' foods, such as cereal bars containing refined sugars, salt and fat. Bananas have a low glycaemic index and contain resistant starches rather than the 'free sugars' that contribute to diabetes, obesity and tooth decay. Bananas promote a healthy gut flora and consumption is linked to reduced tooth decay in children compared with more acidic fruit like apples and citrus. The banana is a cheap, healthy snack enjoyed by millions of Britons every day.

However, scientists are increasingly concerned for the future of the banana. Recent expansion of the virulent fungal disease *Fusarium* wilt, also known as Panama Disease, has highlighted the extreme risk facing the global banana trade. Though many varieties are grown around the world for domestic consumption, the international trade relies on a single susceptible variety, Cavendish. *Fusarium* wilt destroyed the previous export variety 'Gros Michel' in the 1950s, but now there is no alternative resistant variety waiting in the wings, nor any known control for the disease.

This strain of the disease emerged in Taiwan, covering Southeast Asia in the 1990s and spreading recently to Australia, Mozambique, and the Middle East. If this new strain of wilt reaches Latin America and the Caribbean, from where the EU (and US) purchase the vast majority of bananas, the most popular fruit in the UK could disappear from supermarkets. Not only would this dramatically alter UK diets, but producers and developing economies would be impacted with potentially far reaching consequences. Other pests and diseases are also emerging, many of which also lack viable controls.

Banana supply chain particularly vulnerable

The UK retail trade increases vulnerability in the system. The Fairtrade Foundation estimates that the consumer price of bananas has halved over the past decade, while production costs have doubled. Today, the wholesale import price of bananas matches the retail price: the margin is zero. Concern over social and environmental impacts of banana production has led to a significant market for Fairtrade and Organic-certified bananas. However, UK supermarkets have been engaged in a "banana price war", resulting in prices that are insufficient to adequately support producers, and reduce investment in improved production methods, development of new varieties, and social and environmental sustainability. If bananas are to remain a key component of the UK food system, analysis of these threats and mechanisms to counter them must be developed.

Our team of ecologists, biologists, economists, and social scientists will

work closely with the United Nations World Banana Forum, the UK charity Bananalink, and major retailers, to address diverse threats facing bananas. Our aim is to determine how emerging diseases and other factors like changing climate will affect banana production, and to test new methods for disease control.

Our research will complement development of new resistant tradable varieties and fundamental disease biology ongoing around the world. We will analyse how production shocks will affect the UK market, how the UK retail sector and consumers might respond, and how those responses could feed back to producers in the developing world. Through the World Banana Forum we will work with retailers, producer groups, and other stakeholders to produce strategies to increase the resilience of the banana trade to production shocks, and secure the future of the UK's favourite fruit.



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Norway's Arctic strategy: Innovation and sustainability

As M F Warrender writes, Norway's Arctic strategy revolves around making the region innovative and sustainable, economically and environmentally...

Now more than ever the Arctic (a region defined by its natural environment and resources), is facing the serious consequences of climate change. Since 1980, it has seen a 50% loss of ice cover in the Barents Sea, and with temperatures rising two to three times as fast as the global average; there is a risk that the Arctic Ocean may be ice-free in the summer by 2050.

This environmental fragility has not gone unnoticed, with many countries all over the world expressing concern for the Arctic and coming together as part of the Arctic Council. Established in 1996, the Arctic Council is a forum for environmental cooperation, and is now the most important arena for dealing with the common challenges facing the Arctic States (60% of the world's population). Norway, which has particularly played a leadership role in the Arctic Council, has now brought their Arctic Policy to the forefront of their priorities, according to Børge Brende, who has been the Norwegian Minister of Foreign Affairs since 2013.

"The Government is giving greater priority to business development in the north. We want to enhance the links between research and the business sector, with a view to ensuring that investment in research also creates more new jobs. Our aim is to develop North Norway into one of our most innovative and sustainable regions," he said.

Creating value, managing resources, confronting climate change

Norway is increasing the Armed Forces' presence at sea, enhancing their monitoring capacity, in order to maintain a presence in the Arctic, a region that holds such interest and responsibility. Norway's Arctic Policy's key aims are "creating value, managing resources, confronting climate change and fostering knowledge,"



states the Norwegian Ministry of Foreign Affairs, with the government giving priority to the following five areas:

- International cooperation;
- Business development;
- Knowledge development infrastructure;
- Environmental protection;
- Emergency preparedness.

These priority areas have been allocated NOK 3 billion in the policy's budget. Furthermore, "the government is proposing to intensify efforts in the areas of business-oriented research, infrastructure and emergency preparedness in particular." Alongside the policy's con-

tinuing projects from previous years such as Arctic 2030, 2016 brought many new initiatives such as:

- Maritime patrol aircraft and submarines to strengthen the Armed Forces' presence in the Arctic (Ministry of Defence, NOK 97.1 million);
- Enhancing emergency preparedness by lengthening the sailing season for the Governor of Svalbard's vessel Polarsyssel (Ministry of Justice and Public Security, NOK 18 million);
- Increasing the allocation for geological surveys in the Arctic (Ministry of Petroleum and Energy, NOK 115 million);
- Increasing the allocation for the Markom2020 project, which is further developing officer training and maritime vocational training in Norway (Ministry of Education and Research, NOK 20 million).

Norway benefits greatly from its connections to the Arctic, considering 80% of its seas are north of the Arctic Circle, and nearly 10% of its population live inside the Circle – a greater proportion than in any other country in the world. The Norwegian Arctic is experiencing a higher level of economic growth than the rest of the country. This region expects to see a 6-7 % growth in exports in the coming years. The man responsible for Norwegian foreign policies and the promotion of Norway's international interests, [Børge Brende](#), believes that "It is in everyone's interests that the Arctic remains a peaceful and stable region."

This statement highlights the importance of the Arctic Region not just to Norway but also to the world. The Arctic holds many assets and resources that numerous countries can heavily benefit from, such as year-round tourism, the major seafood industry, and abundant energy resources (an estimated 22% of the world's undiscovered oil and gas resources are thought to be in the Arctic).

Norway's Arctic strategy balances opportunity and responsibility

However, with major opportunities come great responsibilities, and Norway faces a duty to support the Arctic

in all areas, through responsible management and international cooperation. Its vulnerable environment is in urgent need of protection, with 15 million seabirds breeding around the Barents Sea, and large populations of polar bears and walrus. Many species and ecosystems in the north are vulnerable to both climate change and fast increasing human activity.

Countries must also strive to protect the region's indigenous people, including the Sami population, which totals approximately 80,000-100,000 people. The Ministry of Foreign Affairs is financing a project entitled "resource extraction and indigenous peoples – evaluating ethical guidelines", which is looking at guidelines regarding resource extraction, and at the possibility of cooperation with indigenous agencies and businesses on developing a ranking system in which companies are ranked according to how they fulfil ethical guidelines and interact with the local population. This, along with many other projects is striving to "promote a more results oriented Arctic policy."

"In a world full of conflicts and competition for resources, the Arctic stands out as a region where close people-to-people cooperation and dialogue across national borders is the norm," adds Brende, reinforcing the importance of Norway's role in this region. It is clear to see that Norway, along with the many other countries safeguarding the Arctic, is dedicated to following through with its promises, both economically and environmentally. ■

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Climate change in the Polar Regions: Past, present and future

How is climate change in Polar Regions affecting sea ice? Professor Hideaki Motoyama and colleagues at the National Institute of Polar Research investigate...

The Polar Regions have the largest amount of fresh water on Earth in the form of snow and ice. These regions also play an important role in the global water cycle and sea level changes. Areas of sea ice undergo considerable seasonal fluctuations, and sea ice contributes to the exchange of heat and energy between the atmosphere and the ocean.

The Meteorology and Glaciology Group of the National Institute of Polar Research, Japan conducts research in the fields of atmospheric science, meteorology, glaciology, sea ice science, oceanography, and paleoclimatology; in particular, the group studies the atmosphere (i.e., the troposphere and stratosphere), cryosphere, and ocean in the Polar Regions. Topics including the phenomena currently taking place, and past global

climate and environment are of interest to the group. To predict future change, studies on the mechanisms of changes in the Earth system are conducted mainly through field observations and remote sensing. In particular, the influence of human activity on climate is extremely low in Antarctica. Therefore, changes in the Earth system can be studied from this remote area. In this article, we introduce ongoing Antarctic research projects aimed at understanding the role of ice sheet and sea ice, which affect the climate, global water cycle, and sea level change in Polar Regions.

Recent research observations have clarified that past changes in the Antarctic had a significant impact on the global environment and they continue to do so. Therefore, it is indispensable to elucidate the mechanism of

changes in the Antarctic region as a subsystem, to understand changes in the Earth system and global environment, as well as predict future changes. The six-year scheme, “Japanese Antarctic Research Plan Phase IX”, started in 2016 by the Japanese Antarctic Research Expedition. Within this scheme, a project entitled “global changes and movements on the Earth system through Antarctic observations” has been launched as the main theme of the prioritised research project for Phase IX. We aim to promote advanced scientific research on Earth and space from a global viewpoint by combining other research categories, including general research projects, exploratory research projects, monitoring, and routine observations. The project is also designed to meet social demands and international research trends with respect to global environmental issues. This project consists of 3 sub-themes, of which our research group is actively involved in the implementation of the following 2 sub-themes.

“Recent research observations have clarified that past changes in the Antarctic had a significant impact on the global environment and they continue to do so. Therefore, it is indispensable to elucidate the mechanism of changes in the Antarctic region as a sub-system, to understand changes in the Earth system and global environment, as well as predict future changes.”

(1) Research of ocean-ice boundary interaction and change around Antarctica (ROBOTICA)

One of the solutions to elucidating fluctuations in the Earth system is the understanding of specific interactions between the atmosphere, ice sheet, sea ice, and the ocean in the Polar Regions. Furthermore, comprehensive investigations on the response of the ecosystem and solid Earth to events, such as sea-ice/ice-sheet fluctuations accompanying these interactions are necessary. Through this project, we aim to understand distinctive changes in the coast of East Antarctica, and to identify background environmental factors including ocean acidification. Specifically, we aim to make comprehensive observations using physical, chemical and biological methods to address the urgent problem of clarifying the effects of ice-shelf melting and sea-ice fluctuations on the atmosphere/oceanic system, the effects of global warming on glaciers/ice sheets, as well as the relationship between sea-ice dynamics and changes in the marine ecosystem.



(2) Antarctic paleo environmental reconstructions for unraveling variations in the Earth system

Understanding the role of Antarctica in global climatic change through studies of Antarctic environmental history is important. In this project, we reconstruct past environmental variations in Antarctica with timescales of 1,000 to 1,000,000 years, through glaciological and geological surveys from the inland to coastal regions. Ice core drilling exceeding depths of 3,000m has been carried out during recent inland observations. We investigate climate change of the Earth dating back to the past 720,000 years by analysing the latest ice cores. In this project, we aim to clarify the influence of the geomagnetic reversal phenomenon that occurred 770,000 years ago on the Earth system. For this purpose, cores of ice dating back to the past 800,000 years are required. To this end, we will start preparing for glaciological surveys, shallow ice core drilling, and the establishment of new inland stations for the subsequent deep ice core drilling. ■

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POLAR: Investigating the issues Arctic communities face

Polar Knowledge Canada, a new federal organisation, brings together indigenous and scientific expertise to look at the issues Arctic communities face today...

Polar Knowledge Canada (POLAR) is primed to set Canada at the forefront of the search for new knowledge of the Polar Regions. Based in Nunavut, the new federal organisation emphasises bringing together indigenous and scientific expertise to create that knowledge – and helping transform it into action on some of the urgent issues that Arctic communities face.

To Inuit and northern First Nations peoples, whose knowledge of the Arctic is built on centuries of experience and close observation, the Arctic is an intimate and familiar home. Scientists consider the Arctic one of the least studied and understood regions on the planet. Both groups are concerned at the significant changes they see occurring there. Whether in terms of sea ice, permafrost, or wildlife, the impacts are being felt today in northern communities – and also in distant corners of the globe, as the Arctic is connected to the rest of the planet via atmospheric and ocean currents.

Learning and sharing opportunities

The purpose of Polar Knowledge Canada is to create new knowledge that decision makers in northern and southern Canada can use to improve economic opportunities, environmental stewardship and quality of life for Northerners and all Canadians. Its headquarters, once construction is completed, will be at the Canadian High Arctic Research Station (CHARS) campus in Cambridge Bay, western Nunavut. With its state-of-the-art laboratories and generous public space, the unique facility is designed to welcome Cambridge Bay residents while ensuring that visiting researchers, educators, and students – from PhD level all the way down to elementary school – have ample opportunity to learn, and share information and perspectives.

POLAR's current research programme is focusing on 4

areas: (1) alternative and renewable energy for the north; (2) increasing baseline information to prepare for northern sustainability; (3) predicting impacts of changing ice, permafrost and snow conditions and how they affect shipping, infrastructure, and communities; and (4) improving design, construction and maintenance of northern built infrastructure. These will be revisited in 2019, and every 5 years thereafter. This regular reassessment and renewal will allow POLAR to adapt to changing research needs, and remain at the forefront of knowledge creation that matters in the Arctic.

One project that POLAR is supporting, SmartICE, brings together the expertise of Inuit hunters and ice scientists to make ice travel safer. SmartICE, which started in Nunatsiavut and has expanded to Pond Inlet, Nunavut, is installing thickness sensors in the ice along routes in places that hunters have identified as potentially unsafe. The measurements are sent to a website where they can be retrieved locally, in Pond Inlet's case by ice expert Andrew Arreak. Sensors have also been mounted on a qamutiik (sled), in order to take measurements while travelling. The technology is reliable and easy to operate, and can be passed from one community to the next.

Another key focus is helping northern communities move away from dependence on fossil fuels for electricity and heat. In the Northwest Territories, this means support for a community-led wood-pellet district heating project in Whati, and 2 community solar power demonstration projects in Inuvik. In Sanikiluaq, Nunavut, a wind monitoring tower will provide data for potential future wind power developments in the community.

Gaps in our Arctic understanding

The size, remoteness, and complexity of the Arctic means that despite decades of excellent research,



The main research building of the Canadian High Arctic Research Station campus in Cambridge Bay, Nunavut, during the midwinter darkness

there are still plenty of gaps in scientific understanding of the region. Those 3 factors also make Arctic research very costly. POLAR intends to create a world class hub for science and technology research in Canada's Arctic, with partnerships an integral part of its success.

"Most Arctic science is only possible because researchers work together, combining their resources," says David Scott, president of Polar Knowledge Canada. "And we've heard from research organisations from around the world who are keen on collaborating with Canadian researchers. They're excited about the possibilities that the CHARS research campus and our programme offer."

One of those is the US National Aeronautics and Space Administration (NASA). NASA's Arctic Boreal Vulnerability Experiment is using on-the-ground scientific teams, satellites, and aircraft to monitor and study environments in the arctic and boreal regions of western Canada and Alaska, which are changing rapidly because of a warming climate.

"We are trying to gain a better understanding of how these northern ecosystems function, how they might

alter under a changing climate and what that means for both northerners and the planet as a whole," says Mike Gill, Senior Science Officer with POLAR. "This will help answer such questions as: Will there be caribou available to harvest? How will the global carbon budget be altered under a warming Arctic and the potential release of methane? Will natural disturbances, such as fire, become an increasing threat?"

Answering these questions affects northerners directly, says Scott, and so it makes sense that northerners be involved in research at all levels. "We're looking to a future where more northerners are in the driver's seat," says Scott, "asking the questions, developing and doing research projects – and finding the answers they need." ■

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Polar Knowledge Canada

www.canada.ca/en/polar-knowledge/index.html

www.twitter.com/POLARCanada

Developing Decision Relevant Information for Adapting to **Climate Change and Variability**



www.climate-service-center.de



The Climate Service Center Germany (GERICS) was initiated by the German Federal Government in 2009 as a fundamental part of the German high-tech strategy for climate protection. Since June 2014, GERICS has been a scientific organisational entity of the Helmholtz-Zentrum Geesthacht – Zentrum für Material- und Küstenforschung GmbH.

GERICS delivers scientifically-sound products, advisory services and decision-relevant information to help support government, administration, and business in their efforts to adapt to climate change. We are located in the historic “Chilehaus” in Hamburg and employ an interdisciplinary team of natural and social scientists.



To read the digital ebook

Clear trajectory for Canada's clean energy strategy

By accelerating the transition to renewables, Canada's clean energy strategy is charting a clear course, as Natural Resources Minister Jim Carr sets out here...

When most people think of Canada's energy resources, they are likely to think about our vast stores of oil and gas. What they might not realise is that Canada is increasingly focused on developing our renewable energy resources as well.

As the world undergoes a historic transition to cleaner forms of energy, countries are positioning themselves to capitalise in a clean growth century. They're realising that climate action is now a competitive advantage. The environment and the economy are now two complementary elements of a single engine of innovation.

Canada's strategy is to leverage the fossil fuel resources we have today to deliver clean-energy solutions for tomorrow. This means making significant new investments in clean energy technology, accelerating its adoption at home and exporting it abroad.

We already have one of the cleanest electricity mixes in the world. Approximately 80% of our electricity comes from non-greenhouse gas emitting sources, primarily hydro (59%) but also nuclear, solar, wind energy, and biomass.

A first for solar heating

Recently, we announced plans to accelerate the phase out of coal-fired power from our electricity mix, which will significantly improve the air quality and the health of Canadians. This initiative will move Canada closer to 90% from non-emitting sources by 2030.

Canadians have already seen exciting developments in clean energy. Last winter, for instance, a community just south of Calgary – the Drake Landing Solar Community – became the first community in the world to meet its heating requirements entirely through solar energy.



Jim Carr, Minister of Natural Resources

Our government is working to accelerate the transition to renewable energy by investing in the research and development of innovative clean energy technologies, energy efficiency programs, alternative transportation infrastructure, and electricity infrastructure interties that promote electricity cooperation across our vast nation.

Smart grid technologies

Since 2001, our renewable energy programs have supported almost 5.4 gigawatts (GW) of new renewable electricity capacity and reduced greenhouse gas emissions in the electricity sector.

Our investments will support the development of clean technologies to increase the supply of renewable energy from sources such as solar and wind energy, as well as that of new and emerging sources, including wave, in-stream tidal, geothermal and biomass. Further, the use of smart grid technologies and grid connections will provide off-grid communities, such as those in the north, with cleaner energy.

Based on existing federal, provincial and territorial policies and initiatives, the International Energy Agency estimates that Canada's renewable capacity is expected to grow by around 13 GW over 2015-2021, led by wind energy (7 GW) and solar (2.7 GW). An additional 2.4 GW



of hydroelectric capacity could also come on line by 2021.

Progress on Canada's clean energy strategy

We are proud of the progress we've made, but there's still much more to do. Climate change is among the great challenges of our time, and we must make investments that reflect this reality. That's why we're investing an unprecedented \$180 billion in infrastructure. This includes green infrastructure investments of \$5 billion announced in the Budget 2016 and a commitment to provide an additional \$21.9 billion over the next decade. These investments will help support greenhouse gas emission reductions; enable climate change adaptation and resilience; and, help communities have clean air and safe water.

We're investing in new low-carbon and renewable power projects; expanding smart grids to make more efficient use of existing power supplies; and, deploying infrastructure for alternative transportation fuels, including re-charging/re-fuelling stations for electric and alternative fuelled vehicles. In order to meet our

emissions reduction target and grow the economy, we have also adopted the Pan-Canadian Framework for Clean Growth and Climate Change – a plan which includes a pan-Canadian approach to pricing carbon pollution, and measures to achieve reductions across all sectors of the economy.

While the transition to a lower-carbon economy may be long, its trajectory is clear. Canada is determined to seize the opportunities presented by the new clean energy economy by acting decisively and investing wisely, and creating jobs and opportunities for generations to come. ■

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Jim Carr

Minister of Natural Resources

Government of Canada

www.nrcan.gc.ca/home

www.twitter.com/NRCan

Sustainability through technology: The power of N

Popularism and bumper sticker science should not stop us tackling sustainability through technology, argues Ingenuity Lab Director Carlo Montemagno...

Ingenuity Lab is a unique organisation, designed and created to solve many of the grand challenges facing a modern world. Ingenuity Lab is a research organisation that focuses on the development and deployment of effective solutions to seemingly intractable challenges.

It works using a formal connect-and-develop process which involves building teams from members of government, industry, and academia. Central to this process is problem identification and the visualisation of the ideal solution. Often the identified problem is not the problem, but a symptom. Symptoms tend to be obvious, but quite often provide little insight into the most effective solution. With the recent intense discussion surrounding the newly imposed carbon tax in Canada, I think that it is time to extract ourselves from the emotion of the issue surrounding climate change, examine the impact of humanity on our environment, and identify the salient challenges needed to ensure global sustainability.

The unassailable fact is that the Earth's climate is changing. But the Earth's climate has been changing since its creation. The Earth's atmosphere, governed by complex, non-linear physical processes is easily perturbed. Changes in solar radiation, volcanic activity, deforestation, construction of cities and roads, large-scale irrigation and, yes, the release of CO₂ into the atmosphere, can all impact the Earth's climate. The

challenge is teasing out the climate variations caused by natural phenomena which we cannot manage from the impacts caused by anthropomorphic activities.

Firstly, we need to understand the impact of human activity versus natural processes on the climate. Then, isolate the impact of different human activities to further identify the effect that each activity has on the environment, especially when many of the activities occur simultaneously. For example, the change in albedo – the amount of solar energy absorbed/reflected – caused by the expansion of population centres is usually accompanied by an increase in CO₂ emissions. Which of the two impacts is more important? Are their collective impacts additive or multiplicative? There are many questions yet unanswered. If we cannot clearly define and quantify the “cause”, how can we craft an effective solution?

Disagreeing with Malthus

The bottom line is that human activity has impacted the Earth's environment since our society transitioned from hunter-gatherers. In 1798, Thomas Malthus postulated that humans were quickly going to exceed the carrying capacity of the Earth and that the positive population checks of starvation, disease, and war were necessary. He also dismissed the idea that technological advances in agriculture would provide the solution to the Earth's resource limits. I hear echoes of Malthus in much

of the dialogue surrounding climate change. While no one is proposing eugenic behaviour for addressing man's impact on the environment, there is a distinct tenor in the dialogue that humankind must accept a lower quality of life and reduced opportunity for future generations. There is also the implied truth that the human race cannot address the challenges associated with man's impact on the environment through advances in technology. I soundly reject both premises.

When I was growing up one of my favorite TV shows was *Get Smart*. I always waited for the moment in the show when Maxwell Smart would use his shoe phone. It was hilarious because most people perceived it as ridiculous. The concept of portable communication was outlandish. Nine years ago when Apple introduced the iPhone, it revolutionised global communication. In just 30 years, the technologies of science fiction fantasy transformed the way we engage in commerce, deliver healthcare, and interact as people. It effectively shrunk the world, making the Earth a single village where virtually every voice can be heard.

Popularism politics and bumper sticker science

Unfortunately, not every voice should be heard at the same volume. The cult of personality has enabled individuals without the requisite gravitas to seed popularism politics and bumper sticker

PROFILE

science. By feeding personal prejudices, rational discussion has been kicked to the curb and has been replaced by intensely polarised emotion. Culturally, Canadians have an intense connection to the environment. I believe that it is fair to say that the wonder of nature is strongly woven into the fabric of Canadian society. This is why Canadians feel compelled to lead the charge against global warming and why Canada has acted to impose a significant tax on the use of carbon. The question that many are asking, both inside and outside of Canada is, is this an effective path for addressing the global warming challenge?

Canada is currently responsible for releasing approximately 1.6% of all of the global CO₂ emissions. The European Union, China, India, Russia, Japan, and the United States are collectively responsible for releasing over 70% of the global CO₂ emissions. It is doubtful that even a 50% reduction of Canadian CO₂ emissions would have any material impact on global warming. To have any real effect on global warming, CO₂ emission reductions must occur in concert with all six of the major emitters. Even with over 10 years of significant effort, it has not been possible to achieve a meaningful coordinated global response to CO₂ emissions. Acting in isolation will only stress the Canadian economy and place an unnecessary burden on Canadians without achieving the desired goal of reducing man's impact on global warming. There is a better path forward.

We must recognise that humankind has impacted and will continue to impact the Earth. It is our responsibility to access the Earth's bounty in a sustainable way. Our ultimate goal should be to consume each of Earth's resources within cyclic processes to maximise the utility of all of the

resources that we harvest. The economic reusing of resources would ensure their continued availability for future generations. Achieving this vision can only be accomplished through technological innovation.

Examining the challenge of CO₂ emissions you find opportunity. Let's flip our perspective; instead of labeling CO₂ as a waste product we should recognise it as a valuable raw material. Carbon is the foundation, the building block of all living organisms. At the very core of the global ecosystem, nature uses the Sun's energy to assemble all living organisms from CO₂. Visioning the solution to CO₂ atmospheric emissions, suppose we can generically insert our industrial processes within the web of nature's carbon cycle. We take the CO₂ which would normally be emitted into the atmosphere, such as from an electrical power generating plant, and instead, using light, repurpose the CO₂ into valuable products. Effectively we insert the carbon that would have been wasted and transform it into the fabric of our society. Ingenuity Lab is currently commercialising this new technology.

Using the power of N – inspiration from nature to guide the manipulation of matter using nanotechnology to build networks – Ingenuity Lab succeeded in replicating the natural process of carbon assembly and translated it into an industrial process. The process required learning how to convert light into the various chemical fuels of life and the ability to cheaply fabricate nano-compartmented systems to assemble an artificial metabolism that fixes and transforms CO₂ into valuable products. While not the total solution to the global climate warming challenge, it does pull back the curtain to display the possible. It shows that the potential for technological achievement is boundless.

Advancing sustainability through technology

We must consider the past technological achievements of modern man as governments assess the optimum strategy for addressing global sustainability challenges. These achievements speak loudly about the human potential for creative innovation. Canada needs to occupy the position of a leading global steward of the environment, but must achieve it as a champion of sustainability through technology. It is the path forward.

Set the stage for a bright future for coming generations by embracing the potential of the possible, as well as understanding that technological achievement can drive market forces that lead to a more sustainable world. World leaders need to focus on providing an environment that supports the crafting of solutions to the global warming challenge and not at regulatory instruments as the primary weapon of choice. This strategy will accelerate economic and societal prosperity and has a much higher likelihood of long-term success. Canada, believe in the inventiveness and creativity of your citizenry. Provide the needed environment, and the people will deliver. The future belongs to the bold.

The logo for Ingenuity Lab, featuring a stylized 'n' in red and green above the words 'ingenuity lab' in a lowercase, sans-serif font.

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Improving building sector energy efficiency across the EU

The European Commission is promoting smart buildings and building sector energy efficiency as part of its recently announced 2030 strategy...

The recent adoption of the European Commission's "Clean Energy for All Europeans" Package, at the end of November 2016, has been greatly publicised and has broadly confirmed the EU's leading role in the fight against climate change.

This unprecedented initiative – in Europe and worldwide – encompasses various aspects of energy policy, from energy efficiency to renewables, from energy market design to governance. It has, in particular, made clear that energy efficiency should be the main driver towards a sustainable society. Only by ensuring that the potential for energy efficiency is effectively tapped in coming decades will we achieve the ambitious objectives set by the European Union's energy policy for 2030 and 2050, as well as ensuring that future generations live in a sustainable and safe society.

“Along with the energy performance certificate of buildings, already available EU-wide, the Smartness Indicator will also ensure that prospective new tenants or buyers can assess the real value of buildings and make the most informed choices.”

Building sector energy efficiency has big potential

When it comes to energy efficiency, one of the most promising areas of improvement has been, and remains, the building sector. Figures speak for themselves: Final energy consumption in buildings represents 40% of the total consumption and 36% of total CO₂ emissions in the EU. In addition, it is estimated that around 75% of the EU building stock is still energy inefficient. This is a figure which, considering the low rate of renovation (around 1% per year on average), is not likely to improve much in the coming years if no additional action is undertaken.

The good news, however, is that EU energy policies have proven extremely successful in promoting energy efficiency in the building sector. To mention only one example, new dwellings constructed today in the EU consume on average 40% less energy than those newly built 20 years ago, while meeting higher standards of comfort.

Building on this success, and in recognition of untapped energy efficiency potential, the time has now come to show even greater ambition. To address this challenge, the European Commission has proposed substantial enhancements to the EU energy legislative framework. This particularly applies to the Energy Performance of Buildings Directive (EPBD), which has been refocused and streamlined in order to foster cost-effective renovation of the EU building stock and to encourage the use of Information and Communication Technologies (ICT) and smart technologies in buildings.

Smartness matters

These enhancements have been long studied, assessed and analysed and are the result of intensive, open consultations involving interested stakeholders from the entire EU, with one main objective: Ensuring that building users and energy consumers will reap some benefits.

In this respect, ICT and smart technologies are particularly promising. They can give building users more visibility of their energy consumption and more control on buildings. They can monitor building energy and adapt to varying conditions, ensuring that optimal conditions in terms of comfort and energy efficiency are guaranteed at all times. They allow for the effective participation of buildings in smart energy grids, ensuring an optimal return on investment from buildings' energy assets. They enable remote monitoring main-



tenance procedures, which are a lot more cost-effective than periodic in situ inspections.

“When it comes to energy efficiency, one of the most promising areas of improvement has been and remains the building sector. Figures speak for themselves: Final energy consumption in buildings represents 40% of the total consumption and 36% of total CO₂ emissions in the EU.”

The list could be further elaborated, but the main point is that building smartness essentially translates into enhanced living conditions, decreased costs of operation and maintenance of buildings, and lower energy bills.

Combined with adequate support for wide-scale renovations, this would be beneficial to all citizens and could, in particular, alleviate energy poverty, which affects a significant number of households in the EU.

On these grounds, the European Commission has set a high priority on promoting the deployment of ICT and

smart technologies in buildings. In its proposal for amending the EPBD, the European Commission advocates, in particular, for the creation of a Smartness Indicator for buildings. This indicator will provide focused and synthetic information about building readiness for smart monitoring and management. Along with the energy performance certificate of buildings, already available EU-wide, the Smartness Indicator will also ensure that prospective new tenants or buyers can assess the real value of buildings and make the most informed choices. ■

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UltraStream300 from Power On Connections is one of the UK's fastest fibre broadband and telecoms network solutions for housing and high-rise apartments on new build developments.



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UltraStream300 makes it easy to add value to every project – without adding a penny more.

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- ▶ 1Gbps (Gigabits per second) fibre ready networks with infinite potential
- ▶ Fibre-ready homes – phone and broadband live when homeowners move in
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FIRS for Entertainment

Our networks support a Fibre Integrated Reception System (FIRS) for access to satellite and free to air TV services including 3D, HD, SkyQ and On-Demand viewing as well as digital radio.

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More reliable, dependable and faster than any alternative, Fibre-to-the-Premises delivers the speed and performance unattainable by copper networks. Even Fibre-to-the-Cabinet (FTTC) relies on copper for the last leg of delivery and is considered outdated due to reliability and speed degradation issues. The industry is moving fast, and FTTP is the only solution capable of meeting the needs of modern online lifestyles - both today and into the future.

* Actual speeds will depend on the service package selected.



Power On for Service

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Part of the UK's leading multi-utility solutions group, our collective capabilities are unparalleled in the industry. At the heart of Power On Connections is a set of core values reflecting our commitment to meeting all our customer's needs.

Our Customers – Skilled, motivated and attentive teams always focused on meeting your needs

Programme Certainty – Committed to comprehensive scheduling and achieving completion dates

Cost Certainty – Competitive quotations, fixed pricing and staged payments for easy finance

Speed of Response – Responsive and flexible from enquiry to connection working within your timescales

Benefits of FIRS

- ▶ Only one fibre network required
- ▶ All installed by a single supplier
- ▶ Saves on cost and space
- ▶ Live when homeowners move in

“Over time we expect ultrafast technologies to evolve towards providing gigabit speeds and above – 1000Mbps or more”

Ofcom Making Connections Report





Inside the ECA audit of the target EU budget spend on climate action

Phil Wynn Owen, member of the European Court of Auditors, gives an insight into the ECA audit of the target for the EU budget on climate action, its findings and recommendations...

In our recent report¹, the European Court of Auditors found that there is a serious risk that the EU's target of spending at least 1 euro in every 5 of its budget on climate action between 2014 and 2020 will not be met.

The EU has agreed that at least 20% of its budget for 2014-2020 should be spent on climate action. This target is intended to be achieved by incorporating climate action into the various policy areas and funds in the EU budget, a process called "mainstreaming".

In the European Court of Auditors' performance audit, we sought to determine whether the target to spend at least 20% of the EU budget on climate-related action is likely to be met and whether the approach employed is likely to add value.

Focusing on cohesion and CAP

Our audit work focused on the overall system established at European Commission level and particularly in 2 areas of shared management: cohesion policy and the Common Agricultural Policy (CAP). Together these areas account for two-thirds of the EU budget and three-quarters of the overall target for climate funding under the 2014-2020 multi-annual financial framework.

Between October 2015 and February 2016 we conducted audit visits in Poland on cohesion and the CAP, in Germany and Romania on cohesion policy, and in France and Spain on the CAP. We also carried out similar audit work for Horizon 2020, fisheries policy and the LIFE Programme at Commission level.

Overall progress has been made

Our audit found that ambitious work was underway and that progress had been made. However, there remains a serious risk that the 20% target will not be met without more effort.

The implementation of the target has led to more and better focus on climate action in the European Regional Development Fund and the Cohesion Fund. But in the areas of agriculture, rural development and fisheries, and in the European Social Fund, we found no significant shift towards climate action.

...but there is serious risk that the 20% target will not be met

According to the Commission, the share of funding dedicated to climate action has averaged 17.6% between 2014 and 2016. To reach the overall EU budget target by the end of 2020, we estimated that the rate of climate funding would need to be increased to an average of 22% for the years 2017 to 2020 inclusive.

Overall, the Commission² itself now estimates that 18.9% will be spent on climate action between 2014 and 2020, which would fall short of the 20% objective.

We found that Commission estimates are based on assumptions concerning agricultural spending on climate action, which include overestimation and which lack sound justification. We calculated that applying internationally established methodologies to agriculture and rural development planned expenditure would reduce its expected contribution by €33 billion over the period 2014 to 2020. This represents around 15% of the overall target.

Ensuring a real shift towards climate action

We make several recommendations to the Commission and Member States. These concern the need for a robust, multi-annual consolidation exercise to progress towards the 20% target, the need for comprehensive reporting and monitoring of results, and for there to be a realistic and robust assessment of climate change needs. We also recommend that overestimates in rural development spending be corrected, and that action plans be drawn up for areas that have fallen behind. Finally, we recommend that all potential opportunities to ensure a further, real shift towards climate action should be explored.

With spending in the 2014-2020 period still at an early stage, the audit largely focused on planned expenditure within the EU budget, and not on actual expenditure. We did not analyse non-climate-related EU budget spending, nor did we examine the potential adverse environmental effects generated by some EU budget support. Similarly, other climate related spending outside the EU budget was also beyond the audit scope. Therefore, the report does not include an assessment of the general effects of EU policies on climate, the performance of the EU against its 2020 and 2030 climate and energy targets, or the optimum level of EU climate funding.

ECA landscape review of EU Energy and Climate

We are currently carrying out a Landscape Review of EU Energy and Climate. Landscape Reviews are different from our audit reports and opinions.³ They are not audits, instead, they consider broad themes on the basis of the Court's research and accumulated knowledge and experience. In the Landscape Review of EU Energy and Climate we will aim to provide an overview on what the EU is doing within the field of EU energy and climate, drawing on the audit work we and others in the EU's Supreme Audit Institutions have done to date, as well as seeking to identify some of the main issues to inform debate and to help focus future audit work. With the European Commission having recently published its "Winter Package", energy and climate issues are likely to remain high on the agenda in 2017. ■

1 Special Report 31/2016: Spending at least one euro in every five from the EU budget on climate action: ambitious work underway, but at serious risk of falling short"

2 SWD (2016) 299 of 14 September 2016 accompanying the mid-term review of the multiannual financial framework COM(2016) 603 final.

3 The ECA published two Landscape reviews in 2014: "Gaps, overlaps and challenges: a landscape review of EU accountability and public audit" and "Making the best use of EU money: a landscape review of the risks to the financial management of the EU budget".

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Phil Wynn Owen

Member

European Court of Auditors

<http://www.eca.europa.eu/en/Pages/ecadefault.aspx>

[www.twitter.com/EUauditors](https://twitter.com/EUauditors)

Modernising Hungary's rail infrastructure: On the right track

As Adjacent Government highlights, the considerable investments have been made to modernise Hungary's rail infrastructure, benefiting transport across Europe...

Across the EU, rail is an integral part of transport. It plays a key role in addressing rising traffic levels and congestion, as well as fuel security and decarbonisation. European railways are also an essential part of Europe's economy and infrastructure, as well as a crucial means of exporting and importing goods.

In 2013, it was reported by the European Commission that more than 8 billion passenger journeys are made by rail each year. As well as transporting passengers, about 10% of all freight traffic across Europe is conducted via the railways, with an estimated revenue of €13 billion.

With a turnover of €73bn and 800,000 employees in the EU, the rail industry is critical to the effective functioning of the European economy.

In Hungary in particular, the railways provide access to other European countries for trade purposes. The country is in a key geographical position, which Hungary aims to take advantage of by improving connections to other European countries, through its rail network. In order to further boost rail infrastructure throughout the country, the government allocated 1.2tn forints (€3.9bn) of its 2016 budget to transport projects – including 790bn forints for rail line and urban rail projects.

Facilitating freight across Europe

At the [Hungarian Railways 2016 conference](#) in Budapest, Minister for Foreign Affairs and Trade, Péter Szijjártó said: "The development of Hungarian infrastructure is required to maintain the country's competitiveness, in which the railway plays a determinative role.

"The goal is for Hungary to be unavoidable and indispensable within Central Europe from a logistics perspective," he added.

During the event, Mr Szijjártó also highlighted the modernisation of the Budapest-Belgrade railway line to improve access to the Port of Koper. The government believes this will help to facilitate the transport of goods from the Far East to Western Europe, which is important to Hungary from a foreign trade perspective.

The government in Budapest is committed to developing the rail network in order to transform the country into an indispensable transit nation for transport on the east-west axis, as well as boosting efforts in international freight transport and improving the connection with the Trans-Siberian main line.

At the conference in Budapest, Minister Szijjártó also commented on the planned modernisation of the Budapest-Belgrade railway line. The project is expected to cost 550bn forints (€1.77bn) and is said to be moving forward in accordance with EU regulations. Following the modernisation, the line is to be expanded to two tracks, with trains on the line travelling at 160km/h. The railway line's axle load will also be increased.

[In 2014, The European Investment Bank \(EIB\)](#) provided €250m worth of finance for the implementation of Hungary's railway infrastructure rehabilitation and upgrading investment programme (2013-2016). The loan was intended to "help the Hungarian railways to become more competitive and attractive when compared to less environmentally friendly modes of transport, such as by road."

The funding was intended for numerous projects across the country, particularly those involving the improvement of tracks, signalling, telecommunications and bridges, as well as the modernisation of stations and passenger buildings. It also aimed to help increase accessibility for people with reduced mobility.



Image: © Tupungato | Dreamstime.com

A new chapter for Hungary's rail infrastructure

Improving the railways across Europe is something that the European Commission are committed to and have been focussed on for a number of years. In December 2016, the European Parliament and the Council of Ministers adopted the so called "market pillar" proposals of the Fourth Railway Package. The Fourth Railway Package is a series of actions that aim to make European railways more attractive, as well as competitive. The proposals for the Fourth Railway package were first adopted by the Commission in 2013, with the aim of delivering better quality and more choice in railway services in Europe.

Proposals for the package also intend to help European railways become more innovative. The recent agreement made by European Parliament, in particular aims to improve the performance of rail services to benefit passengers, with a gradual opening of the domestic rail markets.

Commenting on the announcement, EU Commissioner for Transport Violeta Bulc welcomed the agreement.

"This agreement opens a new chapter for European railways," she said.

"For too long, the rail sector had no incentives to adapt to customer-demand and as a result the market share of rail steadily declined. Gradual market-opening will improve the performance of rail services. This agreement will also create new investment opportunities and foster job creation in the sector. Finally, it should encourage Europeans to make a greater use of rail, contributing to our decarbonisation objectives. When railways become more attractive, everybody wins."

Once adopted, the Fourth Railway Package will complete the single European rail area and deliver on the Commission's agenda of a 'fairer and deeper internal market'. ■

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PAN-LNG Project: Developing Trans-European transport in Hungary

With funding from the Connecting Europe Facility, the PAN-LNG Project is developing a Trans-European transport infrastructure, starting in Hungary

MGKKE, the Hungarian NGV Association, developed the PAN-LNG Project for the liquefied natural gas (LNG) fuelling infrastructure, which has been selected in 2015 for co-finance by the INEA under the Connecting Europe Facility (CEF). The main goal of the project is to prepare the necessary infrastructure in Hungary for LNG-based transportation, to construct the first five filling stations and also establish a supply chain.

To increase its impact, in 2016 the PAN-LNG Project developers introduced further project proposals for the call of CEF 2015 Innovation, which were

eligible for a grant by the INEA evaluation team, and gained the approval of the European Commission. On that basis, nearly 40 new LNG-based compressed natural gas (CNG) vehicle filling points will be established by 2018 along the TEN-T corridors.

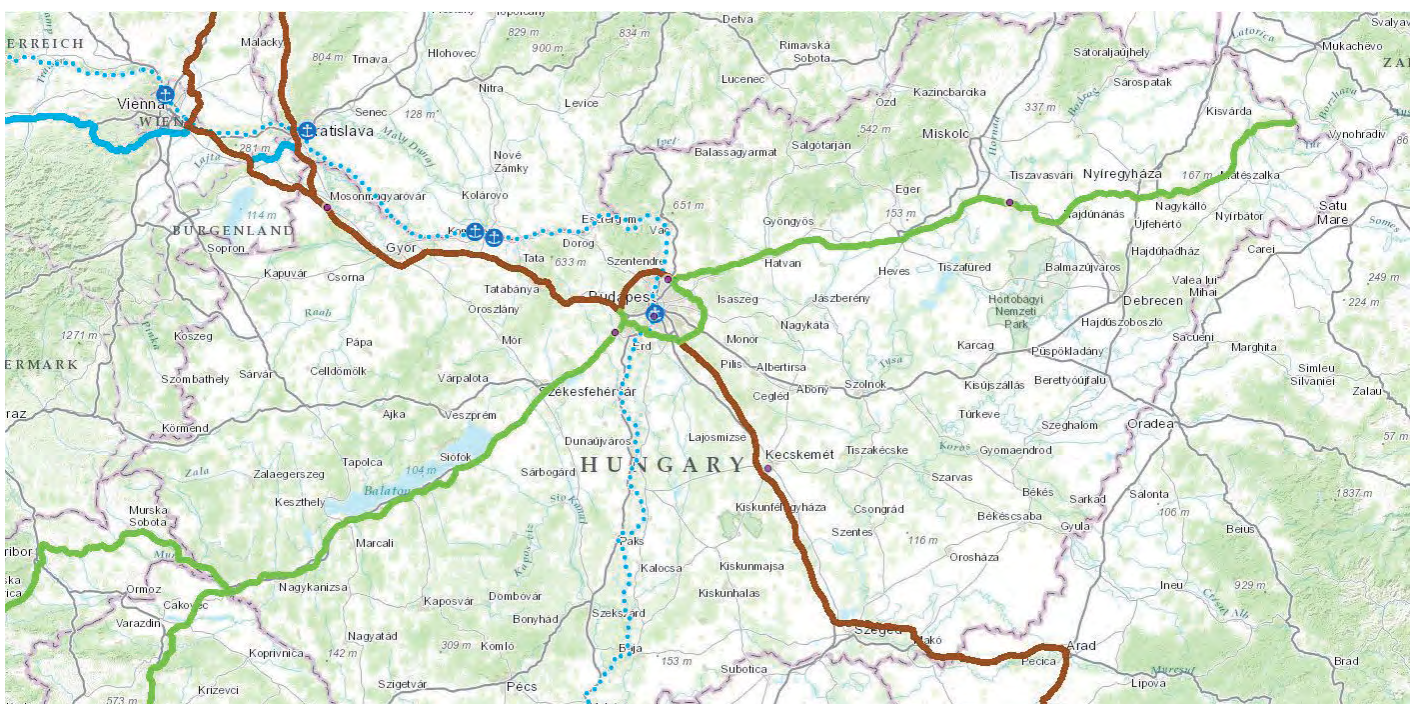
This will most likely boost interest in CNG and dynamically grow the number of motorists using vehicles powered by environmentally friendly fuels.

Expanding the network to shipping

We expect a similar breakthrough effect from the PAN-LNG-4-DANUBE

Project, which built the first LNG fuelling solution for shipping on the Danube, which will serve ships as well as trucks. In 2018, fuelling is expected to start at the middle point of the EU's longest inland waterway, the Budapest-based international port, which is also a tri-modal transportation centre. For the future, upgrading the railway will provide another opportunity; the non-electrified lanes can be revamped with soot-free LNG operation.

Of the propellants that are available today, bio-methane is proven to be the most advantageous, based on emissions of greenhouse gases. The



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feedstock is an organic material, which is not adding new carbon into the air, meanwhile the energy requirement is beneficial and is able to establish truly CO₂-free transport, even for heavy duty vehicles.

On the other hand, bio-methane can secure the cleanest possible burning in internal combustion engines: by virtue of the fact that it is soot- and sulfur-free, it has very low NO_x and

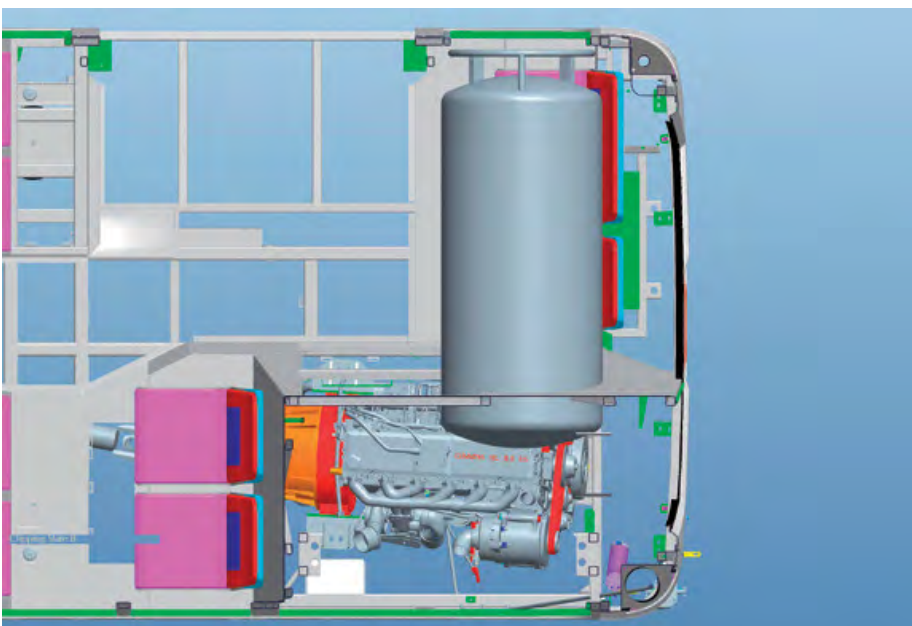
hydrocarbon emissions. The level of environmental load and its social costs are only one tenth of that of today's diesel vehicles.

PAN-LNG Project will fill in missing links

Thanks to funding from the European Commission's CEF fund for the PAN-LNG Project, the new LNG filling points for environmentally friendly transport will completely fill the miss-

ing links along the Mediterranean and Orient-East/Med, as well as the Rhine-Danube corridors in Hungary. The development will link the whole European LNG network, and at the same time create the opportunity to continue progress towards Greece and Turkey, increasing the use of LNG-based Trans-European transport.

The main beneficiary of the grant, Pannon Fuel Ltd (investors in the LNG filling stations), is working closely together with the long-standing Ikarus bus manufacturer to enter the market with a new, innovative LNG-fuelled city and intercity bus family. By obtaining type approvals for the modifications, the production of the outstanding seating ability alternative propelled bus can start in 2017. Based on the intention of Ikarus, the near-zero emission vehicle, which is far cleaner and smoother than the Euro VI diesels but has the same drive and range ability, will have better TCO (Total Cost of Ownership) than any other bus.



IKARUS

PannonFuel

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Projects, goals, investment: Germany's Federal Transport Infrastructure Plan 2030

Minister for Transport and Digital Infrastructure, Alexander Dobrindt, outlines the objectives of Germany's Federal Transport Infrastructure Plan 2030...

The Federal Transport Infrastructure Plan (FTIP) is the central planning tool for the development of transport infrastructure of the Federation. The new federal traffic route plan 2030 was developed and published by the Federal Cabinet, in August 2016. It has a value of €269.6 billion and includes more than 1,000 projects. A key area of the plan is the preservation of existing infrastructure with 69% of the investment of the FTIP 2030 focused on this. The removal of bottlenecks within the main traffic flow and on entrance roads is also a key focus.

Mobility in an efficient traffic system is a prerequisite for a dynamic economy and location is a first-class factor. As an export nation and as a transit and high-tech country, Germany depends on a smoothly functioning passenger and freight transport system. Mobility can only be achieved if sufficient investment is made available in the long term to maintain and expand modern and efficient transport infrastructure.

With my investment boost that is the case for the first time: the investment line for infrastructure rises to €14bn a year – permanently. Now this must be planned and built quickly. The plan is the blueprint for the investments of the federal government into the traffic routes. It specifies the projects in which the government will primarily invest over the next 15 years. Our focus is clearly maintaining our infrastructure. For too long, our roads, railways and waterways have been worn down.

With the new FTIP we will make 70% of our investment available to improve our roads, railways and waterways. With a €2bn programme we will also redevelop the road bridges. The FTIP 2030 is based on a realistic investment size of the federal government for the

transport routes. The total investment of FTIP 2030 is €269.6bn.

For the first time, we have involved the citizens in the establishment of a federal roadmap, with great success. Around 40,000 contributions have been received. In addition to financing, the acceptance from citizens is now one of the key prerequisites for the construction of roads and railways. It is important to discuss the how and why of projects very early – before the plans become concrete. A high degree of transparency and comprehensive possibilities for participation have been developed into the central requirements of the public on politics and administration, especially in the area of the planning and development of the public infrastructure. We have fully listened and complied with these requirements.

From over 2,000 project proposals that have been introduced into the FTIP, 1,700 were for federal trunk roads, approximately 400 for federal railway routes and around 50 on federal waterways. The evaluation procedure of FTIP 2030 has been substantially developed with relation to former federal transport infrastructure plans. The environmental effects of the implementation of the FTIP projects are in a separate environmental report, according to the requirements of the Strategic Environmental Assessment (SEA), which was presented and published simultaneously with the FTIP.

Due to the investment boost for FTIP, it now has a clear financial perspective for the first time. The projects' first priority needs to be implemented or started by 2030. An important criterion for classifying it in the "first priority needs", is the result of the viability study. The prerequisite for this is a generally high cost-benefit



Alexander Dobrindt, Federal Minister of Transport and Digital Infrastructure

ratio and a high contribution of the project to the reduction or elimination of bottlenecks. Other projects have been classified according to its spatial planning and/or urban significance in the first priority needs.

Infrastructure and mobility make the foundation for growth, prosperity and employment. Without mobility, there is no prosperity – this is a basic economic principle. With this investment we are able to have more budget, more useful finance and more private capital available.

The Federal Transport Infrastructure Plan, as an overall strategy for the development of transport infrastructure of the Federation and we use these resources efficiently. With a volume of €269.6bn and more than 1,000 projects, it is a strong infrastructure programme. We are focusing on 5 major innovations:

- We provide a clear financing perspective. The FTIP is a realistic and affordable overall strategy for the maintenance and construction of our infrastructure.
- We strengthen the principle of preservation before construction and new construction. In the overall show, we are thus reaching a record share of 69% for the modernisation of our infrastructure.
- We set clear priorities. Investments are made where the greatest benefit is created for people and the economy. This means: We strengthen main networks and entrance roads – and thereby increase the performance in the entire network.
- We want to eliminate bottlenecks in traffic. The new FTIP concentrates investments on new construction across the transport sector in order to resolve bottlenecks and thereby optimise traffic flow in the overall network.
- We have intensively involved the public. The FTIP 2030 is the first federal roadmap to be developed together with the public – from the basic concept through project proposals to the draft.

With the Federal Transport Infrastructure Plan 2030, we remain the number one leader in mobility – creating the conditions for the growth, prosperity and work of tomorrow. ■

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Alexander Dobrindt
Federal Minister of Transport and Digital Infrastructure

Federal Ministry of Transport and Digital Infrastructure
www.bmvi.de/EN/Home/home_node.html
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Technology has paved the way for a transport revolution

Intelligent mobility and smart technology will change how we travel. Simon White, PR and Communications Manager at the Transport Systems Catapult explains...

Technology has advanced significantly in recent years. In fact, the Digital Age has already dramatically changed how we live our lives, and it is now poised to create a revolution in the way we travel. However, beyond personal travel options, the opportunities the revolution will create in the built environment will come into increased focus over the next decade

By 2025, we are likely to see self-driving vehicles in regular use. These vehicles will disrupt the traditional car ownership model as vehicles become an on-demand service which fundamentally changes the design of urban environments. For instance, urban planners may no longer have to account for car parking, and architects could reuse space traditionally assigned to vehicle storage for home offices to accommodate greater home working.

Meanwhile, smart technology will increasingly manage the way we travel, combining transport modes into mobility packages which give access to the transport which best suits your circumstances. Imagine a seamless journey, planned via a smartphone app which arranges taxis, train tickets, bus routes and more – adapting the itinerary as you go based on real-time information about delays.

All you would have to do is tell your service provider where you want to go and what time you need to be there and the rest would be taken care of, using whichever transport methods best suit your needs.

Infrastructure

This will likely have a profound impact on infrastructure, particularly in urban areas. Much of the built environment is designed around current transport methods

and assumptions, so a significant shift like this could have all kinds of unforeseen consequences.

Out of town transport hubs could become a new feature allowing the transition from short range to long range transport both for people and goods. Current public spaces like railway stations and airports could be transformed to allow seamless transition between different modes of transport. Even roads could end up looking completely different to the way they do now as new technologies emerge.

Intelligent Mobility

Behind the scenes, Virtual Reality and Artificial Intelligence will enable better planning and use of transport infrastructure, as well as helping to design transport hubs like stations and airports. At the Transport Systems Catapult we're already working on technologies that will allow planners and architects to fully immerse themselves in their creations, which can then be optimised before costly real world implementation takes place.

These technologies will also improve the way we interact with transport, improving the customer experience and reducing stress. Artificial Intelligence is already bringing us personal assistants on our phones. We might find we are talking to our transport more and more.

Taken together we call these new advances in transport technology "Intelligent Mobility" – the smarter, greener and more efficient movement of people and goods. As the technology matures there is much to be gained in this new sector. The Transport Systems Catapult predicts the global Intelligent Mobility Market to be worth £900bn per annum by 2025.

A significant share of this market awaits those people, companies and nations who have the technical knowledge, entrepreneurial flair and most importantly, the skills to capitalise on this revolution in transport.

Previous investment in skills development and innovation in our leading aerospace and automotive has helped produce world-beating industries. With digital skills and transportation now converging, the digital economy is becoming synonymous with transport. However, many industries will be competing for the rare skill sets this requires, and they are in short supply – so it is vital that we begin investing in this area as a nation today.

The UK must now seize the moment to secure a pivotal role and drive global leadership in this area by investing in the development of highly skilled people who can develop new business models and new forms of transport that can truly revolutionise delivery and customer experience. The costs could be great if we don't act now, with £50bn of industry potentially lost if we do not keep up with the skills required for this revolution.

A shared vision across industry sectors, academia and government, will be vital. Not least because this new generation of transport professionals will need to be able to work across different disciplines, including planning and building design, rather than focusing on areas such as rail or automotive if we are to gain the full benefits offered by these revolutionary technologies.

With these things in place, we can see a very exciting future in the world of transport. ■

You can read the TSC's recently published Intelligent Mobility Skills Strategy at ts.catapult.org.uk/imskills

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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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The Erasmus+ review: More than a European funding programme

Michael Gaebel, Director of Higher Education Policy at the European University Association, highlights the upcoming European Commission Erasmus+ review and areas for improvement, revealed in a new EUA report...

The European Commission's Erasmus+ Programme is of major importance for European higher education institutions. Like its predecessors, it provides funding for international staff and student mobility, inter-university cooperation, and wider engagement with employers and society. It also stimulates the development and spread of innovative practices, contributes to policy making and, by doing so, underpins the building of European-minded citizens and a united Europe.

“Erasmus+ is much more than a European funding programme. If its designers get it right, it could prove to be not only a safe long-term investment in international exchange and cooperation in higher education, but it could underpin European integration and innovation – not to mention boost international recognition.”

While the importance of this programme is uncontested, an issue for scrutiny is whether and how it can be improved. As the programme is set to expire at the end of 2020, this question is currently up for debate. The Commission launched the midterm review of Erasmus+ in early 2016 and will hold a public consultation in March of this year. The results, expected out in December, will be the basis of the development of a new programme.

The European University Association (EUA), representing more than 800 universities that together enrol 17 million students, held its own consultation on the matter, asking its members to provide feedback on their first-hand experiences with Erasmus+. The Association recently published its [report and initial conclusions](#) on how the Commission can improve the programme.

Erasmus+ report spots room for improvement

From the report, some needed improvements clearly

emerge: The rules and processes for application, management and reporting have to be further simplified. Changes from the previous programme, such as the move towards paperless processes and new support tools, are a step in the right direction. However, more needs to be done to relieve heavy administrative burdens and to better the tools already in place.

Furthermore, universities widely acknowledge that Erasmus+ is insufficiently funded. Under some actions, the number of grants simply needs to be increased as success rates fall well below 20%. This is unacceptable given the enormous amount of time and work that goes into applications. As most higher education institutions in Europe are funded by taxpayers, failed applications translate into wasted public money. The complex differences between the economic situations of the various member states also need to be taken into consideration as this too can have an impact on participation.

On a brighter note, the EUA findings point out that Erasmus+ came with a number of improvements compared to its predecessor programmes. These include a more streamlined and transparent programme structure, as well as better opportunities for cooperation and exchange with universities outside of Europe, and with non-university entities. This provides a solid foundation for further improvement.

Funding with flexibility in mind

Importantly, when addressing these issues, the Commission should consider shifting environments. Recent challenges, such as war in Europe's neighbourhood, massive increases in refugees and asylum seekers, as well as the UK's imminent exit from the Union, require an active response from higher education and research institutions. While such events cannot be foreseen, EUA



has long stressed that the programme needs to be designed with flexibility in mind.

“Furthermore, universities widely acknowledge that Erasmus+ is insufficiently funded. Under some actions, the number of grants simply needs to be increased as success rates fall well below 20%.”

Erasmus+ is much more than a European funding programme. If its designers get it right, it could prove to be not only a safe long-term investment in international exchange and cooperation in higher education, but it could underpin European integration and innovation – not to mention boost international recognition. In addition, Erasmus+ has the capacity to foster civil society exchanges with countries and regions with which official relations are difficult – and this can be quite an asset in

turbulent times. All in all, for one of the smaller items on the EU budget, Erasmus+ holds the potential for an impressive payoff. ■



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How adolescent experiences influence adulthood: The Life Study

The Life Study is investigating how our adolescent experiences influence adulthood by following the lives of individuals over the course of 30 years...

The data structure of the Life Study offers unprecedented insights into an individual's life-course, from youth to middle adulthood. Sustainable and prospective policy strategies target youth as an investment into the future of our society. Yet, even though policy makers set evidence-based standards, there is little scientific evidence on how adolescent experiences influence later life, in early and middle adulthood.

Comprehensive longitudinal studies are crucial, although the high implementation costs might be discouraging. The Life Study is based on over 30 years of collected individual data resources and follows approximately 1,600 German life-courses from adolescence to middle adulthood. Analysing this data corpus might reveal unexpected potential, uncovering causal relationships between variables over time. Moreover, the intergenerational design of the Life Study allows for investigating whether attitudes and personality are transmitted from one generation to the next, i.e. from grandparents to parents, from parents to their children. This may help to understand the process of social inheritance, especially concerning poverty or risk behaviour. Furthermore, those analyses might help to design strategies to reduce negative effects of this intergenerational transmission process.

The Life Study

In the late 1970s, Helmut Fend and his research team started a research project on the life-courses of 12-year-old German adolescents (the main cohort) from rural and urban environments. This target group has been interviewed annually up to the age of 16. Additionally, parents (the parent cohort) and teachers were surveyed twice. Almost 20 years later, in 2002, the first follow-up study was conducted in order to understand the consequences of youth development in adult outcomes. In 2012, approximately 1,600 former adolescents participated again in a second follow-up study at the age of 45. Since many of the former adolescents have their own children (the child cohort) now we are also including their offspring in the second follow-up survey.

And what do the analyses show?

The Life Study shows that parents transmit attitudes, values and political orientations to their children. Despite the progressing pluralism of values, the study shows that there still remains an intergenerational continuity of attitudes and values. For example, we found a transmission of parenting styles: parenting beliefs as well as parenting practices. Participants in the Life Study adopted the parenting styles of their parents when they had children themselves. But this intergenerational continuity of parenting depends on warmth and acceptance in the parent-

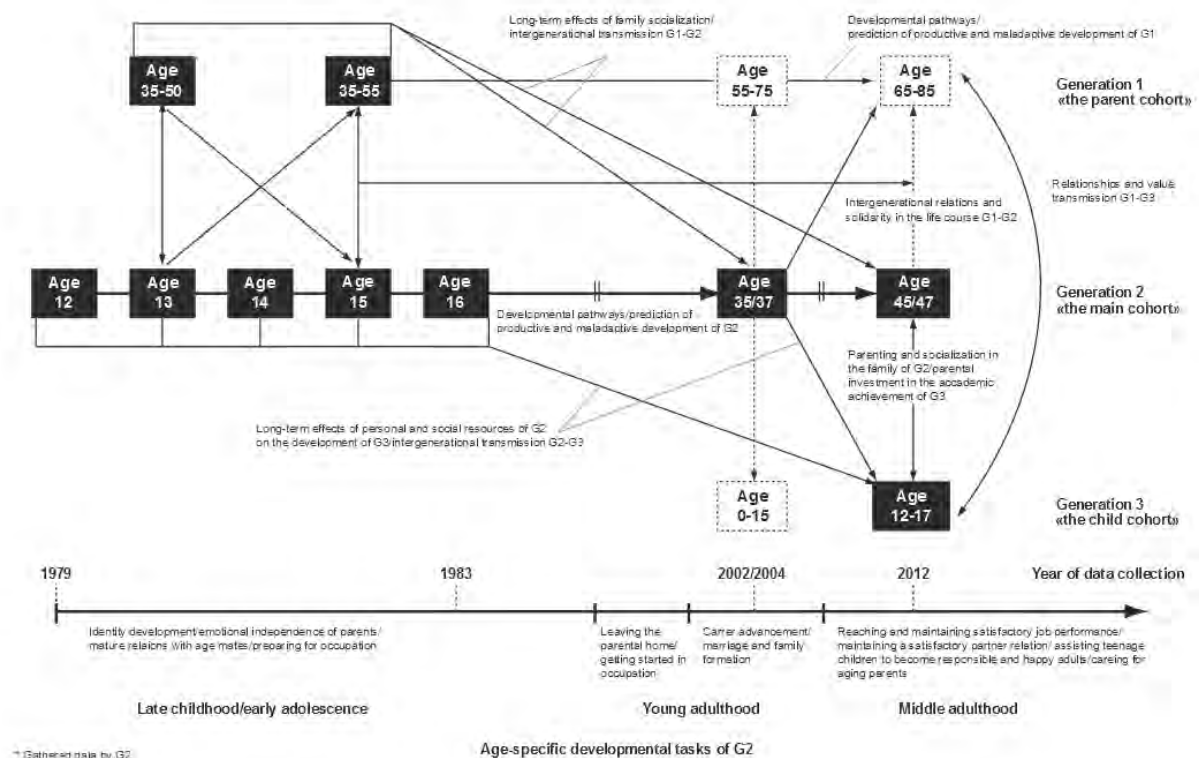
child relationship. The parent-child relationship is also relevant for the transmission of political orientations over three generations.

These transmission effects might explain enduring social inequality. The Life Study revealed that cultural capital – namely educational habits such as reading – is handed down from parents to children. Despite educational expansion, whether children have access to such familial habits is still important for educational attainment.

On a broader level, the intergenerational design of the Life Study also enables us to compare and trace transitions of pedagogical cultures in society. Helmut Fend and Fred Berger depicted a clear shift towards a more humane school culture within these 30 years – a shift they also found in parenting practices within the family.

Adolescent experiences influence adulthood

The long-term data of the Life Study allows for us to examine change and stability in personality variables over the course of life. Our results revealed that self-esteem, one of the most important dimensions for productive life and subjective well-being, is rather stable over 30 years. However, we also found that the development of self-esteem over that time is influenced by external factors, particularly income



and socioeconomic status. Therefore, low self-esteem of adolescents might be compensated for during the course of life.

In addition, the development of achievement orientations in school is rather stable. Adolescents with higher achievement orientation in school also showed higher achievement in middle adulthood at work. Furthermore, a positive and stable school climate in adolescence can enhance achievement orientation in adulthood. Therefore, school experiences are of high importance for the development of achievement orientations, particularly for low-achieving students.

Some interesting results can be identified when analysing timing patterns of romantic partnerships and the quality of the relationship in marriage. We found that marriage and a long-term partnership are still predominant. While personality characteristics like sociability are influential in early partnership experiences, structural aspects such as educational level are more important for later, more institutionalised, partnership experiences.

Positive peer relationships and first romantic experiences in adolescence predict the quality of the relationship in marriage. While bad experiences, from parent-child relationships and from parental divorce, influence the quality of the relationship in marriage at age 35, this influence disappears by the age of 45.

What can we learn from this study?

Adolescence matters – even for middle adulthood. Experiences in schools, families, and with peers during adolescence, regardless of whether they were good or bad, are important for the development of young people. On the one hand, positive experiences can be identified as resources that help to deal adequately with various challenging situations. On the other hand, stress from particular life-events are risky but might be compensated for in young and middle adulthood. In further analyses, we will investigate if there are similar life trajectories for boys and girls, if additional factors influence development over 30 years, and how mechanisms of intergenerational transmission work.



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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-

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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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<https://brocku.ca/social-sciences/departments-and-centres/child-and-youth-studies>

Developing MBA students: The leaders of tomorrow

UK business schools and businesses should work together on developing MBA students and their careers as future leaders, writes AMBA Chief Andrew Main Wilson...

As the global labour market becomes increasingly heated and economies remain an uncertainty, employers need a new breed of leader to launch and execute future-proof strategies. Businesses and business schools have to work together to rise to the challenge of finding – and developing – the global leaders of tomorrow. At the Association of MBAs (AMBA) we passionately believe that MBA graduates represent some of the brightest and best postgraduate future leaders.

In March last year, I had the opportunity to interview Paul Polman, CEO of one of the world's largest employers, Unilever, and he told me: "The moment you become a good leader is when you realise it's not about yourself – investing in others, society, and what I call the common good, is when you make an investment in yourself to prosper.

"The basic skills MBAs need are integrity and hard work – but our volatile, uncertain, complex and ambiguous world needs different leaders with a high level of awareness, engagement, humanity and humility."

This is something I feel very strongly about and an area in which our network of 244 world-leading business schools are trailblazing.

The role of business schools in developing MBA students and their careers

In 2016, AMBA surveyed more than 2,000 of its members in a bid to define and address these skill gaps. Respondents came from 104 countries: 51% live and work in Western Europe; 54% had completed their MBA and the remainder are still studying.

Among graduates, 82% are employed, 17% are not employed, but looking for work and 2% are retired. The

largest majority of respondents (18%) work for organisations with very high turnovers (more than £5 billion), and 14% work for organisations with small turnovers (less than £1 million).

The study revealed that 88% rated their MBA as 'excellent' or 'good'. But it showed scope to include more contemporary business topics such as big data, sustainability and digital marketing in MBA curricula – topics that MBA students and graduates believe will be in high demand from employers. Almost three quarters (73%) said 'greater networking opportunities with employers' and 54% said 'more contemporary business topics and 'more real-life company based projects', might have enhanced graduates' career options.

Why collaboration between business and business schools is key to further help develop leaders

Business schools, businesses and the AMBA have a lot of work to do together. Schools have great curricula but start-ups are struggling, so we need to work together to create value for graduate entrepreneurs. Strong links need to be developed between business schools and venture capitalists to prepare students for dealing with start-ups. It's not just about students having an entrepreneurial mindset, but also understanding how to create a win/win situation in which investors can help start-ups survive and grow.

Some Fortune 100 companies are involved in government-level input into strategy and curriculum design. Some IT companies are working with governments in the developed world to facilitate better provision of data scientists, for example. But generally, I think corporates could be used even more by business schools when exploring populist trends which can be used to inform curricula; there is more work to do to make



courses more flexible and agile to reflect an incredibly fast-moving business environment.

For employers, the priority is to get the best MBA candidates. The relationship with schools completely depends on the extent to which the schools are responding to their needs directly.

The good news is that research conducted by AMBA's strategic partner GMAC, surveyed 748 employers and found that 84% planned to recruit MBAs in 2015, compared to 74% in 2014. The same report found that the MBA was the most sought after post-graduate qualification in the opinion of the employers surveyed.

How AMBA works with business schools

As part of AMBA's employers' strategy, we work closely with MBA recruiters, MBA students and graduates, as well as the careers and alumni teams of AMBA-accredited schools, in developing strong links. These could be developed in the form of collaboration and idea-sharing through recruitment thought leadership articles,

physical conferences on trends in MBA recruitment, or in practical ways, such as recruitment promotions, physical and online careers fairs and an innovative Career Development Centre – for our community, complete with careers advice and employer database, job ads and much more.

The onus, however, is on employers and business schools to join forces and build recruitment strategies together, to find areas of collaboration, ensure their network of talent is future proof, and the content and design of MBA programmes across the world are relevant, forward-thinking and thought-leading. ■

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Andrew Main Wilson Chief Executive

Association of MBAs (AMBA)
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“... the Hertfordshire MBA was perhaps one of the most enriching experiences of my life. What many new entrants do not realise is the wealth of experience that every single candidate brings with them to the classroom. We all have our own way of thinking and solving problems and what the MBA enables you to do is to open your mind to other possibilities... apart from learning about business management, you actually learn a lot more about yourself and become much more self-aware... This to me, has been the true value of doing an MBA.”

Usman Sheikh,
Director of Design and Experimentation,
Barclays Bank PLC.

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Dr Denise Dollimore

Director of MBA Programme

Visit the MBA website:

go.herts.ac.uk/MBA

We need to keep attracting talent to the public sector

HR managers need to focus on talent management and promoting the public sector as an attractive place to work, writes Sue Evans, President of the PPMA...

As the public sector takes on a new shape against the backdrop of perma-austerity and a post-Brexit Britain, people managers have a critical role to play in building organisations with the culture and capability to handle this extensive transformation. It is our skills that are fundamental in not only delivering but also driving successful change, supporting people on the front line and at the top of our organisations along the way.

“We must now continue to be creative and proactive in demonstrating what we do differently to support our organisations in a sector whose demands and needs are not only fundamentally different from what went before but will keep on evolving and changing. This is the only way in which we can continue to develop the role of HR in the public sector and ensure it remains dynamic, effective and fit for purpose in the 21st Century.”

However, faced with fewer resources to deliver the change agenda, HR leaders and their teams must change too. In fact, what is required is a wholesale behavioural change among managers and their teams, a new approach that adequately reflects the emergence of a new sector with different priorities, needs and objectives.

The skills required to deal with these changes vary but have more in common with their equivalent roles in the private sector than ever before. It is imperative that we build our capabilities in the digital arena, for example, in order to simplify processes and make cost savings by sharing data across departments and organisations. Collaboration and entrepreneurship are crucial values in a sector that has spent the last few years transform-



Sue Evans, President of the PPMA

ing and centralising to become commercially-minded enough to cope with ever-decreasing budgets.

We must continue to support skills development in those areas, both top-down and bottom-up, so that they become second-nature to the public sector people managers of tomorrow.

Talent management in the public sector

Reductions in funding as a result of last year's Spending Review have inevitably impacted the extent to which potential employees see the public sector as an attractive place to work. If we are to have the high quality public servants we need for the future, it's crucial that we review our pay and employee benefits propositions to allow us to compete with an increasingly buoyant private sector and to do the job of bringing in key talent.

Attracting younger people into apprenticeships must remain a priority for the public sector – in spite of the challenges presented by punishing budget reductions and the impending apprenticeship levy. And activities such as, the PPMA's Apprentice of the Year and Rising Star awards are specifically designed to support these efforts.



We need to promote the fact that the public sector is a place where people can put their skills and knowledge to work, take responsibility and solve big problems which have an impact on the quality of life of everyone in our communities. We must show that we are fair, adaptable employers who can offer the kind of autonomy and flexibility which people increasingly value as they balance their career with home and family life. We know this is important to our existing workforce, who are likely to have caring/childcare responsibilities, but also to our new generation of employees who work to live rather than live to work. This generation is as interested in corporate social responsibility and a work/life balance as financial reward.

A clear and relatable proposition

Our proposition therefore has to be clear and relatable for both today's and tomorrow's civil servant. As a sector, we are more commercially-minded and business-focused than ever before. We are at the forefront of HR in terms of our approach to knowledge and skills sharing, mentoring and work shadowing programmes. We are continuously and consciously having open, constructive career development conversations across all teams and departments.

We must now continue to be creative and proactive in demonstrating what we do differently to support our organisations in a sector whose demands and needs are not only fundamentally different from what went before, but will keep on evolving and changing. This is the only way in which we can continue to develop the role of HR in the public sector and ensure it remains dynamic, effective and fit for purpose in the 21st Century. ■

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Face your professional challenges head on

Professor Mark Priestley from the University of Leeds considers the options for professional career development in public administration...

No one said dealing with an ageing population, managing migration levels and stabilising levels of unemployment would be an easy task. But as someone seeking to make a positive impact on society, these are just a few of the challenges you may be currently facing in your career as a public administration professional.

As societal and economic trends shift, so do the demands on public sector professionals. These are the issues which you will inevitably encounter the consequences of in your job, as well as in your everyday life.

The strain on government resources continues to force your organisations to rethink the provision and nature of local and national services. Helping your team navigate through such challenges takes strong leadership skills, along with a high level of understanding of the economic environment and the ability to interpret policy which could have an impact on your area.

Career development options

Professional development is key to acquiring or developing these senior-level abilities and advancing to a role in senior public service. There are many options available to you, including an MPA Public Administration programme, which is the key professional qualification for the public and third sector.

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issues and broaden your expertise with international perspectives, equipping you for the next step in your career.

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How will the apprenticeship levy help close the skills gap?

The new apprenticeship levy could help address the skills gap in the UK, argues Penny Hydraulics' General Manager Jess Penny...

If you work within the UK's engineering and manufacturing sector, you'll be well aware of the industry's current skills shortage. Without a pool of top-quality talent to draw from, businesses of all sizes within the sector are struggling to expand due to them not being able to find the right talent to progress. What's more, with the very real possibility of the free movement of labour coming to an end through the UK's exit from the EU, it's never been more important for the country to invest in home grown talent.

Why the UK is suffering a skills shortage

Unfortunately, the UK skills shortage is not an easy problem to solve. Part of the problem comes from the way that STEM subjects are taught in our schools. While most students are aware that a solid understanding of maths and science can help lead to a good job, they currently aren't shown just how expertise in these subjects can lead to a diverse and interesting career.

Moreover, the UK has a serious diversity problem within the STEM fields, with women, ethnic minorities, and the working class being significantly underrepresented in industries such as manufacturing and engineering. This not only means that a vast pool of potential talent is unavailable to these industries, but also that they are missing out on the many benefits that come from a more diverse workforce.

Another very real issue with the way that STEM subjects are taught comes from the fact that much of what is taught all the way through university level is out of date before it reaches the classroom, due to unprecedented pace at which new technologies are changing the manufacturing industry. This leaves graduates with outdated skills, affecting their employability and only making the UK's skills shortage worse.

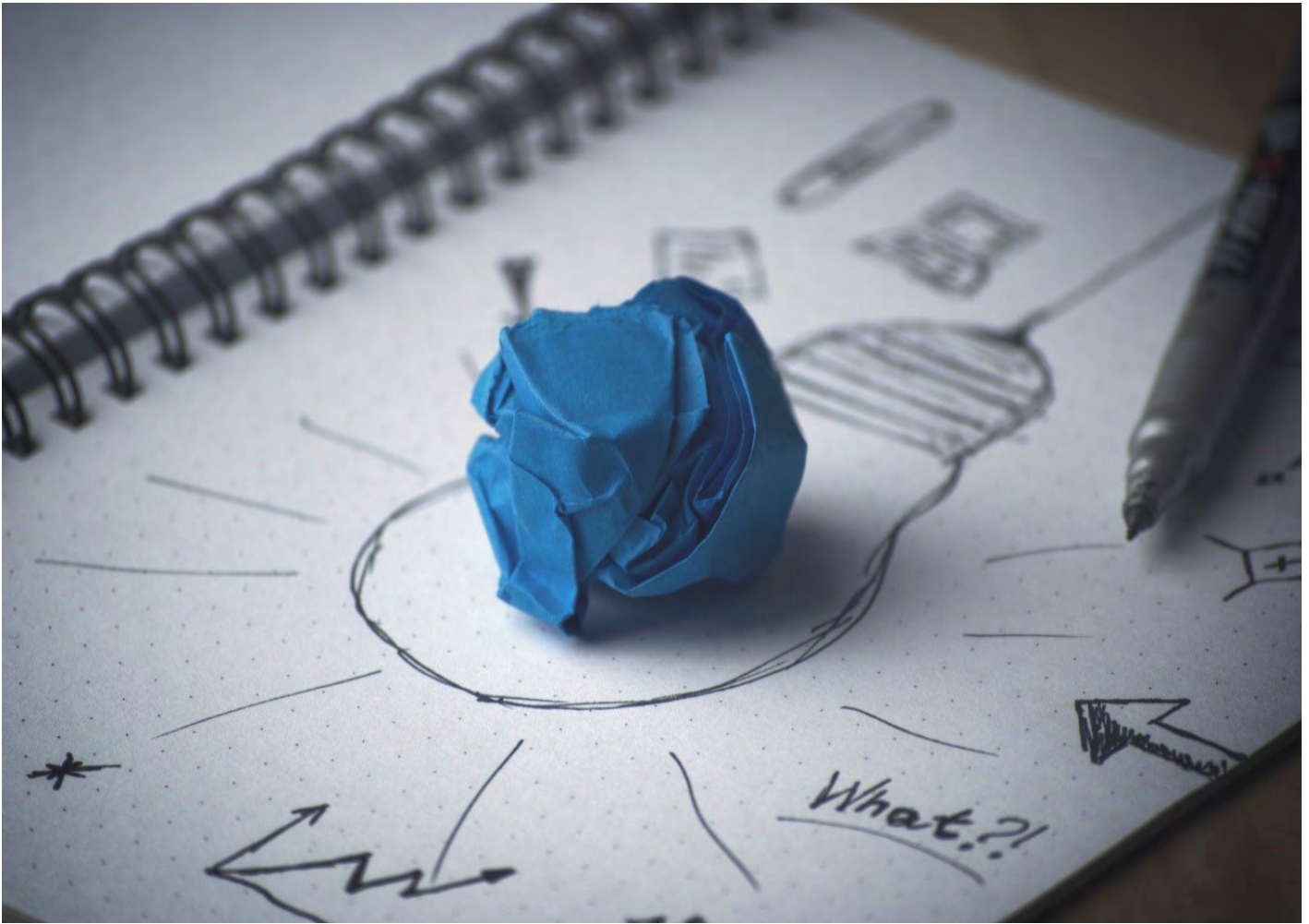
How the apprenticeship levy will help reduce the skills gap

Given the problems with the way the skills young people need to succeed in a career within the manufacturing industry are taught in college and university, apprenticeships have always been a great way of developing home grown talent to fill the skills gap. On-the-job training under an experienced mentor is arguably the best way to learn the specific skills required for the workplace.

"The way the sector is portrayed in the media is also going to have a big impact on its future. As an industry, we need to move away from the image of a man in oil-stained overalls and instead focus on the range of diverse roles that this career path can lead to. Organising partnerships with local schools and visits to your facilities where students can witness the kind of jobs they can expect to enjoy within the industry will go a long way to changing opinions on the sector for the next generation of talent."

In April 2017, the government will be introducing an apprenticeship levy that will require all employers operating within the UK, with a payroll of over £3m per annum to spend 0.5% of their total wage bill on apprenticeships. This is being put into place to improve both the quantity and quality of UK apprenticeships.

This levy is set to help close the UK's skills gap and help our faltering manufacturing industry compete with the world's other nations, as it will encourage employers to take a leap of faith and take on developing fresh talent. While this isn't going to solve all of the manufacturing industry's problems, the influx of thousands more apprentices each year is sure to have a positive impact on the industry.



Why employers need to make careers in the sector more inviting

While the apprenticeship levy is set to encourage employers to develop more young talent, this doesn't absolve the UK's manufacturing companies of all responsibility for the future of the sector. In order to attract the kind of talent that will secure their future in the global marketplace, businesses need to do their bit to get students interested in the manufacturing sector from a young age.

The way the sector is portrayed in the media is also going to have a big impact on its future. As an industry, we need to move away from the image of a man in oil-stained overalls and instead focus on the range of diverse roles that this career path can lead to. Organising partnerships with local schools and visits to your facilities where students can witness the kind of jobs they can expect to enjoy within the industry will go a long way to changing opinions on the sector for the next generation of talent. ■

“Unfortunately, the UK skills shortage is not an easy problem to solve. Part of the problem comes from the way that STEM subjects are taught in our schools. While most students are aware that a solid understanding of maths and science can help lead to a good job, they currently aren't shown just how expertise in these subjects can lead to a diverse and interesting career.”

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How do we drive forward gender diversity?

There's still a way to go to achieve true gender diversity in UK businesses, as Dr Jill Miller, Diversity and Inclusion Policy Adviser at the CIPD, the professional body for HR and people development, points out...

Few would disagree that enabling talented people to reach the top of their game is the right thing to do, irrespective of our identity. However, despite a clear business case for action and few business leaders likely to object to the fundamental principles and basic rights of equality, fairness and equality of opportunity, there remains a stubborn implementation gap if we look at gender diversity across the UK labour market. It remains frustrating how reliant we are on the business case for change to happen.

Why do we need more progress on gender diversity?

We know that diversity of outlook and background brings diversity of ideas. Gender diversity brings different perspectives to decision-making, enables challenge to the status quo, facilitates innovation, enables companies to better identify with their diverse customer base and better reflects the diversity of the workforce. A better gender balance at all levels of seniority will also help tackle under-utilisation of skills, enabling people to reach their potential at work, which is essential for making headway on the UK productivity gap.

Marked progress, but still a way to go

Action at a public policy level has made notable strides, but there's still a long way to go until the UK achieves a true gender balance. The government's commitment to increasing female representation at executive levels has made significant headway. The Lord Davies' review resulted in a significant rise in the number of women on FTSE 100 boards – up from 12.5% in 2011 to 26% in 2015, slightly exceeding the target by 1%. The number of all-male boards in the FTSE 100 has decreased from 21 in 2011, to 12 in 2016.

Building on this momentum, Sir Philip Hampton and Dame Helen Alexander are leading the subsequent



review, with aims of 'broadening the ambition to the entire FTSE 350 and raising the target to 33% of women on boards by 2020'. The Hampton-Alexander review will also look at gender diversity beyond board-level, to enrich the female executive pipeline. Within the FTSE 100 population the 33% target is extended to include executive committee roles and direct reports to the executive committee.

Although some may feel progress is not happening quickly enough, and there's been much debate about whether a voluntary approach is the most effective one to take, I feel voluntary targets are the way to promote more sustainable and long-lasting change. One risk of mandating action as part of a quota system is claims that a role appointment is due to a person's identity rather than their abilities and talent. Furthermore, legislating may promote compliance but is unlikely to prompt employers to address the underlying reasons for a lack of female progression or tackle the obstacles to having a strong female talent pipeline. A business' voluntary commitment to changing the status quo will ideally reflect a belief in the need for grassroots adjustments to enhance the attraction and career development of women at every level. However, if we are to see

ongoing change, the voluntary targets need to continue to be stretched.

Effecting change in non-FTSE businesses

The government targets are directed at FTSE companies, but if we are to truly make UK-wide progress, we need to effect change far beyond this group. It's likely that the approaches and decisions made by those in FTSE companies will affect how business is done more widely, but a wider approach to raising awareness together with the provision of practical guidance on how to make gender balance a reality can only help to speed the progress up. A business-led approach has so far delivered sustainable traction, but there is still a need to nudge businesses in the right direction, and give employers, particularly those without HR support, practical advice.

A significant proportion of the progress to date has been due to increasing representation of female non-executive directors. However, those with decision-making power in executive board-level roles also have the power to change the corporate culture, and effect the same change at all levels through the organisation. Yes, there has been an overall increase of women on FTSE 100 boards from 12.5% to 26% between 2011 and 2015, but women are represented much more in non-executive roles than executive ones. A 2016 Cranfield study gathered data from the FTSE 100 and found 31.4% non-executive roles were held by women (up from 15.6% in 2010), compared with just 9.7% of executive roles (up from 5.5% in 2010).

Attention now needs to be firmly set on increasing the gender balance in executive roles, and a separate target for appointment to executive roles would help here. Extending the scope of the Hampton-Alexander review to below-board roles by strengthening gender diversity in the immediate talent pipeline will also help to boost executive gender representation.

How do we drive forward the ambition in our own workplaces?

CIPD research has examined barriers to female progression to leadership roles. Employer action now needs to focus on removing these. This requires a genuine commitment and strategic approach to attracting and developing women throughout their

career. Actions that help create an open and supportive culture which supports gender diversity include:

- Unbiased recruitment and selection practices to attract diverse talent pools.
- Female role models in executive positions – their influence to inspire the next generation of female leaders shouldn't be underestimated.
- Good work-life balance policies that support female staff with caring responsibilities and enable flexible working at all levels.
- A greater focus on building female talent pipelines to ensure there's not a 'cliff-edge' point in female succession to the top. According to the HR professionals we surveyed, this should include having clear career paths and promotional opportunities for middle and senior management roles.
- Robust data on workforce composition that shows the proportion of female employees being recruited, developed and promoted at every level. Our survey data suggests that many employers don't monitor the profile of their workforce, with just 49% saying they monitor the gender profile of their workforce at all levels and 28% not monitoring at all. The transparency created through such monitoring can also help effect culture change.

Increasing female representation at senior levels is not about focusing on one group of employees at the expense of another. Achieving boardroom diversity is also about achieving diversity of background and outlook. Although female representation is a key part of that, it should be one part of a broader perspective which includes other elements of diversity. ■

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Dr Jill Miller

Diversity and Inclusion Policy Adviser

CIPD (the professional body for HR

and people development)

www.cipd.co.uk

[www.twitter.com/CIPD](https://twitter.com/CIPD)

Women as Leaders: Why women on boards matter

Alison Cutland, executive development partner at the Praxis Centre for Leadership, explains why women as leaders are benefiting business

On the face of it, things are looking positive for the number of women as leaders on boards in the UK. This year we have seen the number of women on FTSE 100 boards increase to 26%. This is good for the UK Economy – a detailed McKinsey report has estimated that if the market participation of women and men were equalised, then the annual GDP could be increased by at least 10% in 2025.

It's not all good news though. The Cranfield University School of Management report led by Professor Susan Vinnicombe, CBE, "The Female FTSE Board Report 2016, Women on Boards: Taking stock of where we are", identifies that there is much more to be done to ensure that women progress through the executive pipeline.

The report gives an insight into women's representation at executive committee level in the FTSE 100, showing that women hold only 19.4% of executive committee roles. So more needs to be done at pipeline level to ensure women will progress to top senior roles and reach a new target of 33% of women on boards by 2020.

Creating gender-inclusive workplaces

Recent research by Professor Elisabeth Kelan, Director of the Global Centre for Gender and Leadership at Cranfield

School of Management has focussed on the pipeline and the positive effect male middle managers can have. Her report "Linchpin – men, middle managers and gender inclusive leadership", showed which practices people in middle management positions can adopt to create greater gender-inclusive workplaces.

Men represent 70% of managers and leaders in organisations and have a major role to play to ensure that gender parity becomes a reality in organisations. There are still many "gender blind" practices in organisations which disadvantage women.

Cranfield School of Management's Professor Kim Turnbull James is one of the Directors of the women as leaders open programme, which sits within the Praxis Centre for Leadership Development programme portfolio. Many arguments for a lack of women at the top do not stack up. We hear things such as:

They're not in the pipeline – this may have been true in the past, but not now. By their 30s and 40s there are many women in the pipeline who are just not reaching the next level.

They jump out of corporate roles for family reasons. Research shows they go instead to other organisations more conducive to women.

There are a growing number of forward thinking businesses that have been addressing women's leadership for some years. Indeed many of the in-house programmes Cranfield runs with client organisations focus as much on organisational change and talent management to ensure that talented women do not get stuck in their careers, as they do on developing the women leaders themselves.

The women as leaders open programme at Cranfield offers senior women an opportunity to develop an understanding of how they might develop their career and time to reflect on and clarify their approach to leadership, in a world which still offers few executive level role models.

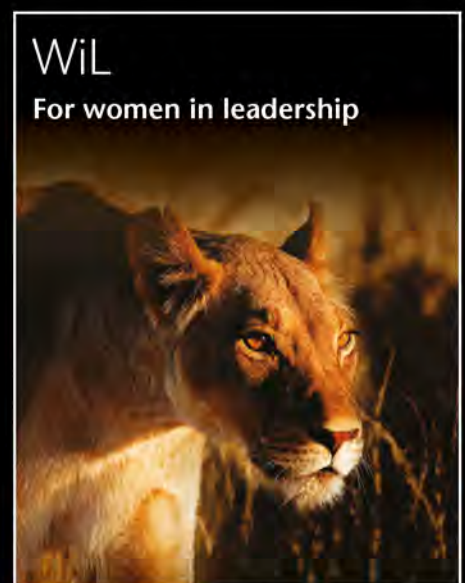


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Why we should invest in women leaders as agents of change

ICAEW speaks to Philip Haberman, Senior Partner and Founder of forensic accounting firm Haberman Ilett, about the importance of investing in women leaders



Philip Haberman believes in giving opportunities to employees with potential, supporting them in their career to achieve their true potential, reasoning: "What better way for them to learn, and to find out what they're capable of?"

When it comes to female leaders, the firm has sponsored three employees to attend ICAEW Academy's Women in Leadership programme (WIL) to date, which supports women aiming for senior management, partner or board roles.

"I found the programme has been really helpful for me and came at the right time in my career development. ICAEW's help, the quality of the instructors and particularly the closeness, honesty and integrity of my particular peer group, have all been so valuable to me," said Vikki Wall, a partner in the firm, and a former WIL participant.

"The WIL programme has real long-term benefits for potential female leaders," Haberman affirms. "The participant meets a group of external peers who see them as a leader, and this helps them to feel like a leader."

"If you consider the value these programmes bring to the individual and the firm, they pay for themselves. They help people move from one career stage to the next, and getting people ready for leadership secures the future of the firm. That's return on your investment."

Invest in women leaders' self-belief

Haberman is of the opinion that in order to be an effective partner, you have to feel like one.

"Real self-belief is fundamental to success in a business environment," he explains. "I need my team to go to their clients and tell them what they need to do with absolute conviction. WIL builds people's confidence. I've seen the difference in employees: They come back from the programme with a belief in themselves, and it resonates with clients."

WIL's particular strength is its focus on a participant's existing assets, seeking to refine and craft their individual leadership style. Haberman adds that its mentoring component is exceptionally powerful. He says:

"It can sometimes be hard to change the views of those who know you. A stranger is more objective, and you start from a position of strength, with no baggage."

Haberman concludes: "If you consider the value these programmes bring to the individual and the firm, they pay for themselves. They help people move from one career stage to the next, and getting people ready for leadership secures the future of the firm. That's return on your investment."

[Find out more about WIL](#)



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The importance of HR compliance

Tom Neil, writer at Acas, explains the necessity of HR compliance, and why it makes sense to go above and beyond your legal obligations...

As organisations strive to become ever more efficient and productive, the importance of having skilled and knowledgeable HR has become increasingly clear. For an organisation to achieve long term success, it needs to engage its staff and be able to resolve any issues that arise quickly before it has a negative effect on the organisation. HR compliance is a vital part of this.

What does HR compliance mean?

All organisations must comply with the employment law, rules and regulations where they are based. To achieve this HR needs to take a proactive approach to ensure that the organisation meets all of its legal obligations. Day to day this means being responsible for meeting health and safety requirements and ensuring that staff receive their contractual and statutory workplace entitlements. This can include following fair recruitment policies, preventing and tackling workplace discrimination and ensuring staff are paid what they are owed. Additionally, HR compliance requires staying on top of any employment law changes; gender pay reporting and rules for employing foreign workers, for example, will affect many organisations in 2017. Deciding how their organisation will meet these new compliance responsibilities is an ongoing task for HR.

Why is HR compliance important?

HR compliance is important because failing to meet your legal obligations will either be unlawful or illegal and can lead to industrial disputes or tribunal claims. In some circumstances, such as allowing an employee to work during the first week after they have given birth, such failures can also become a criminal law matter.

It can of course be difficult for an organisation to ensure that all their legal obligations are continually being met. While organisations may feel confident

about complying with some of their legal responsibilities, such as paying the national minimum wage, they often feel less confident about complying with others, for example ensuring they follow a fair recruitment policy that does not discriminate against someone according to equality laws. To ensure compliance, it is essential that HR are appropriately resourced to fully understand the organisation's obligations and are able to identify areas where further action and/or training is required.

Who is responsible for ensuring HR compliance?

While it is the role of HR to advise, strategise and implement policies and procedures to meet compliance requirements, who is actually responsible for ensuring HR compliance will vary depending on the structure of the business and the specific legislation involved. Typically the responsibility will ultimately lie with the owner, chief executive or HR Director. If legal action is taken it will usually be these individuals who are held responsible if their organisation is found to have failed to meet its legal obligations.

However, HR compliance should involve everyone in the organisation, e.g. fire safety training. HR should implement policies and procedures that are followed to ensure all obligations are met. Managers should be trained and equipped to know what policies and procedures are relevant to any situation and follow the correct process whenever required. Staff should be well informed about their expected responsibilities, behaviour and where they should go for support or to raise concerns.

Going further than compliance

While compliance is an essential requirement for all organisations, many can benefit by going even further



than their legal duties. Offering better terms such as more annual leave and offering office perks can show that the organisation cares about the wellbeing of its staff and helps it to attract and retain the best talent. There can also be business benefits. An organisation that offers a flexible working system that allows part-time working is good for employees, but can also suit the needs of the organisation by making it easier for them to deploy higher levels of resources at times of peak demand.

In the UK there is currently a lot of focus on the new gender pay regulations, with most focus being on what is required to comply with these new responsibilities. For many HR departments this will require liaising with payroll to calculate what their gender pay gap is, publishing the figures on the organisation's website and submitting evidence of compliance annually to the government. This will meet their compliance requirements, however an organisation should be willing to

go further than their compliance requirements. Where a gender pay gap exists, HR should look to understand why this is and consider what actions may fairly reduce this. Again being seen to be an organisation that has gone beyond simply complying with their obligations and actively taken steps to reduce their gender pay gap can be an excellent marketing tool to attract people to the organisation. ■

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Tom Neil
Writer

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Digital Single Market: Everyone should benefit

Businesses and consumers will benefit from the completion of the Digital Single Market, says European Commission Vice-President Andrus Ansip...

The Digital Single Market is the key digital strategy from the European Commission. Adopted in 2015, it has 16 key initiatives to be delivered by the end of 2016. The European Commission believes that completing the Digital Single Market could contribute €415 billion to Europe's economy each year.

As one of the main proponents of the Digital Single Market Andrus Ansip, Vice-President of the European Commission, spoke to Editor Laura Evans at the Web Summit in Lisbon in November. He addressed key challenges of the Digital Single Market and how it will benefit both consumers and business.

"2016 in particular was the year in which 16 proposals were to be delivered and concluded. The decision making process for the Digital Single Market will take some time, but I hope that 2017 will be a really good year for European citizens. At first we hope to abolish roaming surcharges, and we aim to do that by June 2017. This is to ensure people are able to use their mobile phone abroad much more and don't have to pay unnecessary surcharges.

"Thanks to our portability proposal, people will have access to their digital content if they are currently within a member state. I hope that next year we will be able to abolish unjustified geo-blocking. I am mainly talking about visual content and it will take time, but we have to abolish unjustified geo-blocking. All the people here in this room, I expect experience some sort of unjustified geo-blocking, as in, 'sorry this video is not available in your country'. I believe it is discrimination based on your nationality or where your city is and I don't think we have to accept that in the European Union in the 21st Century.

"Our aim is for everybody to benefit from the Digital

Single Market; it's not solely consumers that will benefit. Business will also benefit and they will then help consumers to benefit, so everyone's happy. Global players such as Google are able to deal with and understand the Digital Single Market rules. "However, for all those small and medium size companies and start-ups, it's practically impossible to understand how those 28 types of rules are protecting consumers, and how they are affected by those different rules. For me that isn't fair, we've got to bring the Single Market into the European Union. However it seems so complicated for our start-ups to scale up here in the European Union. Start-ups have started to move out from Union and once again it's mainly because fragmentation, so we would like to support our start-ups.

New proposals for 700 MHz

"Our 700 MHz band for mobile services proposal might not be seen as a sexy topic, but for me it is. Today 700 MHz is mainly used by digital and terrestrial television; we're talking about industry. We made a proposal which we will split into two parts: a 700 MHz band and the sub-700MHz band. The 700 MHz band should be assigned to wireless broadband, which we hope to see by 2020.

"In some countries they said that 2022 would be a much better target because 2020 is a too short a period of time. In South Korea for example they stated that they will start to use elements of 5G from 2018, during their winter Olympic Games. I took part in a G7 meeting in Japan and they said very clearly that from their 2020 Olympic Games, they will use 5G in Japan. In Europe, some countries aim to use 5G from 2018, such as in Stockholm and Tallinn as soon as from 2018. Why is 700MHz important? Without 700MHz we can just dream about 5G in the European Union, about self-driving cars or connecting cars or remote surgery.



Andrus Ansip, Vice-President of the European Commission

“Even if we know theoretically what kind of possibilities this 5G will provide, we can create some action, but at the same time we know that you can get good solutions only when you are working with rare problems in rare situations. I’m talking about apps. In the European Union in 2014, we had 1.8 million jobs just in the apps industry and according to reports there will be 4.8 million jobs in that industry in the European Union by 2018. I’m not talking about small amounts of money, in 2014 there was approximately €20bn, and in 2018 there will be much more than €60bn. If theoretically you know the potential of 5G, you can then understand such things as how to build a car based on its possibilities. And that’s why we made our proposal for urban areas to have 5G networks by 2025, and in all the EU member states they have to provide services on commercial data based on 5G by 2020.

“The Digital Single Market is all about industries, but at the same time it’s about our people – consumers – so for me it’s very complicated to speak to those and separate business and consumers. If consumers are not happy I don’t think industry will be happy.

Brexit impact on digital single market

“The official position of the European Commission is that we will start to negotiate this when the UK will trigger article 50. For me personally this news about Brexit wasn’t good news because the UK was – and still is – one of the strongest supporters of the creation of the Digital Single Market in the European Union and if you lose your strongest supporter you cannot be happy about this. I would like to say that I myself would like to have good neighbourly pragmatic relations with the UK, because in or out we have to live together anyway. Ultimately, it’s not up to the European Commission; it’s up to the UK government what kind of relationship we will have between the European Union and the UK in the future.” ■

Andrus Ansip

Vice-President responsible for The Digital Single Market

European Commission

http://ec.europa.eu/commission/2014-2019/ansip_en

www.twitter.com/Ansip_EU

imec start-up incubation for digital entrepreneurs

For those looking to kick-start their tech business, this imec start-up incubation programme offers support with coaching, facilities and funding...

Imec.istart is an imec business incubation programme that supports tech start-ups with coaching, facilities and funding. The programme has been recognised by UBI Global as one of the world's best University Business Accelerators.

Imec is the world-leading research and development and innovation hub in nanoelectronics and digital technologies. As a trusted partner for companies, start-ups and academia, imec brings together brilliant minds from all over the world in a creative and stimulating environment. By leveraging a world-class infrastructure, as well as local and global ecosystem of diverse partners across a multitude of industries, imec accelerates progress towards a connected, sustainable future.

Imec start-up incubation takes off

As part of its activities, imec has created a leading business incubation programme, imec.istart, to support young tech start-ups in developing their business. Getting a tech start-up off the ground requires skills, resources and the right technology. Turning it into a success is an even bigger challenge. The imec.istart programme offers entrepreneurs and start-ups in-depth coaching, facilities and support services, as well as a safe and stimulating environment to develop and grow their business.

The goal of an imec.istart incubation project is to assess the feasibility of its (digital) business idea, create a start-up to drive commercialisation and prepare the (commercial) launch of its first product(s). The programme is open to any entrepreneurs (be it from the imec research community, other academic researchers, external entrepreneurs or students) who wish to engage in the commercialisation of a technology-driven innovation or project.

“Entrepreneurs from anywhere around the globe are welcome to join the growing community of 120 successful imec.istart start-ups...”

The imec.istart programme combines pre-seed funding, coaching and mentoring, and other types of support (e.g. housing, software deals, marketing and communications support). The coaching and mentoring aspect focuses on access to market, technology, finance and talent. Additionally, imec.istart (often together with industry partners) offers market-specific support. The following figure depicts the overall imec.istart offering.

The basic offering of imec.istart consists of pre-seed funding of €50,000 (under certain conditions extendable up to €150,000), complemented with a substantial package of coaching and mentoring by experienced imec Innovation Managers and external industry experts. These coaches and

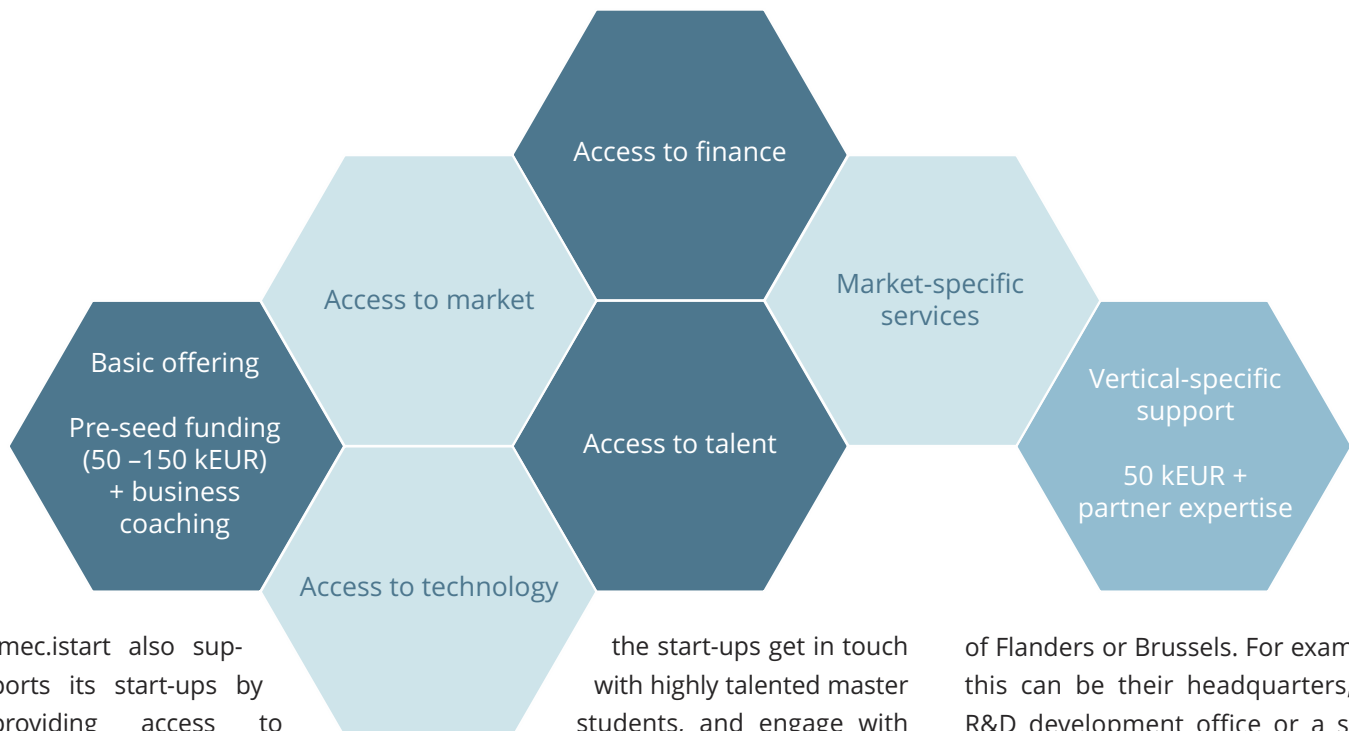
mentors advise the start-ups for an intensive 12- to 18-month period on all aspects of their business. Industry experts are used to cover specific topics, such as B2B sales, branding, legal matters related to fundraising, or intellectual property rights in start-ups. Additionally, the start-ups can count on marketing and communications support, housing, and additional perks and benefits provided by imec.istart partners (including software deals from amongst others Amazon, Google, Microsoft, Hubspot, Github, and many others).

This little start-up went to market

One of the 4 focus domains of the imec.istart programme is access to market. The programme helps start-ups prepare for the market launch of their first product(s), by challenging their business model, by helping them shape their pricing strategy or by suggesting the most optimal go-to-market strategy for their specific product(s). Imec's local and international network also provides invaluable introductions to help find reference customers or commercial partners.

Being primarily a research organisation combining the strengths of over 3,500 researchers, imec has a vast amount of innovative technologies in its portfolio. One of imec.istart's missions is to help its start-ups use these technologies by lowering the adoption barriers.

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Imec.istart also supports its start-ups by providing access to finance, as most start-ups need additional funding to achieve growth. The imec.istart coaches advise the start-ups in developing a sound business and financial plan, help them practice their pitching skills and provide them with access to local and international investors. Different reports and benchmarks (including the 2015 benchmark by UBI Global and the Europe Scale-Up Report 2016 by Omar Mohout) have positioned imec.istart as one of Europe's most successful programmes in terms of creating scale-ups (i.e. start-ups that attract at least 1 million EUR in follow-up funding). Twice a year, imec organises an Investor Day to draw attention to some of its most promising start-ups.

Matching start-ups with mentors

Last but not least, the imec.istart programme aims at reinforcing start-up teams. In the first place, it helps the founders develop additional skills and acquire new knowledge through coaching, expert advice and workshops. Secondly, imec.istart has teamed up with partners that can help

the start-ups get in touch with highly talented master students, and engage with those as interns, freelancers and/or (future) employees. Last but not least, through its entrepreneur-in-residence programme, imec.istart matches start-ups with experienced entrepreneurs to join their teams.

For certain industries, mainly those in which imec.istart already has a few start-ups in its portfolio, market-specific services have been developed by imec and its vertical partners. In the healthcare industry, for example, additional workshops and experts are available to cover CE certification and/or FDA approval of digital innovations. In the media and entertainment industry, imec's partners open up their production systems or provide datasets to experiment with. Additionally, in this vertical, imec's partners can top imec's pre-seed investment with another €50,000.

Entrepreneurs from anywhere around the globe are welcome to join the growing community of 120 successful imec.istart start-ups, as long as they're willing to establish a substantial part of their business in the Belgian region

of Flanders or Brussels. For example, this can be their headquarters, an R&D development office or a sales office for Western Europe. Imec.istart has 3 application calls per year (in January, May and September).

More information can be found on [imec's website](https://www.imec.be/istart).



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Centre stage of space innovation in the UK

Thales Alenia Space is developing cutting edge satellite technology which puts it at the forefront of space innovation in the UK...

As we become ever more interconnected with one another, the pace of change is increasing at a rate never previously imagined or conceived. This is true in many fields of endeavour, and the application of space technology is a prime example. We are all increasingly dependent on and consuming more and more 'space' data, as part of our daily lives; from using GPS navigation whilst driving our cars, travelling on trains or planes, to watching the latest 'on demand' videos on our smart phones. Satellites are at the heart of this trend; constantly 'on' as they gather and send large volumes of the data back down to earth.

There have been several important developments in the space sector that make all of this possible; and as the demand for using space based information grows, there has been an explosion in the number of applications and devices designed to entertain and help us 'manage' our daily lives.

Manufacturing costs coming down

Significantly, at the same time as this, the cost of manufacturing satellites and satellite applications has been reducing, making it much more attractive and accessible to industries, as well as governments and their countries, to benefit from these cutting edge innovations. For example, Thales Alenia Space, the largest designer and manufacturer of telecoms constellations in the world, created 'Iridium-Next' – a telecommunications satellite

constellation designed using the most advanced engineering, robotic and miniaturisation techniques – making it possible to increase the power of the satellites whilst significantly reducing the cost of manufacture.

"The world leader in the production of satellite constellations. Thales Alenia Space creates space systems and payloads that provide communications, navigation and environmental monitoring. Other systems and payloads also monitor the environment to help improve our understanding of climate change and drive scientific progress."

Today, as we look to the future, many are seeking to take advantage of these developments. One example is in the field of meteorology, where there's been rapid evolution of weather monitoring instrumentation to provide faster and more reliable weather predictions, as well as the tracking of severe weather patterns. This provides better information and improvements to the early warning systems needed by those in the affected areas. Thales Alenia Space UK is also developing instruments to monitor air quality, an important development for managing climate change and monitoring air pollution in densely populated towns and cities and for future urban planning.

Other applications may be less familiar. Satellites provide vital timing data to the global financial markets,

including electronic banking services deployed in remote rural areas where often there is limited or no physical infrastructure or high speed internet. These important services allow people to 'virtually' connect with one another, far beyond the physical borders of their own countries, which in turn enables trade to take place, allowing people to contribute to their local (micro) economy.

From crop health to human health

Sectors such as agriculture are already benefiting from space-borne earth observation services to great effect, for everything from disease prevention and crop health management, to carbon sequestration and field levelling to help prevent water loss. Satellite data will increasingly play an even greater role in this sector as food production and crop yields need to increase. The Food and Agriculture Organisation, a United Nations' agency, published a report in 2009 which suggested that by 2050 agricultural production will have to rise by 70% to meet projected demand.

Satellites are also key to the provision of healthcare services; particularly those deployed in remote areas where access to even the most basic healthcare is extremely limited, as well as the life-saving care which forms part of humanitarian aid programmes. With the advent of High-Throughput communication, video and internet, healthcare can now be offered to those who need it

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most, quicker and more cost effectively – and all of this is only made possible through satellites and satellite application services.

Space innovation in the UK and Europe

At the centre of this world-class innovation is Thales Alenia Space.

The world leader in the production of satellite constellations. Thales Alenia Space creates space systems and payloads that provide communications, navigation and environmental monitoring. Other systems and payloads also monitor the environment to help improve our understanding of climate

change and drive scientific progress. Thales Alenia Space has also been a pivotal partner in Europe's missions to explore our solar system. Currently, Thales Alenia Space is the prime contractor for the ExoMars Rover and Orbiter, Herschel and Planck flagship infrared observatories, and the Euclid deep space mission.

Thales Alenia Space has built up unrivalled expertise in dual (civil-military) missions, constellations, flexible High-Throughput communications, payloads, altimetry, meteorology, and high-resolution radar and optical observation, as well as deep space exploration. Thales Alenia Space has firmly established its

leadership in today's fast-evolving space sector. It posted consolidated revenues exceeding €2.1 billion in 2015 and has 7,500 employees in 9 countries.

In the UK, Thales Alenia Space (TAS-UK) has world leading design, test, integration and manufacturing facilities in Bristol, Harwell and Belfast. TAS-UK contributes to a range of major ESA science programmes such as the ExoMars Rover and the BepiColumbo mission to Mercury and is also responsible for the Broadband Radiometer – a space-borne instrument – as part of the European Space Agency 'EarthCARE' programme, which will help scientists understand and monitor climate change. TAS-UK is also making an important contribution to the next generation Neosat telecommunications satellite development for Europe.

Looking to the future, where Thales Alenia Space continues to be the world leader of satellite constellations and spacecraft propulsion, it provides the best innovative solutions to meet the most complex science and space challenges, bringing the benefits of space to each of us.

ThalesAlenia
a Thales / Leonardo company **Space**

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Users come first in seamless digital public services

At the third D5 conference in South Korea, Cabinet Office Minister Chris Skidmore explained how putting users first is making digital public services better...

I am delighted to be in Busan to represent the UK at the D5 Ministerial Summit. This is my first visit to the Republic of Korea, a country with whom the United Kingdom has enjoyed a strong relationship for over 130 years.

And I am especially delighted that this year's D5 ministerial Summit takes place alongside Korea's 3.0 Global Forum. It's a privilege to speak to a global audience of distinguished guests here today and to share with you the UK's digital journey. And I commend our hosts on their excellent organisation of this event.

“The new digital strategy will be published by the end of this year. It will lay out the ways in which we will continue to transform government together.”

The UK Government is proud to be recognised as one of the leaders in digital government. But in 2009 we told a different story. Our government IT spending was higher than that of many other countries, but far less efficient. So we have come a long way. But, as we know, the digital landscape shifts at an unprecedented rate and we cannot afford to be complacent.

We must continue to be alert to the opportunities that technology and the internet provide, and open to sharing and learning with other countries.

That is why the D5 was founded in 2014. It gives us the chance to learn and share with like-minded colleagues and digital leaders across the world.

D5 countries share the same mission: to transform the relationship between citizen and state and in doing so, improve citizen's lives. To do this, collaboration is vital. We must work together to share best practice, develop

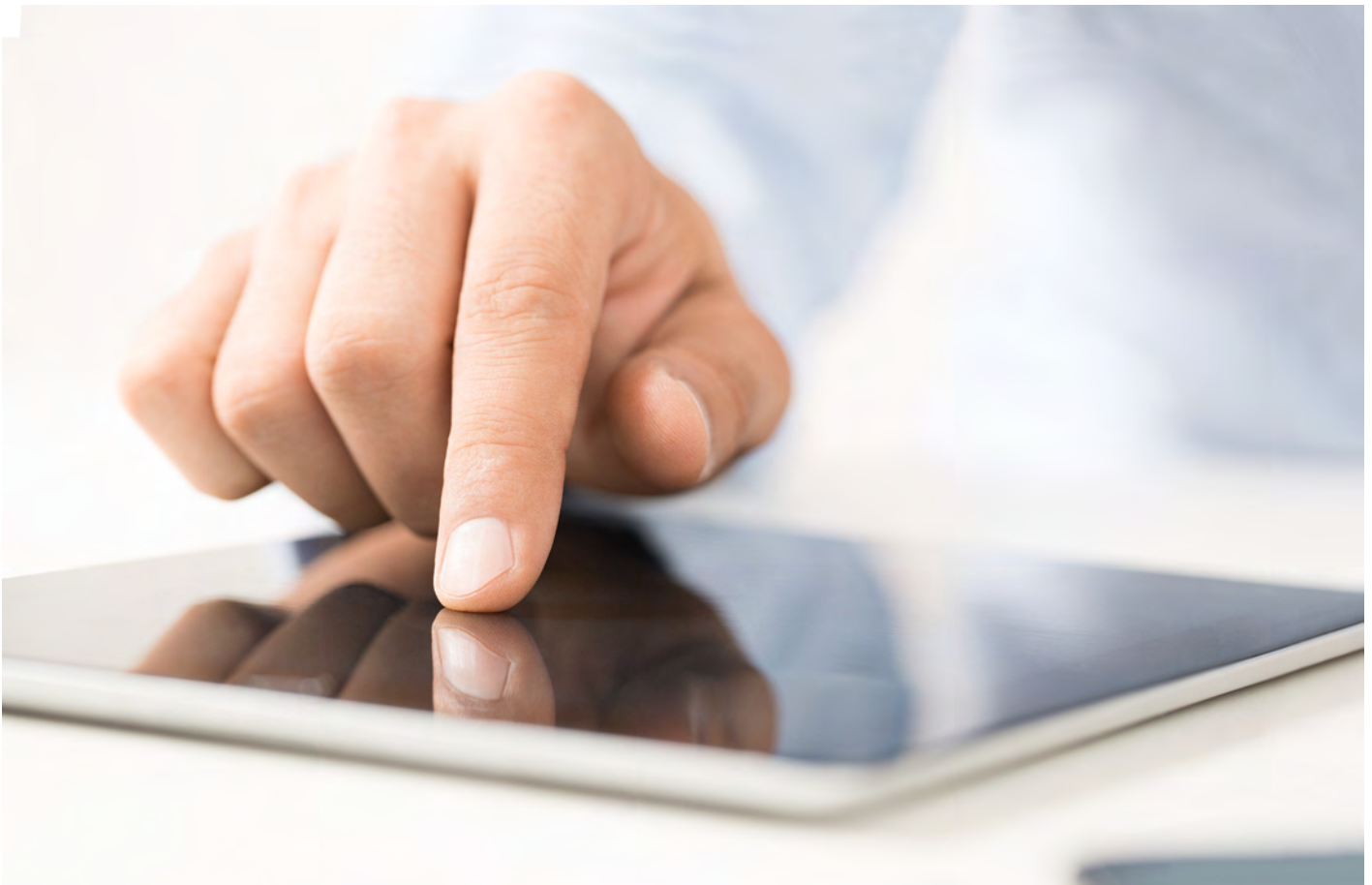


solutions to common issues, and build digital public services.

And in the spirit of collaboration, I'd like to start by sharing a little about what the UK has done to improve its public services. Then, happily, I'll tell you what we've achieved as a result and what the future looks like for us across the UK.

When we set about reforming our services, we knew that users had to be at the heart of everything we do. And that is the first principle of our Digital Service Standard, a standard which has been replicated by governments both locally and internationally.

Putting users first means understanding exactly what people need from their interaction with government and then delivering it seamlessly.



It means creating common services across government, services like:

The Digital Marketplace, which improves procurement by opening up the public sector to Small and Medium Enterprises. In the last few months, the total spend through Digital Marketplace has exceeded £1.5bn. Now, the barriers have been lowered for small businesses and innovative start-ups to sell digital services to government. This is a billion pound a year market, 52% of which is with small businesses. We are buying from the best, be they big or small. The determining factor is now, rightly, the technical excellence of a business, not how skilful they are at filling in a procurement form.

GOV.UK Verify which allows the citizen to create a single online identity to access a growing number of government services. And since going live in May, GOV.UK Verify has verified more than 900,000 users.

GOV.UK Notify enables service teams to send text messages, emails or letters to their users, before they get anxious enough to call. This saves time and effort by reducing the need for people to sit on hold waiting

for an update on their application or to check if their payment has been received. GOV.UK Notify has started sending text messages and emails to users of government services.

GOV.UK Pay makes it easier for people to pay for government services online. It has been industry accredited and is ready for business.

This work has made us number one in both the United Nation's E-Government Development Index and the E-Participation Index this year.

We believe that by making things open, you make things better.

We share expertise worldwide through open source, open standards, open data and international collaboration.

We want to be the most transparent government in the world. We are committed to the UK's Open Government National Action Plan, which sets out our commitments to greater openness, transparency and civic

participation. We publish new commitments every two years, alongside other members of the Open Government Partnership, such as our D5 co-founders New Zealand, Israel, South Korea and Estonia who are in the room today.

We have shared our code for Digital Marketplace with the United States and Australia. As a result of this collaboration, Australia has recently launched a public beta for its own Digital Marketplace.

We release our open data sets through data.gov.uk to enable people to build their own products and services. A number of apps based around health and transport, for example, have been built using open government data.

The Open Standards Principles are the criteria by which we judge a standard as “open” and whether it deserves to be approved for use by government. We identify and contribute to Open Standards for software interoperability and data formats that will help to meet user needs across government and support the delivery of common components.

And we collaborate and build networks, both at international summits like this, but also within our own government.

We have, for example, recently strengthened our Technology Leaders Network, to better support the needs of our users: in this case, the technology community.

I’ve spoken about what we’ve established. Let’s talk about the future.

Many of you here today will recognise the challenge of recruiting and retaining the right people to support and enable digital transformation. We’ve made a lot of headway in this area and this is something we will discuss at the D5 Summit tomorrow.

Essentially, we must build our capability, to make government the destination of choice for digital data and technology professionals. That’s why we have a designated specialised professions team, to support our plans to transform the civil service giving government the capability to efficiently deliver citizen-facing services.

Leanna Jones, Learning and Development Lead at GDS will be leading a workshop to share more about what we have done, and intend to do in the future, to increase digital and technology capability cross government.

The new digital strategy will be published by the end of this year. It will lay out the ways in which we will continue to transform government together. And just last week, at the National Cyber Security Centre, we launched our cyber strategy, which received £1.9bn of investment. It sets out ambitious policies to make the UK the safest place to live and do business online.

“The UK Government is proud to be recognised as one of the leaders in digital government. But in 2009 we told a different story. Our government IT spending was higher than that of many other countries, but far less efficient.”

So let me finish by saying, there is still a lot to do, but we’re determined to keep pace with the speed of change. We want to help other governments to build the best public services. To share our code, our methodology, our standards.

And we want to be open about what we’re doing so that citizens feel confident and empowered, selling to government is competitive and open, and new technologies are harnessed.

We’re committed to collaboration because we know that we can’t achieve what we need to without it.

This is a speech that was given on 9th November 2016 in Busan, South Korea. ■

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Chris Skidmore MP
Minister

Cabinet Office

www.gov.uk/government/people/chris-skidmore

Challenges for digital government: Still a long way to go

Daniel Thornton at the Institute for Government highlights some of the challenges for digital government, with its complex objectives and legacies...

Generations of internet start-ups have transformed services for consumers – starting with search, moving on to retail and banking, and now with the development of new services built on the sharing economy. Citizens also expect public services to be transformed. But while 4 out of 5 adults in Great Britain use the internet every day, only two-thirds have ever transacted online with government.

“Digital transformation” is an expression that’s now mentioned a lot in the public sector, but it’s often not understood. There’s a big gap between where government is and how the best services work in the private sector.

The model of a start-up, which can develop new processes that use digital technology from scratch, looks attractive, but is rarely relevant to government. This is partly because government is often trying to do things that have complex objectives, but also because government has legacies and obligations that are not relevant to the private sector.

There are 6 challenges for digital government:

1. Government needs to recognise the scale of change that is required in services, organisations, processes and ways of working. This will require leadership beyond digital teams and IT departments. Permanent secretaries and heads of agencies need to “get” digital and make sure their organisations are prepared to adapt and work across organisational boundaries. And ultimately ministers need to be prepared to lead change.

2. Government needs to understand how technology can create new options for policy. For example, before automatic number plate recognition was available, creating a congestion charge for central London would have meant toll booths – which would have created

more traffic. So understanding digital technology needs to be built in early to the policymaking process, which will mean policy and digital professionals working together in a new way.

3. Government needs to update its technology. Some of the public sector’s main services – such as pensions – run on systems going back to the 1980s. These are slow, inflexible and insecure. These systems will need to be updated if the full benefits are to be realised.

“The Cameron government made much of its commitment to digital government. For example, in 2015, George Osborne heralded a ‘digital revolution’ in Whitehall, and committed £450m of funding to it. The current Chancellor of the Exchequer, Philip Hammond, said nothing about this in his first fiscal statement in Autumn 2016. Theresa May has also stayed silent on the subject, in contrast to David Cameron’s enthusiastic support.”

4. Government must improve the way it manages digital work. “Agile” development involves decision-making which is swift, and as close to the user as possible. This is not how decisions are made in government, with its overlapping layers of control from the centre and within departments and agencies. Public servants need to learn the specialist skills to do this, and a new approach to risk is needed.

5. Government needs to continue to build centres of expertise outside London, and to develop specialist terms and conditions to recruit digital staff. Recruiting and retaining staff with the skills needed to manage digital transformation is hard, particularly around London.



6. The centre of government – led by the Government Digital Service (GDS) – needs to be clear about its role and how digital can support everyone in the civil service. GDS's head, Kevin Cunningham, has said that GDS will focus on supporting departments with digital transformation, particularly where joining up services for citizens is failing to happen because departments and agencies are not working together as they should. This is a fine aspiration but it remains to be seen how this will work in practice.

The UK government has over the last few years had a good international reputation for its digital performance, with GDS being emulated in the US, Australia and Singapore, and the code for GOV.UK being used by New Zealand. But a recent [study](#) comparing the performance of governments on digital services across the EU found that the UK was a “moderate” performer – behind both France and Germany.

The Cameron government made much of its commitment to digital government. For example, in 2015, George Osborne heralded a ‘digital revolution’ in

Whitehall, and committed £450m of funding to it. The current Chancellor of the Exchequer, Philip Hammond, said nothing about this in his first fiscal statement in Autumn 2016. Theresa May has also stayed silent on the subject, in contrast to David Cameron’s enthusiastic support. While the hard work of transformation lies in departments and agencies, people notice when an agenda is supported from the top of government – and when it isn’t.

It’s time for the UK government to redouble its efforts to meet the digital challenge, and bring real transformation to public services. ■

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Agile transformation: Moving to the organisational dimension

Agile transformation is enabling change and adding value across the public and private sectors, as Agile Business Consortium Member Hugh Ivory outlines

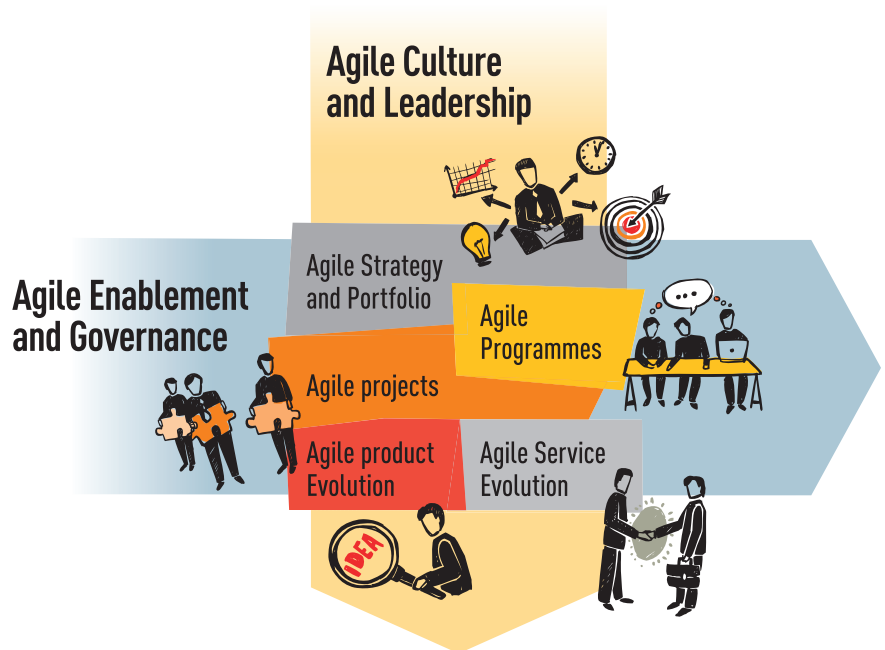
The term “Agile” is often misunderstood and consequently there are many interpretations of what it is. Although Agile has its roots in software delivery, it has now grown well beyond this to be much more. It is more than a set of methods, practices and behaviours. Agile is about delivering value for an organisation, however that value might be defined. In government, for example, that value could be defined as meeting citizens’ needs; in the private sector, meeting customers’ needs; in healthcare, meeting patients’ needs.

So for clarity, when I use the term, I mean “an approach where people with a variety of appropriate knowledge and skills collaborate to deliver value in the most effective way (early and often)”.

In this context, Agile is an enabler for transforming organisations, departments and teams; highly relevant and effective for the public sector as it strives to deliver ever more value in a fast changing world.

Agile transformation requires new approaches across a number of dimensions:

- **Delivery (engineering)** – where the push for Agile normally starts, from practitioners influenced by education, social media, peers, pragmatism



- **Governance (management)** – once the delivery teams start doing things differently, ways of governing and assuring are challenged to remain fit for purpose
- **Organisation (culture)** – the changes being driven from the delivery and governance dimensions will highlight issues with an organisation’s culture which need to be understood and addressed

Those of you in delivery teams using Agile to build products and services will often feel frustrated, hamstrung by the mechanisms and structures that delay your progress. You should

realise that the leaders in your organisation want the same thing as you – the delivery of value, early and often. They want to protect their investment, and they look for assurance that it is possible. You can help by explaining how iterative and incremental delivery, with frequent demonstration of how the end result will look, protects their investment. Providing easy access to your information and reports, and inviting them to visit you will often help.

Delivering the Agile transformation

Those of you in leadership positions want your organisations to be Agile

PROFILE



Hugh Ivory, Member of Agile Business Consortium, and COO of Agilesphere LLP

and adaptive, to react to the forces of change – reduced budgets, new legislation and better informed customer and citizen needs. You may be frustrated by the pace and cost of change. You will be concerned about the risk of wasted investment and the consequences of that in terms of investor, regulator and media scrutiny. Because of this, you look for assurance and the appropriate governance to safeguard your investment.

If you have good Agile delivery teams, their very approach is safeguarding your investment. They will ask you to empower your best, most visionary people to work with them to deliver what you really need. They will ask for time to explore, make mistakes and learn. They will ask for your patience – don't expect the false certainty of a two-year plan – let them know your desired outcome, give them space to figure it out. Visit them as often as you can – they'll welcome you.

Those of you responsible for governing and assuring are caught in the middle of this drive for agility and adaptability.

You are expected to be the brokers between the sponsors and the delivery teams, facilitating the means for ensuring that money is invested appropriately and is being used effectively.

You will need to create the conditions whereby leaders can:

- Make decisions about the most important things to do
- Allocate skilled, knowledgeable and empowered people to the delivery teams
- Come and see the progress for themselves; delivery teams will expect that the information they generate as they work should be sufficient to demonstrate progress and control

Everyone will also expect you to ensure that governance approaches add value and don't slow down delivery.

In a nutshell, the potential for Agile to enable organisational transformation can only be fully realised when all of you (leaders, managers and delivery teams) align your behaviour as you mature from focusing on the delivery dimension, (using Agile practices to deliver a specific product or service) through to the organisational dimension (harnessing agility to create an adaptive, learning and evolving organisation).

Enabling Agile Business

The Agile Business Consortium is a not-for-profit membership organisation that promotes, supports and enables Agile Business by providing

advice and guidance through an accredited range of Agile frameworks, products and services.

The Agile Business Consortium is co-ordinating the work of experienced Agile practitioners across a broad spectrum of disciplines and sectors to create the Agile Business Change Framework launching this year. To find out more about this, and how you can get involved, visit www.agilebusiness.org.

Hugh Ivory is a Member of the Agile Business Consortium and the COO at Agilesphere LLP. Agilesphere is working with the Agile Business Consortium to develop and promote Agile business change initiatives.



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Government IT: The year to adapt, change and collaborate

SolarWinds' Patrick Hubbard looks forward to the year ahead for government IT professionals, and how DevOps culture could change the landscape...

If there is one thing government organisations are used to, it's change. From central government to local government and healthcare, budgets, technology, and policies are constantly changing. It is therefore no surprise that the IT professional's role within government is constantly evolving.

We are at a turning point in the age of education and certification within IT. Not only do government IT professionals have to deal with the usual difficulties of trying to keep up with new technology, such as cloud, containers, microservices, and the Internet of Things (IoT), they also need to deal with budget cuts, restrictive policies, and a lack of resources. It is now more important than ever to scrap the traditional siloed IT roles, such as network, storage, and systems administrators, and instead take on a more collaborative role that allows liaison across different siloes, as well as government leaders.

“The role of the government IT professional is constantly evolving. Since the good old days, when IT pros did little more than assist when emails stopped working, they now have much more power to shape the wider business strategy due to the reliance on technology for everyday tasks.”

A general, holistic approach to government IT

Unlike in the past, when having a specialist was critical to a well-rounded IT team, the ability to learn new IT concepts and skills on a general level is now much more vital. This is particularly important within government IT, where resources and budgets may be stretched. The ability to have a holistic understanding of the IT infrastructure and make quick and informed decisions is crucial over the next year and beyond.



2017 is likely to bring new machine-based technologies and the continued adoption of DevOps, which encourages collaboration between siloed IT departments. Therefore, government IT professionals need to expand their viewpoints to focus on tools and methodologies they may not be immediately familiar with to prepare for and manage next-generation data centres.

Leave the automation to machines

As predicted, this year will bring new machine-based technologies that are going to become better and more sophisticated over time. Before technology, such as bots and artificial intelligence, is leveraged, new management and monitoring processes will need to be introduced to government organisations.

This integration of machine-based IT professionals will aim to automate basic processes and search functions, and therefore require the government IT professional to take on a more strategic role than ever before.

DevOps culture is coming

Unless you have been hiding under a rock, you would have heard the term “DevOps” thrown about over the past few months. The term describes the culture and



collaboration of the development and operations teams that is geared toward software development. The transition to DevOps is not something that happens overnight, and it's certainly not without its challenges. However, by leveraging these principles, government organisations can be well on their way to reap the benefits of an integrated DevOps mentality.

“We are at a turning point in the age of education and certification within IT. Not only do government IT professionals have to deal with the usual difficulties of trying to keep up with new technology, such as cloud, containers, microservices, and the Internet of Things (IoT), they also need to deal with budget cuts, restrictive policies, and a lack of resources.”

Ultimately, despite being a bit of a difficult term to define, DevOps is a positive organisational movement that will help government organisations empower IT departments to innovate. It also has the potential to improve agility, deliver innovation faster, provide

higher quality software, better align work and value, and give the ability to respond to problems or changes.

The role of the government IT professional is constantly evolving. Since the good old days, when IT pros did little more than assist when emails stopped working, they now have much more power to shape the wider business strategy due to the reliance on technology for everyday tasks. By staying relevant and maintaining a general knowledge across the entire IT infrastructure, embracing a collaborative DevOps culture, and being open-minded to the integration of machines, government IT professionals will find themselves prepared for the changes that are coming their way. ■

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Patrick Hubbard

Head Geek

SolarWinds

www.solarwinds.com

How will GDPR affect your business?

For consumers, new data protection legislation offers increased privacy, but how will GDPR affect your business? The Information Commissioner's Office explains...

The General Data Protection Regulation (GDPR) builds on the previous Data Protection Act, but provides more protections for consumers and more privacy considerations for organisations. It brings a more 21st century approach to the processing of personal data and it puts a responsibility on businesses to change their entire ethos on data protection.

The GDPR gives consumers more control over their data. Consumers and citizens have stronger rights to be informed about how organisations use their personal data. They'll have the right to request that personal data be deleted or removed, if there's no compelling reason for an organisation to carry on processing it. They'll also have the brand new right to data portability: To obtain and port their personal data for their own purposes across different services.

The GDPR will include new obligations for organisations. Businesses will have to report data breaches that pose a risk to individuals to the ICO, and in some cases to the individuals affected. They'll have to ensure that specific protections are in place for transferring data to countries that haven't been listed by the European Commission as providing adequate protection, like Japan and India. Consent will need to be freely given, specific, informed and unambiguous, and businesses will need to be able to prove they have it if they rely on it for processing data.

Increased power for regulators

For the most serious violations of the law, the ICO will have the power to fine companies up to €20m or 4% of a company's total annual worldwide turnover for the preceding year. The GDPR gives regulators the power

to enforce in the context of accountability too – data protection by design, failure to conduct a data protection impact assessment, DPOs and documentation. If a business can't show that good data protection is a cornerstone of their practices, they're leaving themselves open to a fine or other enforcement action that could damage bank balance or business reputation.

Under the GDPR, you must appoint a data protection officer (DPO) if you:

- are a public authority (except for courts acting in their judicial capacity);
- carry out large scale systematic monitoring of individuals (for example, online behaviour tracking); or
- carry out large scale processing of special categories of data or data relating to criminal convictions and offences.

The DPO's minimum tasks are defined in Article 39:

- To inform and advise the organisation and its employees about their obligations to comply with the GDPR and other data protection laws.
- To monitor compliance with the GDPR and other data protection laws, including managing internal data protection activities, advise on data protection impact assessments; train staff and conduct internal audits.
- To be the first point of contact for supervisory authorities and for individuals whose data is processed (employees, customers etc).



The DPO should report to the highest management level of your organisation – i.e. board level. You can allocate the role to an existing employee, as long as the professional duties of the employee are compatible with the duties of the DPO and do not lead to a conflict of interests.

The ICO remains committed to helping organisations to improve their practices and prepare for the GDPR. We've recently published an update setting out what guidance organisations can expect. It's essential reading, as it will help you plan what areas to address across the next 12 months.

The Article 29 Working Party and new guidelines

Consistency across the EU is one of the key drivers of the GDPR, and the Article 29 Working Party – the body that currently brings together data protection authorities across Europe – is leading the way in developing guidelines on some of the key aspects of the law. As the UK is a member of the Article 29 Working Party, we're contributing to this process and taking a lead role on a number of priority guidelines aimed at organisations.

In December, the Article 29 Working Party published guidelines on the role of the Data Protection Officer, the new right of data portability, and how to identify an organisation's main establishment and lead supervisory authority.

The central pillar to our guidance is the '[Overview of the GDPR](#)'. We are developing the Overview as a living document, adding content on different points as more guidance is produced by us and Article 29.

If you want to stay updated on new guidance, our [e-newsletter](#) is a good place to start. More information, help and advice is available on our website or you can contact the ICO helpline on 0303 123 1113. ■

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Tighter data controls: Opportunity and risk

As the EU brings in tighter data controls and the UK passes the Investigatory Powers Bill, iStorage considers opportunities and risks around data protection

The increase in data theft is definitely on the rise and there are more and more reports daily of criminals taking advantage of unsecured data. Whilst the EU is placing tighter controls on data through the new General Data Protection Regulation, the UK government has on one side stated the UK will meet the new EU regulations, but has also asserted its rights to pry through the Investigatory Powers Bill – the so-called ‘Snoopers Charter’.

The Bill has just been passed into law, giving the UK government unparalleled permission to track its citizens’ online behaviour. It will allow over 40 government bodies to access phone records and internet data. Many online services, such as Snapchat and WhatsApp, have already taken measures to provide encryption.

Encryption is more important than ever; hackers are getting better every day at taking small chunks of personal data and then, with the aid of social media profiles and the like, gathering more information to enable them to make use of that personal data for fraudulent activities. The kind of data that cybercriminals are targeting comes from your bank account, passport, insurance certificates or even driving licence. At this year’s Consumer Electronics show there were a plethora of new smart/connected/Internet of Things devices for the home, creating even more opportunities for cyber crimi-



nals. By taking the measure of storing this information on encrypted devices, the risks are massively reduced.

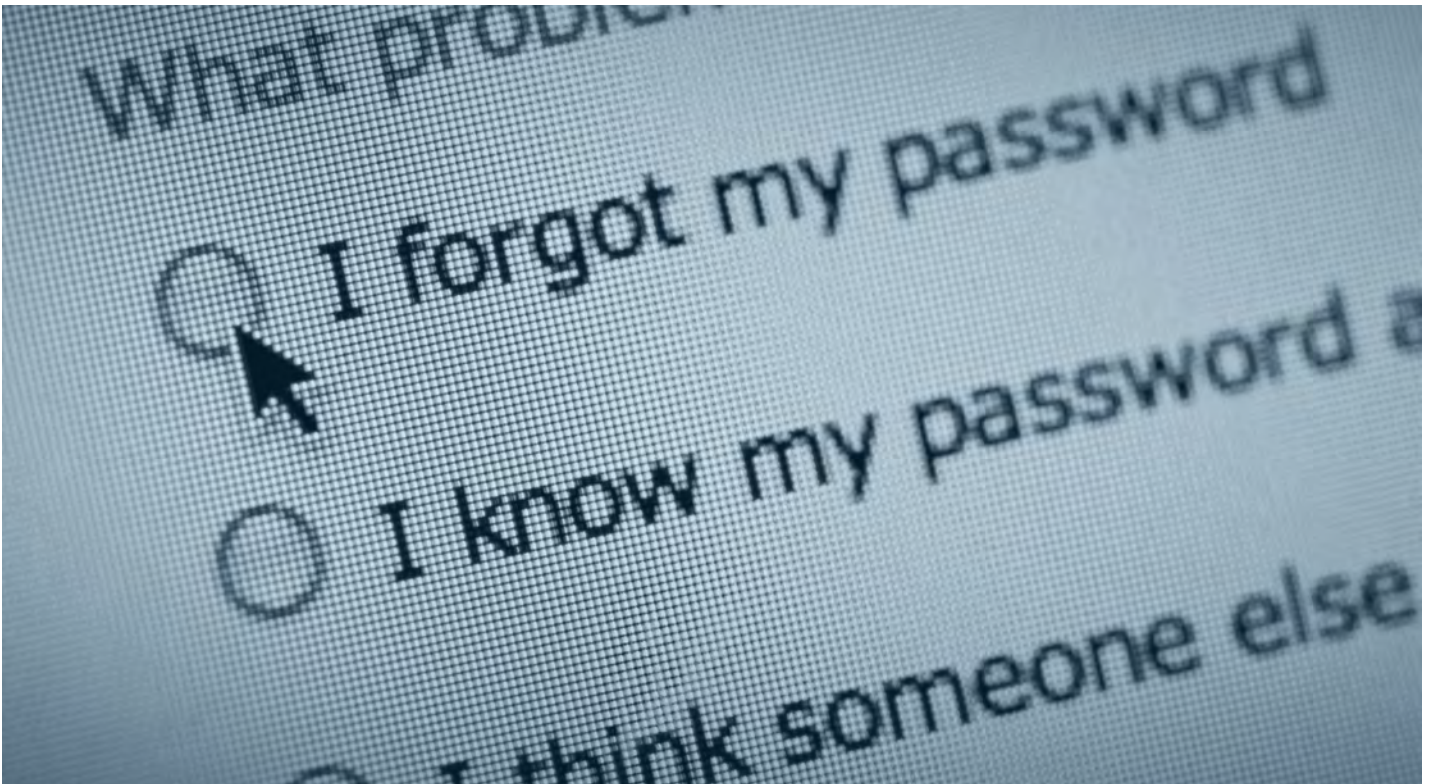
Documentation and reporting requirements

Meanwhile, the EU’s General Data Protection Regulation (GDPR) comes into force in May 2018. The regulation is designed to protect an individual’s personal data, but its impact will be wide-ranging.

Many of the new regulation principles are similar to the current Data Protection Act. It’s a primary premise of GDPR that organisations need to know exactly what personal data they hold. GDPR puts greater emphasis on the documentation that data

controllers must keep and, of course, where the data is stored. The data needs to be assessed for risk and procedures need to be in place to detect, report and investigate a data breach. Any breach must be reported in under 72 hours. However, Article 32 states personal data needs to be stored with either encryption or pseudonymisation to ensure confidentiality and integrity.

Brexit doesn’t change the fact that organisations in the UK will still need to comply. GDPR will be enforced on the 25 May 2018, and even if the UK government triggers Article 50 in spring 2017, it is anticipated that it will take two years for Brexit to happen. That gives businesses a full year to comply and ensure that they avoid a



hefty fine of €20 million or 4% of global turn-over (whichever is greater) for suffering a data breach.

Elizabeth Denham¹, UK Information Commissioner, recently acknowledged that legislative change brings nervousness, but, she said, "It also brings opportunity". Having stronger data protection laws and enforcement is aimed at "inspiring public trust and confidence", and the GDPR is "an incentive to improve your practices, to sharpen things up, and encourage organisations to look at things afresh".

She continued, "We believe that future data protection legislation, post Brexit, should be developed on an evolutionary basis, to provide a degree of stability and clear regulatory messages for data controllers and the public".

Data is the new gold

Minister of State for Digital and Culture Matt Hancock, who has previously

hinted that GDPR would stay in place, upon the release of the report said:

"As part of building a country in which people have confidence to use and build digital technology, we are committed to making the UK the safest place in the world to go online. The responsibility for keeping the UK, its economy and its citizens safe is shared.

"Every business, charity and institution up and down the country must realise that cyber security is their job as much as it is Government's. Only when the effort is concerted and persistent can we fully tackle this challenge.

"The Review notes that the upcoming General Data Protection Regulation (GDPR) will be key to ensuring strong organisational data protection regimes supported by strong cyber security."

The definition of "personal data" is

both nuanced and broad, it is any information relating to an 'identified or identifiable natural person', which is a minefield. Personal identifiers don't just include name, location and online identity, but also mental, genetic, cultural or social identity.

If data is the new gold, then you are going to need a great bank!

¹ Extract from Elizabeth Denham's first speech as UK Information Commissioner



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In GDPR, cyber security meets compliance

With the introduction of GDPR, cyber security will top many business agendas over the next 12 months. RedSocks Security can help in the race for compliance

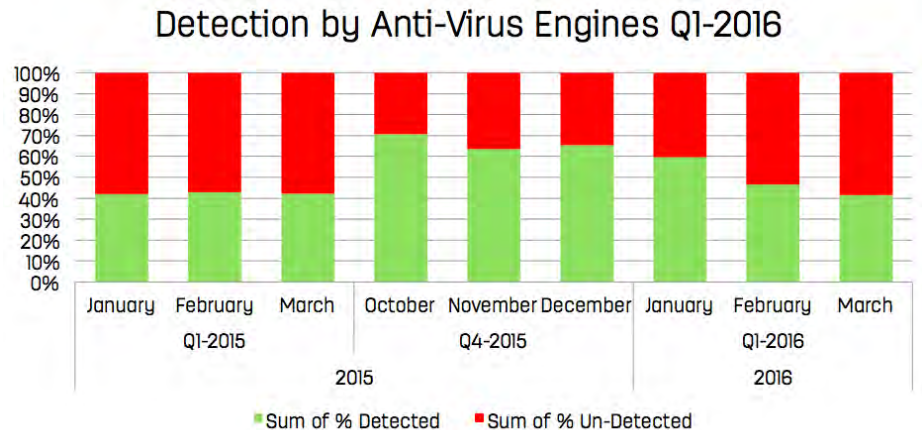
When it comes to malware and advanced persistent threat (APT) protection, many organisations have a false sense of security. They believe they have secured their key services against these threats simply by deploying anti-virus solutions or firewalls in their network infrastructure. However, today's generation of malware has become sophisticated and widespread enough to bypass many, if not all, of these security measures. Infections typically go undetected for an average of 200 days, which in the long-haul causes serious damage to organisational health.

The key to controlling cyber risk is to achieve the right balance between awareness, prevention and detection.

GDPR and businesses

With the implementation of General Data Protection Regulation (GDPR) in 2018 steadily approaching, organisations have started looking into fail-safe ways to ensure that compliance will not be an issue.

The regulation will impact how organisations gather, process and store individuals' data. It will affect any business operating from, doing business in, or storing its data within the EU. The enforcement of this strict data protection regulation can result in high penalties of up to 4% of global turnover in cases of non-compliance.



The two-year implementation period (April 2016 to May 2018) allows businesses the opportunity to prepare for compliance, re-evaluate their data protection agreements in contracts, prepare for transitions that meet (international) standards, update privacy policies, and revise marketing plans.

Business impact

The GDPR makes it easier for non-European businesses to comply within the European Union. The downside of this, however, is the enforcement of strict data protection laws with potential penalties of up to 4% of global turnover. The GDPR not only imposes requirements to implement the appropriate security measures, but also makes it mandatory to report any data breaches to the relevant data protection authorities.

Cyber security solutions

Ideally, organisations would be looking into solutions that equip them with

the tools for continuous network monitoring. The main issue with most of these solutions is whether or not solution providers are able to have full visibility of a company's network activities, and thereby have access to potentially confidential information.

When it comes to cyber security there are many options, the most common including firewalls and anti-virus software. A firewall, for instance, approves inbound traffic by matching it with an earlier outbound request. An anti-virus product approves inbound traffic on content. Both of these methods, however, have blind spots due to their sole reliance on inbound traffic monitoring. *

GDPR-proof cyber security solutions provide:

- Non-intrusive network monitoring that ensures privacy and information security from both ends.



- Non-stop network monitoring that ensures that your organisation is alerted the instant malicious activities take place.
- Data retention opportunities to ensure potentially malicious network activity can be retraced and used in forensic analyses.
- Overview of (potential) blind spots in an organisation's network and the (potential) activity therein.

New standards in cyber security

Egress monitoring is steadily becoming the new norm for cyber security solutions, where outbound network traffic (i.e. network metadata) is monitored rather than inbound. This ensures that network data is subject to more in-depth monitoring based on the behaviours and destinations of

outgoing data. In doing so, potential oversight of breaches in your network caused by blind spots are significantly reduced.

Data retention is also a growing necessity since it acts as a failsafe for a secure network environment. The analysis of previous network traffic enables the detection of a specific type of advanced persistent threat (APT), stealth malware that sparsely contacts its creators for new instructions and barely sends out data. This ensures that another potential blind spot is being stealthily monitored.

Next steps in cyber security for 2017

- Invest in a cyber security insurance policy. Innovative insurance providers such as Hiscox have implemented policies that cover damages to a company's network environment.

- Find a cyber security solutions provider that gives you applied threat intelligence. Sophisticated cyber security solution providers take ownership for gathering, analysing, using threat intelligence, and the delivery of tailored analytics.

About RedSocks Security

RedSocks Security is specialised in detecting suspicious network behaviour and tackling cybercrime, and develops innovative, scalable cyber security solutions for its clients. These solutions can be implemented within organisations of all sizes, and also serve as a tool for compliance to EU privacy legislation.

With the help of a specialised Malware Intelligence Team (MIT), RedSocks Security solutions are updated hourly with over 50,000 new malicious indicators. MIT is able to share cyber threat intelligence with clients via the RedSocks Malicious Threat Detector (MTD). This intelligence combined with advanced security analytics equips RedSocks Security clients with the insights they need to detect and analyse breaches in privacy, and act on potential data leaks.



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Harnessing the power of the electronic signature

Qualified electronic signature solutions can provide security and efficiency, as Comsign Europe explain

According to Gartner, Inc., 6.4 billion connected things will be in use worldwide this year and by the year 2020, the number of connected devices – i.e. the Internet of things (IoT) – will grow to nearly 21 billion. Other research suggests that over half of major new business processes will incorporate some element of IoT by 2020.

As a company which leads transformation in healthcare, governments, telecom, finance, energy, education, enterprises and others, Comsign Europe are constantly surprised to see the shift our society is going through and that in fact, we are always facing “the next big change”. It is clear that the digital age changes the way we live and raises the expectation bar of consumers on how they use services – they want it to be on demand, simple and secure from their mobile phone or connected device. It also changes the organisational conduct, allowing businesses to create efficiency, cost reduction, sustainability and other new opportunities.

Alongside all these significant benefits, we are now exposed to major risks more than ever before. With the increasing number of hackers’ attacks and their ever increasing level of sophistication, the prospect of our digital future might appear to be worrying. So what can we do about it?

Choosing a technology to meet the needs of tomorrow

The UK Department for Business,

Energy and Industrial Strategy recently published a paper on Electronic Signatures and Trust Services. This follows the changes made to the electronic signature regime introduced by Regulation (EU) No 910/2014 on electronic identification and trust services for electronic transactions in the internal market (the eIDAS Regulation).

The eIDAS Regulation is divided into three parts. The first section deals with electronic identification systems. The second part deals with Trust Services and electronic signatures and clarifies existing rules, as well as introducing a new legal framework for electronic signatures and seals, time stamps, registered delivery services and website authentication. The third part deals with Electronic documents.

These rules offer greater legal certainty to services that follow eIDAS rules, which are designed to improve the reliability and trustworthiness of these services.

When choosing an electronic signature solution, it is important to utilise a proven technology that complies with regulations and directives of the state law, in order to meet different types of business goals, such as keeping your organisational data secure while implementing a cost effective process. For example, with regards to e-documents like electronic medical prescriptions signed by physicians or while sending electronic affidavits by lawyers to court – one has to be certain about the identity of the signer.

Qualified Electronic signature (compliant with eIDAS) – from “nice to have” to a survival tool

Qualified electronic signature solutions bring huge benefits such as:

- Trusting the electronic signature as the representation of the REAL identity of the signer.
- Trusting the validity and integrity of the e-document.
- Trusting the automated electronic processes to be more secure than previous paper processes.
- Minimising administrative work and mitigating the risk of human errors.
- New trusted channel to connect with suppliers, customers, etc.
- Convenient workflow to sign from anywhere at any time.
- Document management – gaining control over the entire process.
- Enhanced data security – technology including time stamping, electronic seals and other features.
- Legally binding – qualified signatures can’t be forged or denied and are admissible in court.
- Sustainability – become environmentally friendly.
- Eliminating all costs related to paper-based processes (production, storage, mailing, handling and archiving) creating a substantial saving.

Solutions you can apply today



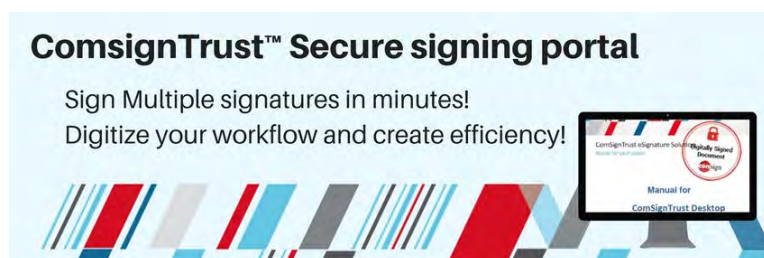
Signing server **Signer1™** - to automatically sign and send millions of documents

Designed to meet the needs of medium – large size organisations, you can integrate a server solution (as the Signer1) with the enterprise's document generation workflow, to automatically sign a large amount of documents in minutes. The server includes an internal cryptographic device a portal to be used by the customer and a large storage. The solution also comes as SaaS. [Click here to read more.](#)



Point Of Sale – to create the ultimate customer's experience

A solution that allows customers to sign agreements on tablets at the branch, from home or on the go. Shortened lines, friendly process, no scanning or printing involved. The point of sale solution includes many functionalities to deliver maximum flexibility. The product is ready to be implemented and can be custom-made to specific needs. [Click here to read more.](#)



Online Portal – to sign clients, suppliers, employees, peers, etc. from anywhere in minutes

The online signing portal was developed in order to facilitate difficulties with internal and external workflow processes. The portal allows the organisation to upload documents and send the link to peers or customers in order for them to sign online, from the office or on the go. It allows for improved document management, it sends alerts and notifications and makes what was once a long process, a short, monitored and friendly one. [Click here to read more.](#)

What to look for in the future?

As more and more parts of our lives are becoming digitally connected, the use of secure infrastructures becomes more and more critical. One way to try to overcome the ever increasing security threats is to apply an IoT infrastructure based on electronic signatures and qualified digital certificate (eIDAS). With security remaining the top concern among businesses in relation to IoT, the infrastructure to support IoT needs careful consideration, as typical enterprise-scale infrastructure investments will not enable the IoT to scale economically.



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Data breaches will get worse – but there is a silver lining

Data breaches are on the rise, and things are bound to get worse before they get better, Destiny Bertucci, Head Geek at SolarWinds tells Adjacent Government...

For better or worse – and most would argue worse – 2016 was a year of change, from celebrity deaths to the shifting sands of politics. Data breaches were also subject to change, with the threat and damage of breaches only intensifying, to the extent that they now top the list of government concerns.

A government survey reported that two-thirds of large businesses in the United Kingdom were hit by a cyber-attack in the past year. It was uncovered last year that in 2014, Yahoo! fell victim to the biggest data breach in history, losing nearly 500 million accounts' worth of personal user data to attackers.

A data breach costs a business money, damages its reputation, and can impact its customers in deeply concerning ways. That being said, the carnage wrought by a massive data breach in a governmental organisation can have far worse consequences.

Data breaches disaster

A data breach in a government organisation can result in severe ramifications, not just for the organisation, but also for the government's citizens, with personal data potentially falling into the hands of the attackers. Two major government breaches took place in the United States in 2015, compromising the personal data of over 22 million people.

It was only a couple of years ago that the NHS topped the list of serious data breaches, with nearly 2,500 breaches of patient confidentiality. Top this off with possible theft of sensitive government data, and it is clear that the damage caused by a data breach is catastrophic.

As data breaches continue to evolve from the work of basement dwellers to frighteningly well-equipped and

well-financed operations, both the volume and visibility of these breaches are likely to increase. However, before you start trying to figure out ways to lock yourself and your data in some underground hacker-proof bunker, you should know that 1) it wouldn't work anyway, and 2) things may not be as bad as they seem.

“More businesses will have to weigh the cost of a breach versus the cost of paying for protection, sometimes opting for the former. This is especially likely with ransomware, when there is no guarantee that the attackers will give up the data once their demands are met.”

It will get worse before it gets better

Much like the common cold and the Fast and the Furious film series, some things must get worse before they can get better. As the year goes on, cyberattacks are expected to get more prolific. However, one benefit of this is that it will likely increase awareness in government organisations and result in better preparation.

We can also expect new information security firms to enter the marketplace to help tackle this issue, providing guidance on penetration testing and other security expertise. Given the amount of data breaches taking place, this is a market gap that will surely soon be filled.

Sadly, this may also result in a high number of charlatans peddling their wares, offering subpar security advice under the guise of expertise. Given that government funding has increased for cybersecurity, it is important that organisations are not duped by both attackers and those purporting to stop them.

More businesses will have to weigh the cost of a breach versus the cost of paying for protection, sometimes



opting for the former. This is especially likely with ransomware, when there is no guarantee that the attackers will give up the data once their demands are met.

“A data breach in a government organisation can result in severe ramifications, not just for the organisation, but also for the government’s citizens, with personal data potentially falling into the hands of the attackers. Two major government breaches took place in the United States in 2015, compromising the personal data of over 22 million people.”

As the year goes on, more attacks will lead to greater exposure and a higher number of preventative methods. While it may be a year in which data breaches

become even more ubiquitous than they already are, just remember that sometimes things really do need to get worse before they get better. ■

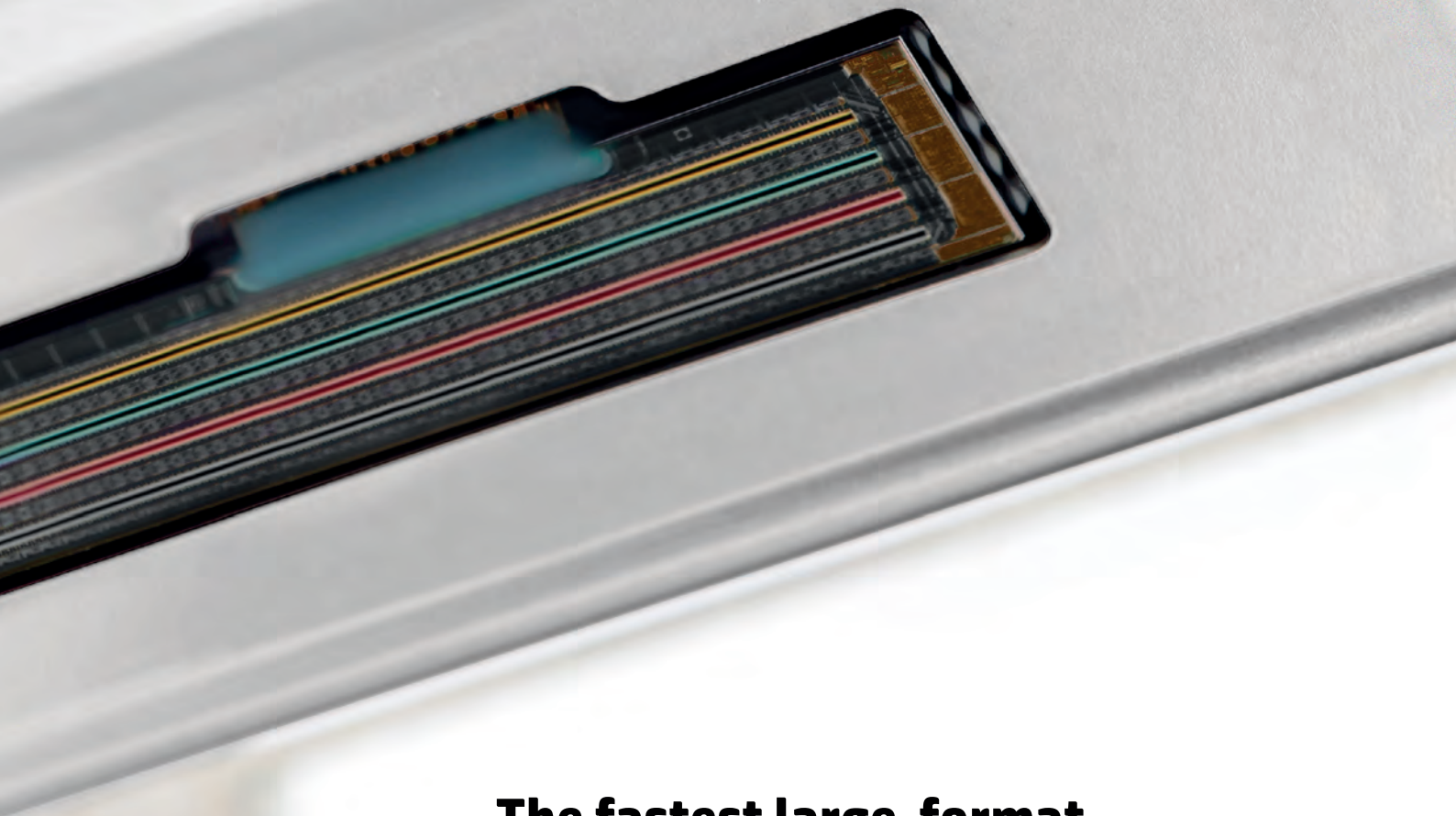
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1. Fastest based on internal HP testing and methodology compared to alternatives for large-format printing of technical documents, GIS maps, and point-of-sale (POS) posters under \$200,000 USD as of March, 2015. Production costs savings based on comparison 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

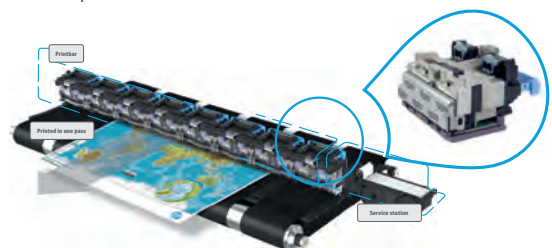
Many repro houses use an LED printer for monochrome print runs and an inkjet printer for colour. Managing both monochrome and colour printing, along with bid sets that consist of a mixture of small format and large format pages, means having to rely on a wide range of printing hardware and software. 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

Cyber security in healthcare: Lessons from enterprises?

Joe Kim, CTO of SolarWinds, explores the potential learning opportunities from business for cyber security in healthcare organisations...

The cyber security market is currently valued at \$122.45bn, with an expectation that this will rise to \$202.36bn by 2021. Cyber security is becoming a huge concern for businesses, with so many enterprises coming under attack recently. However, over the next few years, the threat landscape will develop and the aim of a cyberattack won't be solely financial.

Though cybercriminals are usually incentivised by financial gain, the reality is that a cyberattack can create far more damage than just hitting an organisation fiscally – this is especially the case when it comes to healthcare organisations. Health data is far more valuable to a cybercriminal, going for roughly 10 or 20 times more than a generic credit card number. Therefore, we can expect to see a surge in healthcare breaches. However, the impact of this won't just cripple a trust financially. It's possible a cybercriminal could take over a hospital, manipulate important hospital data, or even compromise medical devices.

It's already started

These sort of breaches are already happening. At the start of 2016, 3 UK hospitals in Lincolnshire managed by the North Lincolnshire and Goole NHS Foundation Trust were infected by a computer virus. The breach was so severe it resulted in hundreds of planned operations and outpatient appointments being cancelled. The event, which officials were forced to deem as a "major incident", also made it difficult to access test results and identify blood for transfusions, and some hospitals struggled to process blood tests. This is one of the first examples of a healthcare cyber security breach directly impacting patients in the UK, but it won't be the last.

Follow in the footsteps of enterprises

Breaches like these have put a great deal of pressure

on healthcare IT professionals. Though there has been a shift in mentality in enterprise, with security becoming a priority, the same can't be said for the healthcare sector.

Before healthcare IT professionals can even start to fully protect against these potential life-threatening attacks, the mentality of healthcare organisations needs to change. Currently, it's very common for most healthcare organisations to lack basic cyber essentials, with some still running on outdated operating systems, and many devices not having basic anti-virus software.

It's already a challenge for healthcare IT professionals to keep the network safe and secure. From a community nurse using her iPad to input important patient data, to hospital clinics trying to record everything, the entry points are enormous.

This creates a huge disadvantage for healthcare IT professionals from the get go. The situation is worsened with most healthcare organisations often having budget cuts, making security a hard thing for the board to prioritise.

It doesn't need to break to be fixed

Healthcare IT professionals have made it clear that they aren't confident they could prevent their trust from a severe breach. Many assume the board will only focus on security once a significant breach occurs, and wonder how bad it needs to get for them to listen. It is time healthcare organisations learned from enterprises that have seen breaches occur and acted. In the meantime, there is work that requires little investment that IT professionals can do to protect the network.

Educate and enforce

Employees are often the weakest link when it comes



to security in the workplace. Few workers understand how simple it is for a cybercriminal to gain access to the network through an employee's mobile phone, and often opt to use their own devices in the workplace.

“It’s already a challenge for healthcare IT pros to keep the network safe and secure. From a community nurse using her iPad to input important patient data, to hospital clinics trying to record everything, the entry points are enormous.”

However, it is vital that healthcare IT teams have a consolidated overview of what devices are connected to the network by running an awareness campaign that encompasses both education and enforcement. By doing so, employees will have a better understanding of the potential threats that could come from having an unauthorised device connected to the network.

For example, healthcare workers need to be shown how a cybercriminal could infiltrate the network

through hacking someone’s phone. This would also start a dialogue between healthcare employees, helping them to prioritise security and thus giving the IT department a better chance of protecting the organisation from a breach.

It’s naturally assumed that a healthcare IT professional should be able to effectively protect his or her organisation from an attack. However, even the most experienced security professional would struggle to do so without the right tools in place. To protect healthcare organisations from disastrous attacks requires funding, investment, and cooperation from employees. ■

.....
Joe Kim
CTO

SolarWinds

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How accredited security consultants can help manage risk

James Kelly, Chief Executive of BSIA, tells Adjacent Government why reputable security consultants and staff training are worthwhile when it comes to risk...

As we begin to move forward through 2017, planning for the future and ensuring risk management processes are in place for all eventualities is essential. 2016 was a tumultuous year, with terror attacks continuing to pose a very real threat to our society. Adding to this, organisations can face a wide number of threats year round, including fires, flooding, cyber-attacks and financial losses.

Ask the experts: Reputable security consultants

One of the best ways to plan for a crisis and develop fit-for-purpose incident management processes is by firstly identifying the risk register. As a business, it's paramount to know what you are protecting yourself against and at the heart of any business's security and its resilience to threats is its risk register. The risk register is a key tool that helps a business identify the day-to-day risks that it faces and the best ways to counteract them.

As this is such an important step, it can be worthwhile to enlist the help of a credible security consultant in order to assist in adequately identifying the risk register. Security consultants can provide independent professional support to ensure that any security measures required by the client correspond to both existing and emerging threats, whilst complementing a business' environment and operation in order to protect people, building, assets, and ultimately, reputations. An outsider's professional opinion can be very valuable, as they are able to identify risks that may have been overlooked previously. Consultants can carry out a range of services, including, but not limited to, risk assessments, due diligence checks, cyber investigations and security penetration checks.

Ensuring that you're enlisting the help of a reputable consultant is essential in effective risk management.



To aid in this process, the BSIA has produced its own 'Code of Ethics for Companies Supplying Security Consultancy Services', which sets out the professional standards and integrity that BSIA security consultancies should encompass. For example, it is best practice to choose a supplier that can act "with integrity, honesty and professionalism", who is "transparent and impartial in all that is done and will "provide soundly managed services that engender trust and confidence with their clients."

It is absolutely essential to choose a consultant that applies "British, European, government and Ministry of Defence standards" at the core of all "processes and methodologies used in security and risk management." The business should also be subject to ISO 9001 and BS8549, with all security consultants undergoing continuous professional development throughout their career.

Training for purpose

When creating contingency plans, it is important to look at how the organisation operates on a wider level in order to identify what aspects of the business are essential in its ability to continue to function in a crisis. For



training should also be professionally qualified tutors with real-world experience of the industry in order to provide an insightful, valuable course.

In order to ensure the training is truly fit for purpose, it is important to choose a trustworthy training provider. Members of the BSIA's Training Providers Section are committed to working with fellow training providers, colleges, security companies, trade organisations and the government to drive standards, increase professionalism and ultimately improve the standard of training offered to the security industry. Keeping in line with these values, the section has also created its own 'Code of Conduct' in order to help safeguard the interests of consumers of services provided by BSIA members, as well as raising the bar of professionalism amongst its members. Adhering to the code provides tangible evidence of each member company's commitment to proficiency and probity, helping them to keep abreast of current practice, regulation and applicable laws affecting training, in order to ultimately position themselves as the best in the industry.

example, ensuring that employees can work securely offsite, if necessary, is crucial in ensuring business continuity. It is not enough just to have plans in place in the case of an emergency; it is also paramount that all employees are aware of existing contingency plans so that they may go about their roles as necessary. Such plans should also be efficient in their structure, making sure that incidents are dealt with in a timely manner, as not to compromise the business further.

As well as enlisting independent professional support from a consultant, it can also be worthwhile investing in specific training in order to ensure that members of staff are able to respond accordingly to potentially threatening situations. To be fully prepared for a crisis, employees, particularly those in senior management, can undertake specialist training courses on crisis management. Such training should be delivered by a reputable training provider whose comprehensive courses can help members of a business develop the essential skills and confidence to effectively deal with a crisis. The training available is extensive and can cover all aspects of incident management, such as, risk assessments, security surveying, continuity management and disaster recovery. Those that deliver the

Ultimately, when implementing security strategies and preparing for the future in an uncertain world, one thing remains steadfast – the importance of quality. Whether it's a security consultant, training provider or any other form of security, those responsible for procuring security products and services for their organisation should only be enlisting the help of a trusted, professional provider who meets with the necessary British and European standards. ■

.....

James Kelly
Chief Executive

British Security Industry Association (BSIA)
www.bsia.co.uk
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Postal operators' security challenges are great, but collaboration is key

Botond Szebeny, Jean-Paul Forceville, David Pilkington, Antonino Scribellito and Waqas Ahsen at PostEurop describe their work to tackle postal operators' security challenges...



Botond Szebeny

Q: Can you tell us about the collaboration at PostEurop, and how important this collaboration is from a postal security perspective?

Botond Szebeny – Secretary General, PostEurop: The main tasks of PostEurop always involve promoting cooperation, innovation and bringing added value for our members; this is deeply ingrained in the Association's strategy and goals. Through many different committees, working groups and transversals, we are able to establish a connection between all the postal operators in Europe. In this sense of connection and unity, the security and customs transversal of PostEurop plays an important role in order to make our members share their best practices to better reinforce security in Europe. For this, we also have a dedicated working group within the Security & Customs

Transversal (SCT), which works closely with the European Commission to ensure that legislation is properly improved and implemented, with particular regard to the new European Union Customs Code. All of this is also supported by the framework of our European Projects department, within the SAFEPOST Project.

Q: In your opinion, what are the emerging challenges facing the postal industry in general, and how will they affect the area of postal security?

Jean-Paul Forceville – Chairman, PostEurop: In my personal view, unfortunately it is extremely difficult to predict with 100% accuracy the

upcoming challenges to postal security. However, as the postal industry moves towards a more digitalised area, related to new e-services and markets, I can only assume that one of the biggest challenges will be related to cyber security and how we can protect our clients and citizens. In any case, a constant challenge that we are facing every day is how to secure and protect the integrity of our supply chains. This is an exercise that will always be under constant scrutiny, as new and more dangerous criminal practices are appearing daily, linked, for example to terrorism, counterfeit, drugs and weapons. As postal operators in Europe, we need to keep this fruitful collaboration among operators, in order to better guarantee Europe's safety.



Jean-Paul Forceville

Q: In your position as Chair of PostEurop's Security and Customs transversal and as the Royal Mail's lead on customs issues you are ideally situated to understand the challenges ahead for postal operators. What in your opinion are the current challenges for Royal Mail in security and customs, and what are your views on the importance of having these two areas linked together?

David Pilkington – Chairman, PostEurop Security and Customs transversal:

There are numerous challenges for Royal Mail Group, as a designated postal operator many of which are common to all postal operators. The biggest and most urgent challenge for the postal sector is the requirement to provide electronic data, in advance, for customs and aviation security purposes driven by legislative changes and the emerging market environment.

There are many new and emerging pieces of legislation coming forward from across the globe that will radically change the landscape for postal operators and their customers. An example of this is the UCC requirement for postal operators to provide advance electronic data to improve security and facilitate import customs processes by 2020. This timeframe is also reflected in the Universal Postal Union's EAD roadmap. Royal Mail Group is now integrating the Customs Declaration System (CDS) into its IT infrastructure and processes. We are doing this with the full cooperation of the UPU's technology department, our UPU partners and the UK Border Force (BF) and Her Majesty's Revenue and Customs (HMRC), to help meet these legal requirements and allow us



David Pilkington

to serve our customers better. We shouldn't underestimate the scale of this task; postal operators will have to implement new IT systems, migrate customer to new data driven products, and achieve all this globally by 2020!

The security environment is more challenging and constantly changing. Postal operators, through our work in the security and customs group, are focusing on: Ensuring we achieve exact security standards for the physical security of our mail centres; ensuring PostEurop members are taking action to mitigate risks to their IT systems from cybercrime; and combating abuse of the postal network. Recently, we have experienced an increase in fraudulent postings and mail scams. Our customers' safety will always be a priority for us, thus fighting against the rise of fraudulent mail volumes has become a new focus for our security and customs team. That is exactly why, together with PostEurop, we are developing a strategy that will be able not only to raise awareness amongst the many operators in Europe (and globally), but also be able to implement the necessary counter measures to tackle this issue.

The protection of national borders and the facilitation of legitimate trade is a key part of the work postal operators do in partnership with security and customs agencies. The dual use of data (security and customs clearance) will enable postal operators and other agencies to use new technologies to further improve the security of our mail streams, protect borders, our staff and our customers. We have already recognised that these two areas are interlinked and it's important we ensure this continues, structurally and through our actions.

Q: Has the SAFEPOST project resulted in a concrete product or service?

Antonino Scribellito – Senior Project Manager, PostEurop & Waqas Ahsen – Assistant Project Manager, PostEurop:

The SAFEPOST Project resulted in a concrete prototype called "D-Tube". The D-Tube electronic nose prototype – which was developed by Swedish company Tel-lusecure in cooperation with FOI and UNIGE – is an excellent screening and decision system to detect and remove anomalies based on gas chromatography, gamma detection, laser Raman

PROFILE



1. Continued and concerted efforts toward harmonisation, standardisation and mutual recognition of a consolidated and comprehensive European Postal Security Stamp (with the detailed data requirements agreed for implementation).

2. A European Union Horizon 2020 funded research project to develop the technology integration, data sharing and cooperation agreements and regulatory recommendations – this may actually need to be two projects, with one being directed toward technology integration and actual systems required for data sharing, and another to address the political, regulatory and cooperation agreement elements necessary in order to take full advantage of the EPSS and what it offers.

3. Small Horizon 2020 funded pilot projects to address the actual implementation of the EPSS integrated solution – these should encompass at least 10-15 of the European Union member states with perhaps 2 or more consortia tasked to address this on a Europe-wide scale.

spectroscopy and image recognition. The key aim is to have a prototype which did not exist in the market before, realised and fit perfectly in the postal sorting centre, in order to avoid slowing down the flow, as well as to detect narcotics and explosives in the monitored postal service environment. This also applies for customs detection and law enforcement needs.

Additionally, regarding the other technological solutions produced by SAFEPOST Project, such as European Union Common Postal Security Space (EU Parcels Schengen Space), all postal operators (small, medium and big) are willing to support customs and law enforcement agencies using the European Postal Security Stamp (EPSS) for the following advances:

- Enhanced efficiency arising from increased availability of information;
- Capacity to manage higher demands for security;
- The ability to upgrade security against theft, explosives and ammunition, weapons, hazardous materials, smuggling, drug trafficking, money-laundering and (low-budget) terrorism;

- Ability to match postal security measures to national threat levels.

The EPSS information input will be used for shipment targeting and the selection of appropriate screening techniques at downstream security control points. The security stamp data will include inspection results and description of applied techniques. Data captured will include:

- Date, time and place of inspection;
- Applied inspection methods;
- Prints and reports of inspection results (including images, and D-tube outcome);
- Risk Assessment.

The EPSS represents potentially the greatest opportunity for innovation and eventual exploitation as a result of the work of the SAFEPOST project, while at the same time posing many challenges of harmonisation, standardisation and data sharing. Thus, there are 3 recommendations, which result from extensive analysis of the opportunity presented by the EPSS. They are as follows:



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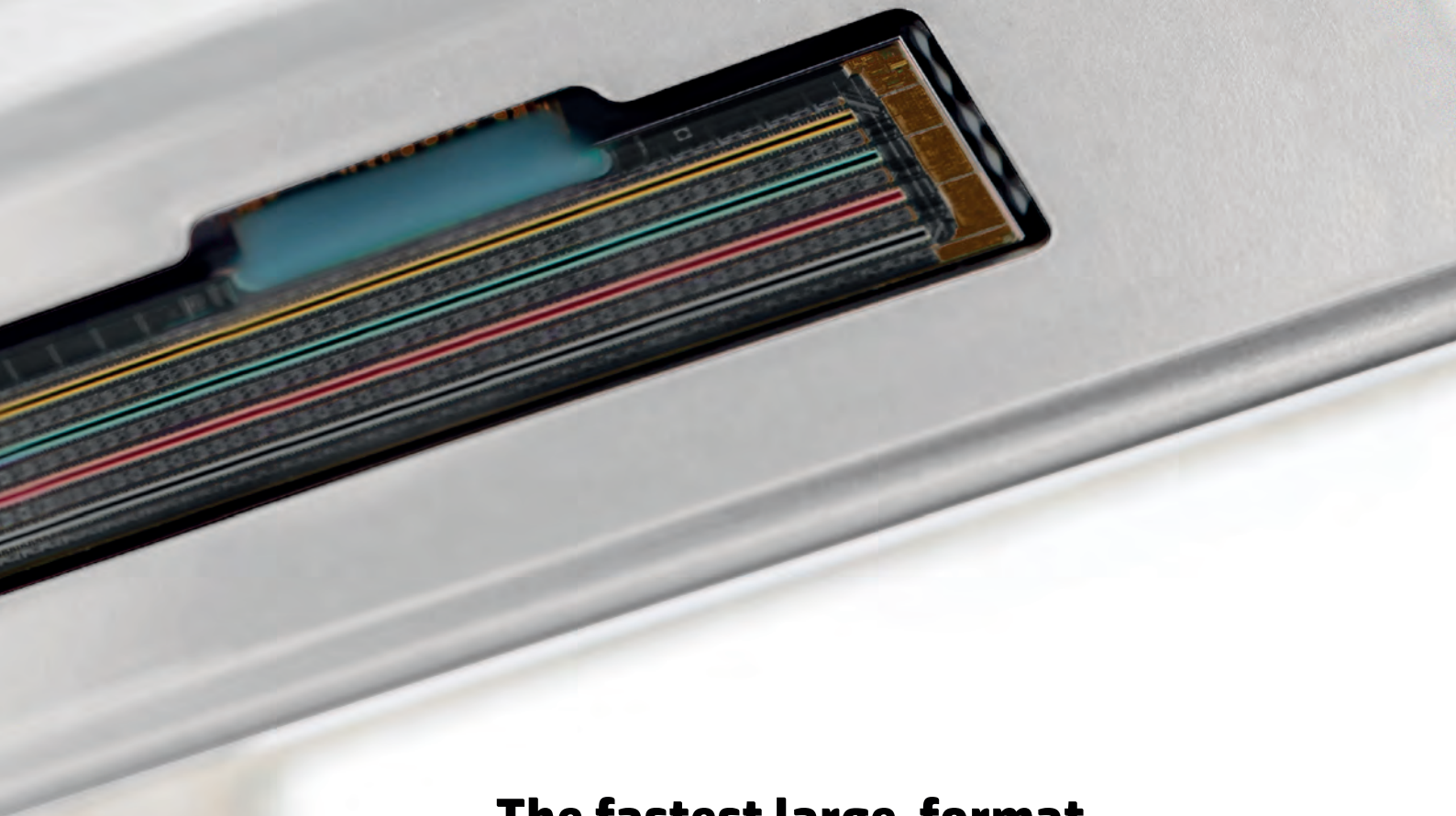
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2. With a maximum linear speed of 23 meters/minute (75 feet/minute), the HP PageWide XL 8000 Printer is 60% faster than the KIP 9900 printer which, at 14 meters/minute (47 feet/minute), is the fastest rated LED printer as of March, 2015.
3. Using HP SmartStream software compared with using equivalent software programs. For testing criteria, see www.hp.com/go/pagewidexlclaims.

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