



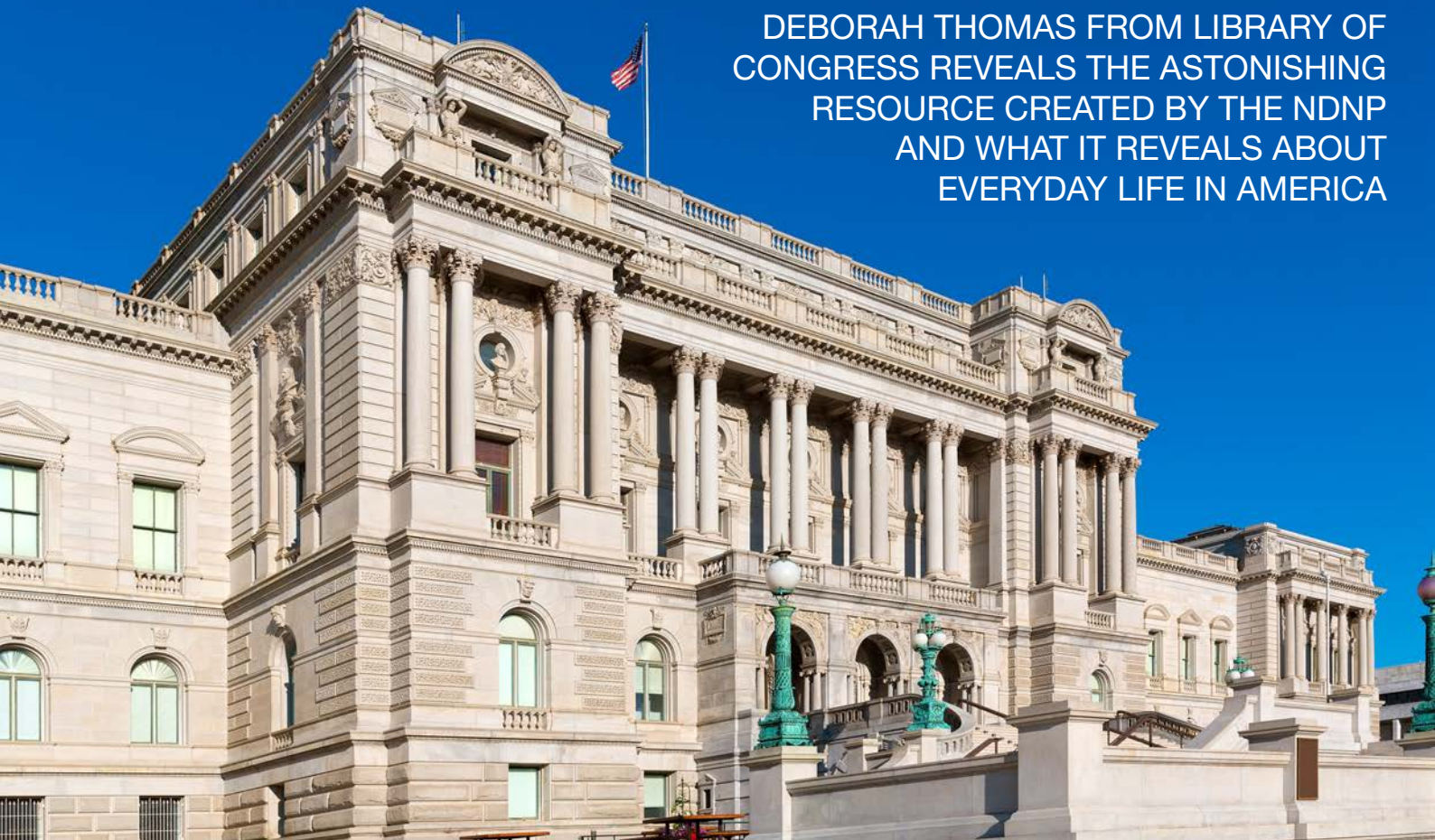
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NORTH AMERICA ANALYSIS

05

UNDERSTANDING THE RICH HISTORY OF LIFE IN AMERICA

DEBORAH THOMAS FROM LIBRARY OF
CONGRESS REVEALS THE ASTONISHING
RESOURCE CREATED BY THE NDNP
AND WHAT IT REVEALS ABOUT
EVERYDAY LIFE IN AMERICA



IN THIS ISSUE

Angela K. Wilson and Carol A. Bessel from the Division of Chemistry (CHE) at the National Science Foundation provide a fascinating insight into the future of chemistry

Minister Carolyn Bennett details her key priorities concerning the advancement of Indigenous Affairs in Canada

Minister Lawrence MacAulay says Canadian agriculture has deep roots and the government is working to build a future for the next generation of farmers

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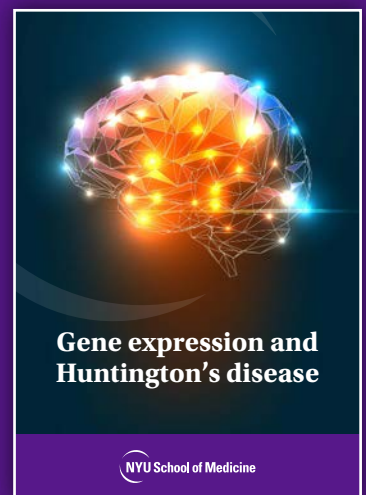
Gene expression and Huntington's disease

Naoko Tanese from New York University explores how monitoring gene expression can be used to treat neurodegenerative diseases such as Huntington's.



Naoko Tanese, PhD

Associate Dean for Biomedical Sciences
Director, Sackler Institute of Graduate
Biomedical Sciences



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Registered in England & Wales.
Company Reg No. 8667479.
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INTRODUCTION

Welcome to the November edition of North America Analysis. This comprehensive edition highlights several policy issues, including health, science, agriculture and energy.

Heading up this edition is a compelling interview with Deborah Thomas, Program Manager of the US's National Digital Newspaper Program at the Library of Congress in the United States.

In a thought-provoking piece, Chair of the NIMH Suicide Research Consortium at National Institute of Mental Health, Dr. Jane Pearson discusses suicide as a public health concern and addresses how it can be prevented and the contributing factors behind it.

Turning to the subject of science, I took part in an engaging conversation with Angela K. Wilson and Carol A. Bessel from the Division of Chemistry (CHE) at the National Science Foundation (NSF), who both provide a fascinating insight into the future of chemistry.

In terms of this edition's Canada articles, one very interesting one comes from Minister of Crown-Indigenous Relations and Northern Affairs, Carolyn Bennett. The Minister details her key priorities concerning the advancement of Indigenous Affairs in Canada.

In addition, Canada's Minister of Natural Resources, The Honourable Jim Carr shares his thoughts the potential of

energy efficiency – the “invisible fuel”. Added to this, Canadian agriculture has deep roots and the government is working to build a future for the next generation of farmers, writes Minister of Agriculture and Agri-Food, Lawrence MacAulay.

I hope that you find this edition insightful. I would certainly welcome any comments you have about this journal. ■

Jonathan Miles
Editor



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Understanding the rich history of life in America

Deborah Thomas from Library of Congress reveals the astonishing resource created by The NDNP and what it reveals about everyday life in America

In America, newspapers can help us understand both the country's history and democratic process. For decades, newspapers have been the primary resource for sharing information in local communities and to learn about both regional and national events. In addition, historic newspapers provide a populist perspective of events, which can be key to understanding the cultural context of the time.

To enhance access to this material, Library of Congress and the U.S. National Endowment for the Humanities decided to create The National Digital Newspaper Program (NDNP) in 2004, with repositories around the country to develop the resource of historic American newspapers. NDNP provides both funding and guidance for representative and state institutions to select and digitise historic newspapers from their own collections, which can be distributed through Chronicling America (chroniclingamerica.loc.gov) an online digital resource at Library of Congress.

Program manager Deborah Thomas explains that free and open access to American newspapers is given through the NDNP. She says that Library of Congress provides access to the digitised versions of the newspapers, as well as digital information about newspapers (U.S. Newspaper Directory, 1690-Present). She tells us more about the scope of the NDNP's work in her own words, as the interview kicks off.

"The first newspaper published in America was during 1690 in Boston, and while we don't have the actual digital copy online at this point, we do have information about it online.

"We currently have digital content from 1789-1943 and Library of Congress has the potential to add newspapers from 1690-1963, after which U.S. copyright law

regulations changed. All the materials on the website today are in the public domain."

The conversation then moves to how the NDNP builds on the legacy of the strategically successful United States Newspaper Program (USNP), which ran from 1982-2011.

"NDNP was the first national program to address the use of American newspapers as archival material, beyond the individual library collections. The National Endowment for the Humanities and Library of Congress got together in the 1980's and developed a sponsored program in each state and territory.

"The aim was to identify and centrally describe newspapers from across the U.S. and selectively microfilm the most at-risk material, so along the way the USNP developed several standards, archival descriptions of newspapers and microfilming practices. For the first time, the approach of newspaper libraries to archival materials was standardised."

Adapting to digitisation

When this program began to wind down, the National Endowment for the Humanities and Library of Congress looked at what it had accomplished and spotted a rising tide of both digitisation and technology. Thomas says that The National Digital Newspaper Program (NDNP) has benefitted from the networks that were established during the time of the USNP program.

"Concerning NDNP, we reused and enhanced descriptive information, standardised data and microfilm that was created during the life of USNP. The digitisation of newspapers in the current program generally comes from the microfilm copies, because that is the most common format available. The newspapers were

preserved on microfilm, for preservation reasons primarily.”

Thomas then tells us her thoughts on championing digitisation, both on a national and local level. This could benefit those in school, the local library or even at home Thomas enthuses, before developing this fascinating point further.

“Digitization of newspapers, in particular, gives people access to the views of American society over time, a window into what people thought and did and how they reacted to the events of the day in ways much more accessible than individual reels of microfilm, residing in distributed locations around the country.

“Having ready access to this kind of material provides new points of access through digital technologies – and different views into data that can provide a new perspective on history – in ways that books and biographies may not. Newspapers are important, particularly at a national and local level, indeed every small town in America has its own newspaper. These include the views and narratives of not only major historical figures and events, but also individual voices and elements of life in terms of social news, humour and editorial perspectives.

“Newspapers are therefore key to discovering American history and are usually very well used in most library collections. Putting digital technology to work to make that content broadly accessible has a powerful effect on distributing the content – and it also provides a rich ground for research and analysis in terms of American history.”

So, technology has really impacted and changed the way we access information and how libraries and museums are addressing these changes as well as embracing them. Thomas underlines that the way technology has impacted upon distribution methods is nothing but epic, with the ability to endlessly replicate newspapers and with the advent of the Internet to distribute them almost instantly. Thomas is keen to tell us more on this absorbing point in her own words.

“We not only have access to huge amounts of information anywhere in the world, but we also have access to many different views and sources for that. Libraries

and museums are both invigorated and challenged by these changes because the newspapers can reach so much more people than they could previously. We are challenged by these opportunities because our essential purpose has not changed, nor have our physical collections diminished. We now manage more physical material than we ever have before and we manage both digital copies of that material and digital material that never existed in physical form.

“The challenges of managing data in terms of a long-term and sustainable model is still a work in progress, so we are working very hard at Library of Congress to provide access to the newspaper collections for wide audiences, including researchers and patrons in ways that are the most useful for them.”

So, the future for The National Digital Newspaper Program (NDNP) certainly looks bright, and Thomas is keen to offer her concluding remarks, stressing that it provides access to the lives of everyday people in a manner that may be different from other historical materials.

“We provide access to all manner of community information and have newspapers from several ethnic and immigration groups, including materials in 12 different languages which we plan to expand over time.

“We have found that some of our most dedicated users are family historians, who are fascinated by what they can learn from newspapers. Whether or not they can find their actual history documented, they can still learn about the times that their ancestors lived in and the cultural context of the country. The newspapers provide both a very broad and detailed view of what American culture is all about.” ■

Deborah Thomas
Program manager

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Georgia's digitised newspaper efforts and the national digital newspaper program

Sheila McAlister explains how the Digital Library of Georgia is helping create a digital newspaper and better access to resources

Founded in 1995, GALILEO ([Georgia Library Learning Online](#)), the state of Georgia's virtual or online library, provides web access to library materials to all citizens of Georgia. This collaborative, resource sharing project of the Board of Regents of the University System of Georgia, as well as the digital newspaper project, strives to deliver equitable access to information resources and facilitate the sharing of resources among all types of Georgia libraries from those at public schools to those of academic research libraries.

Over its history, GALILEO has broadened its scope from providing a core set of vendor-supplied electronic reference resources to the provision of a common library management system for the university system libraries and the creation of a state-wide cultural heritage digitisation initiative, the Digital Library of Georgia ([DLG](#)).

Based at the University of Georgia Libraries, DLG collaborates with Georgia's educational and memory institutions to provide access to primary and secondary resources on Georgia history, culture, and life. DLG is not just a collection of digitised historic materials. Rather it, in partnership with LAMs, develops, maintains, and preserves online cultural heritage digital library resources. DLG acts not only as a digitising agency, but also provides consultation and other services to strengthen digital initiatives in



the state. Also, the DLG is the home of the state's newspaper microfilming project, the Georgia Newspaper Project.

As a collaborative, DLG engages with other agencies with state-wide educational and cultural heritage missions such as the Georgia Public Library Service, the Georgia Humanities Council, the Georgia Council for the Arts, and the state Department of Education. At the grassroots level, DLG works with a wide variety of cultural heritage institutions including municipal archives, public libraries, historical societies, religious archives, state agencies, colleges and universities, state archives, and museums regardless of their membership in GALILEO.

One of DLG's most important collaborations is the Georgia HomePLACE

(Providing Library and Archives Collections Electronically) project, a cooperative initiative with Georgia Public Library Service that works to encourage public libraries and related institutions across the state to participate in The Digital Library of Georgia. Through LSTA funding, DLG and GPLS can digitise local history and genealogy materials of interest to public library patrons and those materials found within public libraries themselves.

DLG depends on hard- and soft-funding at the state and federal level to fulfil its mission. Past funders include the Institute for Museum and Library Services (IMLS), the National Endowment for the Humanities (NEH), National Historic Publications and Records Commission (NHPRC), and the Digital Public Library of America (DPLA).

To provide “one-stop shopping” of digitised historic materials, DLG aggregates descriptive information or metadata from its partners into three portals. [The Georgia portal](#), contains over 550,000 digitised items related to the state’s diverse history from almost 150 different memory institutions in Georgia. With funding from the IMLS, DLG staff created the Civil Rights Digital Library ([CRDL](#)) which promotes an enhanced understanding of the American Civil Rights Movement. This portal helps users discover almost 18,000 primary sources and other educational materials from over 100 libraries, archives, museums, public broadcasters, and others nationwide.

Finally, DLG in partnership with the Association of Southeastern Research Libraries ([ASERL](#)), hosts and maintains the American Civil War portal, [Civil War in the American South](#). All three of these portals contain a wide variety of historical materials including local, state, and federal government documents; books and newspapers; historical manuscripts; artworks; photographs; cartographic resources; sound recordings; and moving images and are freely accessible to anyone worldwide.

Another key collaboration is DLG’s role as a service hub for the Digital Public Library of America ([DPLA](#)). The DPLA network consists of state and regional digital libraries (service hubs) and large digital libraries such as those of the Smithsonian and National Archives. DPLA “bring[s] together digitised and born-digital content from across the country into a single access point for end users, and an open platform for developers.”

As one of the six initial service hubs for DPLA, DLG aggregates all our partners’ metadata for freely available online digitised materials, not just those found in DLG’s three portals, and funnels it to the DPLA. By sharing with DPLA, DLG helps highlight its partners’ rich resources. Beyond these aggregations, DLG provides a suite of services to build digitisation capacity in Georgia such as metadata and digitisation services including reformatting, storage, training, and consulting.

DLG and Newspapers

As mentioned above, the DLG also serves as the state’s primary historic newspaper microfilming agency through the Georgia Newspaper Project (GNP). Historic newspapers provide a unique look at the state over time. They are invaluable to scholars and the general public alike as they provide in-depth coverage of Georgia counties and cities, report on the activities of state and local government, and reflect the social and cultural values of the time that they were created. Therefore, their preservation is a high priority. Without the funding and guidance of the NEH, much of this work would have been difficult, nigh impossible.

Georgia’s newspaper publishing history began in 1763 with the establishment of the state’s first newspaper, the *Savannah Gazette*, but efforts to preserve the state’s print journalism heritage began much later. In 1953, the GNP began when the University of Georgia’s alumni association provided funds to establish the program. The first issues were filmed in December 1953, and that year, the UGA library staff began to collect back files of newspaper titles from throughout the

state for filming. The GNP received \$557,550.00 of support through the NEH’s U.S Newspaper Program ([USNP](#)) for the cataloguing and filming of Georgia newspapers. In 2000, it was estimated the project had filmed 24 million pages, 25,000 reels. The GNP continues to film over 220 current titles from throughout the state at a rate of about 500 new reels a year; however, microfilm readers are increasingly expensive to maintain and replace. Accustomed to full-text searching available through online resources, library users demand similar ease-of-use for historic newspapers. In a 2014 survey of DLG’s public library partners, 92% of the respondents reported that their patrons want free access to digitised historic newspapers. Public library partners and DLG users regularly request digitisation of additional titles.

In response, DLG began to investigate how it might deliver historic, public domain Georgia newspapers. In 2007, DLG’s first full-text newspaper database debuted (*The Red and Black*, the student newspaper of the University of Georgia). Since beginning our full-text newspaper delivery, DLG staff have digitised over one million pages of newspapers from communities and regions across the state including Athens, Atlanta, Augusta, Columbus, Macon, Milledgeville, and Savannah as well as East, North, South, and West Georgia.

At the time that the *Red and Black* database debuted, the National Digital Newspaper Program ([NDNP](#)), a joint project of the NEH and Library of Congress, was in its infancy. These new, robust technical specifications for NDNP ensured the longevity of the digitised newspapers and provided

users with the full-text searching they desired. The bar was set high, and few institutions or vendors could meet these specifications. To balance DLG users' almost ravenous demand for digitised newspapers, DLG's financial resources and technological infrastructure, and concerns about the sustainability of these digital assets, DLG staff elected to employ a low-cost, less metadata-intensive method of delivery while following NDNP's guidelines for imaging.

As GALILEO's developers were stretched thin, the method of newspaper delivery required a minimum of developer assistance. Therefore, the eXtensible Text Framework (XTE), an open-source platform already familiar to DLG staff and the DJVu image format were chosen to build a series of city and regional digitised newspaper portals. While this method was cost-effective, the DJVu file format required the use of a plug-in that proved less stable over time. In addition, by using a non-standard method of creation and delivery, DLG was unable to benefit from the NDNP's grants or community of practice.

By far, the digitised newspapers are DLG's most popular content. Almost 3.4 million pages were viewed from January to September of 2017.

DLG, Chronicling America and the NDNP

Fast forward ten years and DLG finds itself in a different landscape. The NDNP technical specifications have become a de facto standard. Numerous vendors now provide conversion services that comply with the NDNP technical guidelines. Therefore, the price point for this conversion is like

that of our home-grown method. Moreover, digitised newspapers converted following the NDNP standards will be far more sustainable over time as the files and metadata created comply with a well-documented and widely-adopted standard.

The NDNP program boasts a strong nationwide community. Program participants such as those from Oregon and Nebraska have launched their own instances of LC's open-source newspaper delivery system, Chronicling America, paving the way for other states' adoption of the platform. Use of DJVu images provided a barrier to DLG's users, and the XTE platform is aging. It made more sense to work with an open-source, community-driven delivery system than to continue as a "lone wolf." Therefore, DLG staff decided to implement NDNP's technical guidelines and platform.

In July of 2017, DLG launched its new digitised newspaper portal, Georgia Historic Newspapers (GHN). The site was built employing the open-source platform Chronicling America. It provides much of the functionality DLG users demand (for example, hit highlighting, article clipping, and advanced searching) as well as several new features. These include:

- Essays about the publishing history of various newspaper titles;
- Browsing by region (corresponding to regions of older sites) and;
- Browsing by types that include community papers, papers-of-record, African American papers, religious papers, school papers, or Native American papers.

Its robust nature will allow DLG to maintain a single newspaper portal, rather than separate city or regional portals, a plus for our users and more efficient and sustainable for DLG's technical infrastructure. Thanks to tools developed by the North Carolina Digital Heritage Center, a past NDNP recipient, DLG staff is converting its previously digitised newspapers to incorporate them into the new GHN platform.

At the same time, staff are working with vendors to digitise more new content. Twelve years after the inception of NDNP, Georgia finally applied to join the program. As a recipient of a 2017 NDNP grant, DLG will be digitising another 100,000 pages over the next two years on top of our normal newspaper digitisation efforts. Without the leadership of NEH, LC, and NDNP, the preservation of the country's newspaper heritage and free and sustainable online access to this content would be impossible.



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Suicide: A major public health concern

Dr. Jane Pearson from NIMH highlights suicide as a public health concern and addresses how it can be prevented and the contributing factors behind it

Suicide is a major public health concern. Over 40,000 people die by suicide each year in the United States (US); it is the 10th leading cause of death overall. Suicide is complicated and tragic, but it is often preventable. Knowing the warning signs for suicide and how to get help can help save lives.

In the field of public health, it is a type of death that is considered preventable, indeed things can be done in terms of the environment or ways to affect behaviour. Dr. Pearson says that in addition to suicide deaths (mortality), prevention approaches consider suicide attempts as morbidity to prevent, improving ways that people are functioning, feeling, thinking. So, we talk about both prevention of deaths and attempts, in terms of suicide.

“For suicide, it is difficult, because we don’t have a blood pressure check or test that tells us much about an individual’s suicide risk, so we rely on their ability to describe their internal state. That is not always easy for everyone, so that makes it a challenge now.”

Dr. Pearson then tells us more about prevention and what is known about risk factors. Those who consider suicide typically have been on a trajectory which has been shaped by several things piling up, such as a mental illness, hardship, embarrassment and shame. There could also be a family history of mental illness and suicide, in terms of getting a background picture. Dr. Pearson describes why a history of attempting suicide increases risk for suicide death.

“There are many risk factors, which in themselves are not specific, but people who have attempted suicide are at increased risk. We think that is because they have done it once before, and as such, they are not afraid to repeat those behaviours, and previous

thoughts return that focus on suicide as the only solution. Because of the need to avoid psychological pain, these ‘familiar’ self-destructive tendencies may cancel out more ‘life preserving’ thoughts.

“So, the pattern is a complicated one, indeed researchers have asked people about their suicide thought patterns. Suicide thoughts can ebb and flow during the course of a day, weeks or even months. We are only just beginning to get an understanding of how this affects people daily. Sometimes however, there are precipitating events and we do have research in the US about the economic recession, such as losing their home which can be a precipitating event.”

Signs and symptoms

Dr. Pearson explains the signs and symptoms of suicide – that is when people are thinking about it and their state of mind – from a public health perspective.

“If there is a means of suicide that is readily available when someone is contemplating suicide, then we know that is not a good combination. We want to put time between the person who is thinking about suicide, and how they are considering it.

“In the US, half of our suicides are by firearms. We know that if somebody is in a house with a firearm in it, then the risk is much higher for suicide. There is much international research, which reveals that if you have less access to lethal means, such as reducing access to guns or pesticides and the more time you can buy, then the less suicides they are.

“Another issue is having somebody else who can be there with you, in terms of having a social connection. We try to think though some ways that are acceptable to people and feasible for communities – and there



have been many interesting approaches to that when you think of the individual person's context.

"So, if it concerns an older adult – then they may be becoming increasingly isolated for several reasons – how would they make connections? If it was a youth in school, who feels they are not doing well and have no support or friends, we are trying to figure out ways to ensure they get help that is effective.

"While we have several studies from the community perspective, we also are thinking about how healthcare systems should know how to address people who are suicidal, especially when it comes to behavioural health. Unfortunately, training in mental health does not always include suicide prevention, but those requirements are beginning to change."

Ongoing research

In order to know who is most at risk and to prevent

suicide, scientists need to understand the role of long-term factors (such as adverse childhood experiences) as well as more immediate factors like mental health and recent life events. Researchers also are looking at how genes can either increase risk or make someone more resilient to loss and hardships, Dr. Pearson goes on to say.

There are a few institutes at NIH that recognise the behavioural side of suicide prevention. For suicide, there are no specific genes, but we might have some inkling of what might put somebody at risk (e.g., excessive drinking and other risk-taking behaviour), which is true for many other disorders where there is no specific gene.

"We also endeavour to access as many areas of health care now, in terms of larger data sets, by letting the computers pull out what might be considered as risk. If we have data from people who are followed over time, including whether they have died by suicide or not, we can figure out what the risk trajectories are.

Then the next step is to determine the best ways to talk to patients about their risk, as well as advising clinicians on what do with the information.

“For suicide, it is difficult, because we don’t have a blood pressure check or test that tells us much about an individual’s suicide risk, so we rely on their ability to describe their internal state. That is not always easy for everyone, so that makes it a challenge now.”

Treatments and therapies

Research has shown that there are multiple risk factors for suicide and that these factors may vary with age, gender, physical and mental well-being, and with individual experiences. Dr. Pearson then underscores that there are treatments and preventative methods that are out there – to help prevent someone from taking their own life.

“If there is a means of suicide that is readily available when someone is contemplating suicide, then we know that is not a good combination. We want to put time between the person who is thinking about suicide, and how they are considering it.”

She also tells us that there aren’t many types of medication available now – which has been something of an issue in the US – because most pharmaceutical companies in the psychiatry area have not focused on preventing suicide death.

“They want medication to look safe, so there hasn’t been much incentive to test medicine for suicidal people. There is one medication that reduces suicide risk for those with schizophrenia – and there is a lot of descriptive data on the value of lithium for people with bipolar disorder – to prevent relapse. While it’s protective, it’s very difficult to do long-term studies for proving that it specifically prevents suicide.

“As we are depending on people’s thoughts and actions, which is true for mood and anxiety disorders generally, some of most effective treatments are therapies that help people to identify feelings, how not to act on them and what opposite actions could be taken. Cognitive therapy has been shown to be very effective for

preventing suicide attempts. So, we must think about the specific thoughts and behaviours around suicide.”

Concluding thoughts

In closing, Dr. Pearson stresses that when addressing suicide, it is vitally important to have an open and honest conversation concerning the subject. She also highlights the toll-free National Suicide Prevention Lifeline (NSPL) that is available.

“It’s also important to keep a distance between themselves and the means they are think of, such as keeping them away from tall buildings and to be supportive and be there for them.

“The US has a national hotline, manned by some highly-trained counsellors. They work very hard to ensure people stay safe and get connected to health. It’s also worth noting this is a tough haul – people don’t reach a suicidal state overnight – the are many contributing factors.” ■

Further information: You can call the toll-free National Suicide Prevention Lifeline (NSPL) at +1 800 273 TALK (8255), 24 hours a day, 7 days a week. The service is available to everyone. The deaf and hard of hearing can contact the Lifeline via TTY at +1 800 799 4889. All calls are confidential. The National Institute of Mental Health also encourages children to put the crisis number in their mobile phone contacts.

Dr. Jane Pearson Chair, NIMH Suicide Research Consortium at National Institute of Mental Health

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The symptoms of Huntington's disease

Chief Executive of the Huntington's Disease Association, Cath Stanley explores the symptoms, causes, and the vital role of research within the field

Huntington's disease is a rare genetic illness caused by a faulty gene on chromosome 4. If a person has Huntington's disease, it means they have inherited a faulty version of the Huntington's gene. The faulty gene that causes Huntington's repeats a particular coding sequence known as CAG (cytosine-adenine-guanine) too many times – a bit like adding too much of one ingredient in a recipe. This means the protein it makes damages nerve cells in the brain. If a person has 40 or more CAG repeats, it is certain that they will develop Huntington's at some point.

Huntington's is what's known as an "autosomal dominant disorder" this means that you can inherit the gene, and therefore the disease, from only one parent. One of your parents is likely to have Huntington's too. Every child conceived naturally to a parent who has the faulty Huntington's gene has a 50% chance of inheriting it and the disease. If both parents have the faulty gene, there is a 75% the child will also have the gene. A person can find out if they carry the faulty gene by taking a blood test known as a predictive test. You usually need to be 18 years old to take the test.

Symptoms

The symptoms of Huntington's disease vary widely between people. Even people in the same family may be affected differently. However, changes usually affect three main areas: movement (chorea movements, dystonia, and rigidity), cognitive (difficulties with planning and thinking) and behaviour (changes in behaviour and personality). Symptoms usually develop between the ages of 30-50 years, although they can start at any time. Sometimes, symptoms are present for a long time before a diagnosis of Huntington's disease is made.

Professionals and families can mistake Huntington's for a different illness such as Parkinson's disease or



Image: © Kevin John Stanley

**Cath Stanley,
Chief Executive**

Alzheimer's disease. This is especially true when people are not aware that the faulty gene is in their family and that they are at risk.

If a person develops symptoms before the age of 20, this is known as Juvenile Huntington's disease. The symptoms may at first appear as stiffness and clumsiness in the arms and legs. Parents may notice a change of performance at school, behavioural changes and disturbances in speech. The disease is progressive, meaning that symptoms worsen over time.

Movement disorder

The movement disorder is usually the most obvious first symptom. This can include physical symptoms such as involuntary and voluntary movements being impaired but also speech and swallowing difficulties. The cognitive disorder is usually the symptom people find affects them most in daily life. This may be less obvious, particularly earlier on in the illness but causes great disruption into a person's ability to function. The behavioural disorder is usually the one that gives patients and carers the most concern. This can present as mood and behavioural changes, impulsivity, frustration, apathy and depression and the inability to wait, all of which can compound social isolation.



Research

It is a really important time in Huntington's research. There are many different avenues of research being carried out. Perhaps one of the most significant is the ISIS-HTTx. This is a trial involving a drug called ISIS-HTTx and is the first therapy designed to address the genetic causes of Huntington's directly. It targets the protein huntingtin's RNA and reduces the production of the huntingtin protein. Research in models of Huntington's has shown by lowering huntingtin RNA and protein levels with the drug slowed down the progression of the disease, increased survival and improved symptoms.

The aim of the current study is to determine the drug's safety and dosage levels and is expected to continue throughout 2017.

The Huntingtons Disease Association is a charity that supports people affected by Huntington's. We offer support and advice through our website, literature and from our Specialist Huntington's Disease Advisory service. All our specialist advisers are experienced and

compassionate care management professionals. We understand that whole families may need our support.

We have a specialist adviser dedicated to helping young people with Juvenile Huntington's disease and a specialist youth worker.

Our specialist advisers support anyone who needs their help at any stage of the Huntington's journey. They can help people living with the disease, people at risk of inheriting the disease, family members and carers, and children/ young people. They can also advise friends, neighbours, employers and medical teams. ■

Cath Stanley **Chief Executive**

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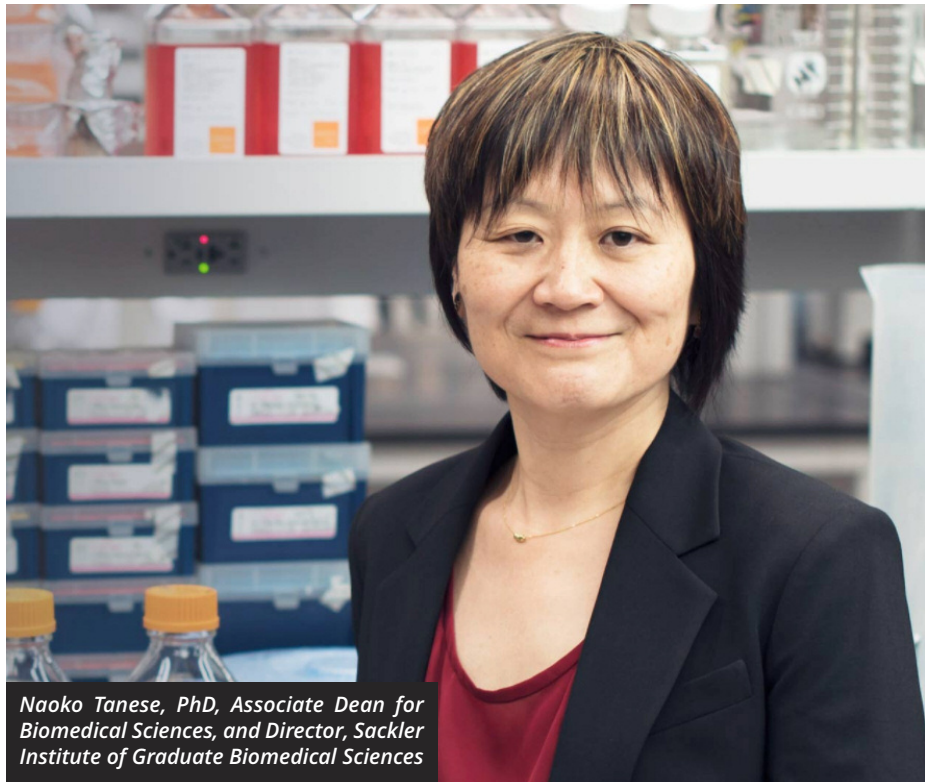
What's in an aggregate? Therapeutic intervention in Huntington's

Naoko Tanese from New York University School of Medicine outlines their work around Huntington's disease (HD) and effective new targets for therapeutic intervention

Huntington's disease (HD) is a rare hereditary neurodegenerative disease that strikes patients in mid-life. American physician George Huntington first described the disease in 1872 after seeing affected residents in East Hampton, New York. Patients generally experience a progressive decline in cognitive, psychiatric, and motor functions. The disease is fatal. In 1993 an international team of scientists discovered the gene that causes the disease. Despite years of intense research, no cures or treatments to delay the onset or prevent the progression of the disease are available.

HD is caused by an inherited dominant mutation in the Huntingtin gene, HTT. This means an offspring of a parent who carries a mutant HTT gene has a 50% chance of inheriting the mutant gene. The mutation results in an increased number of repeats (greater than 40) of the amino acid glutamine in the encoded Huntingtin protein (HTT).

A normal HTT protein has between 7 and 35 glutamines. Increased number of glutamine repeats changes the property of the protein and renders it toxic to cells. The HTT protein is present throughout the body and throughout life. However, mutant HTT is toxic to select cells. Postmortem examination of the brains of affected individuals shows massive cell loss in certain parts of the brain, leaving



Naoko Tanese, PhD, Associate Dean for Biomedical Sciences, and Director, Sackler Institute of Graduate Biomedical Sciences

other cells and tissues intact. This indicates that some neurons are particularly sensitive to the toxic effects of mutant HTT.

The normal HTT protein has been implicated in many cellular functions. However, we have an incomplete understanding of how mutant HTT causes the disease. A better understanding of the functions of the normal and mutant HTT protein is paramount, if effective therapies or cures are to be developed.

Proteins made in cells maintain certain structures dictated by their biochemical and biophysical properties. This is

referred to as protein folding. When proteins misfold, they often lose their normal functions. Cells have developed elaborate mechanisms to remove such aberrant, misfolded proteins. This protects the cells from potential harmful effects of misfolded proteins.

However, misfolded proteins can accumulate over time and form irreversible aggregates that impair cellular homeostasis. These aggregates are a hallmark of many neurodegenerative diseases. They are found in postmortem brain tissues of affected individuals. Age-associated diseases such as Alzheimer's disease, are linked to protein misfolding. HD is

also considered a protein misfolding disease although many other mechanisms are thought to play a role in the disease pathogenesis.

Decades of research have uncovered intriguing properties of different types of protein aggregates, some of which are RNA-protein granules found in normal cells. Each granule appears to have distinct properties and its formation is driven by specific sets of proteins and RNA. Some granules are formed in response to stress. This mechanism serves to halt energy-consuming cellular activities, by sequestering proteins involved in key biochemical processes. Upon removal of the stress, granules disassemble and the released proteins resume their normal functions.

Interestingly, mutant proteins linked to several neurodegenerative diseases have been located within these types of granules. They include mutant RNA binding proteins associated with amyotrophic lateral sclerosis, spinal muscular atrophy, and fragile X syndrome. These RNA binding proteins normally play a role in RNA transport, translation of RNA to make proteins, and formation of RNA-protein complexes.

Mutant RNA binding proteins, however, show altered biophysical properties. They have increased propensity to interact with one another and affect the formation and function of granules. There is increasing evidence that over time mutant RNA binding proteins in these granules steadily accumulate and become converted to irreversible aggregates that are toxic to cells. Neurons are vulnerable to aberrant proteins that accumulate because neurons do not divide. Ultimately the machinery in the cell fails to remove toxic proteins, causing cell death.

Since the functions of normal HTT and the mechanisms by which its mutant counterpart contributes to HD remain unclear, my lab began investigating the role of HTT in RNA metabolism. New imaging techniques have helped us determine the location of the normal HTT protein inside neurons.

Strikingly, we discovered that HTT could be found near neuronal RNA granules. RNA granules are large RNA-protein assemblies responsible for transporting RNA to specific locations in the neuron. To determine whether HTT influences RNA localisation, we reduced the level of normal HTT in neurons grown in a culture dish and examined its effect on transport of RNA. We found that the reduction of HTT in cells disrupts RNA localisation. The result points to HTT contributing to the integrity of RNA granules during RNA transport.

New experiments in HTT

To further investigate cellular processes that HTT is involved in and how they might differ in mutant HTT, we designed experiments to purify normal and mutant HTT proteins from cells and tissues. We next identified proteins that interacted with each form of HTT. By identifying the functions of the proteins that co-purified with HTT, we uncovered new functions for HTT. Analysis of the binding partners of HTT proteins revealed that both normal and mutant HTT interact with proteins involved in RNA metabolism and protein synthesis.

We have thus uncovered new roles for normal and mutant HTT in RNA metabolism. The findings have several implications for the development of HD. We have located mutant HTT in neuronal granules, similar to those associated with aforementioned RNA

binding proteins linked to neurodegenerative diseases. Our results suggest HTT has a role in the formation of RNA-protein granules.

Unlike normal HTT, mutant HTT has a propensity to interact with one another through the increased repeat sequence. At high concentrations, mutant HTT alters biophysical properties of RNA-protein assemblies and shifts the equilibrium in favour of forming aggregates.

Furthermore, a recent study reported stable formation of RNA aggregates containing repeat sequences. Collectively, the findings suggest that mutant HTT together with repeat sequence-containing RNA forms granules that become converted to irreversible toxic aggregates over time. The development of chemical agents that prevent aggregation or disrupt aggregates may serve to reverse the toxicity associated with the mutant protein and RNA. Through understanding of how HTT supports neurons with these functions, we hope to reveal effective new targets for therapeutic intervention.



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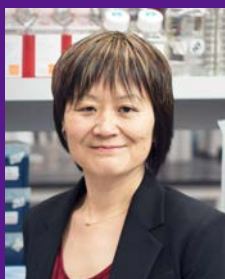
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Gene expression and Huntington's disease

Naoko Tanese from New York University explores how monitoring gene expression can be used to treat neurodegenerative diseases such as Huntington's.



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Biomedical Sciences



**Gene expression and
Huntington's disease**

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Looking forward to the future of chemistry

Angela K. Wilson and Carol A. Bessel from the Division of Chemistry (CHE) at the National Science Foundation (NSF) provide a fascinating insight into the future of chemistry

The National Science Foundation (NSF) [Division of Chemistry \(CHE\)](#) is essentially concerned with fundamental chemistry. CHE funds everything from fundamental research related to the development of instrumentation to making and understanding chemical reactions; areas of research include catalysis, synthesis, and the study of life processes, the environment, and nanomaterials, reveals Division Director Angela K. Wilson as the interview kicks off. She then says more about CHE's work in her own words, including their annual budget and the kind of activities they are involved in.

"Our annual budget is approximately \$240 million per year, and we are broken up into Individual Investigator Award (IIA) Programs, of which there are 8. Within these programs, individuals and teams can submit their pro-

posals. In addition to these core programs, we also have a Centers for Chemical Innovation (CCI) Program – which funds much larger teams working on very complex problems. These center awards are for \$4 million per year – for up to 10 years (\$40 million total).

"The CHE Division also takes part in the Research Experiences for Undergraduates (REU) Program. Here, undergraduates can learn how to do research over the summer months and this helps to develop our scientific workforce. CHE also participates in the Major Research Instrumentation (MRI) Program. This program supports major instrumentation such as nuclear magnetic resonance (NMR) spectrometers, electron microscopes, and other instruments used by the chemistry community, so that people can do their work."

NSF's Ten Big Ideas

In summary, NSF's Ten Big Ideas includes the following research and process ideas:

Research ideas:

1. Harnessing Data for 21st Century Science and Engineering;
2. Work at the Human-Technology Frontier: Shaping the Future;
3. Windows on the Universe: The Era of Multi-Messenger Astrophysics;
4. The Quantum Leap: Leading the Next Quantum Revolution;
5. Understanding the Rules of Life: Predicting Phenotype;
6. Navigating the New Arctic.

Process ideas:

7. Mid-Scale Research Infrastructure;
8. NSF 2050;
9. Enhancing STEM Through Diversity and Inclusion and;
10. Growing Convergent Research at NSF.

Concerning the [Ten Big Ideas](#) for Future NSF Investments, research agendas that identify areas for future investment at the frontiers of science and engineering, Bessel points out the Quantum Leap: Leading the Next Quantum Revolution idea, where investigators work in areas such as materials chemistry and computing. She says that building a new type of computer could help solve many of today's encryption problems and this is critically important to providing security in areas such as banking, medical records, and national security Bessel explains. She then expands on this interesting point further.

“The aim in CHE is to develop new products and technologies for the future. CHE wants to get people ready to be a part of the discoveries in the future.”

“Such quantum computing only exist today as very simplistic models, but we are currently developing materials and computer methods to make the next generation of computer. New quantum materials would be passed on to computer scientists and engineers for further development and commercialisation. Nearly every division at NSF could have a role in quantum computing, for example, we need investigators in the social, behavioural, and economic sciences to understand how such devices could impact society.”

Wilson is keen to tell us about the important area of harnessing data, which is another of NSF's Big Ideas, and is also very important to the wider chemistry community. In terms of data in laboratories, Wilson believes that we need to come up with better ways to harness data – that is, data visualisation, data mining, machine learning and other data analytics that can be used in the domain sciences such as chemical catalysis.

“There are many possible catalysts that would be useful to manufacturers. Chemists have only explored a very small number of catalysts because it is labour-intensive to make them, characterise them, and then study their reactivity with other molecules. If we had better ways to explore our current data, then perhaps we could identify new types of catalysts in a faster way. It's like the drug discovery processes, where a lot of modelling

On the importance of fundamental scientific research to benefit society, much of CHE's work leans heavily towards this. For example, fundamental discoveries take place within the CHE's Catalysis Program and Chemical Synthesis Program – these groups focus on designing and making new molecules – and often these molecules end up being a part of the wider industry such as agriculture, pharmaceuticals, plastics, and materials for energy capture and conversion.

New materials

The NSF-funded Center for Sustainable Polymers (CSP) is concerned with designing and developing a much more biodegradable type of polymer. Wilson adds that it's not easy to recycle plastics, such as plastic grocery bags or soda bottles, so CSP are coming up with much better materials for these industries. Deputy Division Director, Carol A. Bessel then joins in the conversation, to tell us about sustainable chemistry, which is a vital aspect of the CHE's work.

is done to design and select the best pharmaceutical molecules before the experimental work is begun in the laboratory or in the clinic.”

Biological processes

Bessel then tells us that one of the areas CHE plays a significant role in is around biological processes that are controlled by chemical reactions. That could be anything from the use of glucose to make your muscles work – to the neuron that control how your brain gets and stores information. Bessel then stresses that CHE seeks out to understand the fundamental processes that are controlling life and as such, they are focussed on the Understand the Rules of Life – another Big Idea. NSF’s role in examining the rules of life is different than that of the National Institutes of Health (NIH) in the US. NSF generally examines the how chemical and biological structures influence biological function, while NIH examines the malfunction of fundamental life processes that lead to disease and death.

In closing, I asked Wilson and Bessel what their vision is for the future of the NSF’s Division of Chemistry (CHE). Wilson begins by revealing that there has been much emphasis on the Materials Genome Initiative (MGI), which concerns exploring space in terms of the discovery of new materials and developing these materials from modelling and experimental perspectives. Such efforts make it is easier to make materials with specifically desired properties.

“In the same way, we need to do more of this in the field of chemistry, by harnessing data. We started this initiative in 2016, but there is much more work to be done in this area, and we want to use this to really push forward chemical discovery.”

Bessel adds her thoughts on the matter, by highlighting the logistics in terms of making things happen and to move communities forward, so that they can explore the interactions with other fields, such as materials, computing, biology and physics.

“In this vein, we want to grow new fields where the workforce of the future will be employed. CHE wants to

be a leader in new industries that will make life better. We are trying very hard to develop new networks for our communities, so they can work not only with chemists, but also with mathematicians and computer scientists, as well as those in engineering or the economic and social sciences.

“The aim in CHE is to develop new products and technologies for the future. CHE wants to get people ready to be a part of the discoveries in the future.”

“Wilson is keen to tell us about the important area of harnessing data, which is another of NSF’s Big Ideas, and is also very important to the wider chemistry community. In terms of data in laboratories, Wilson believes that we need to come up with better ways to harness data – that is, data visualisation, data mining, machine learning and other data analytics that can be used in the domain sciences such as chemical catalysis.”

In closing, Wilson adds that along the above lines, CHE has held many workshops which aim to bring those from diverse communities together, to talk about emerging areas in chemistry. ■

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The outermost frontiers of knowledge and scientific progress

The National Science Foundation (NSF) is an agency created in 1950 to further scientific progress, as Open Access Government reveals

The National Science Foundation (NSF) is an independent federal agency created by Congress in 1950 “to promote scientific progress; to advance the national health, prosperity, and welfare; to secure the national defence” according to the organisations website².

The National Science Foundation (NSF) has an annual budget of \$7.5 billion (FY 2017), NSF are the funding source for approximately 24% of all federally supported basic research conducted by America’s colleges and universities. In many fields such as computer science, mathematics and the social sciences, NSF is the major source of federal backing.

NSF fulfils their mission chiefly by issuing limited-term grants – currently consisting of about 12,000 new awards each year, with an average duration of three years - to fund specific research proposals that have been judged the most promising by an objective and rigorous merit-review system. Most of these awards go to individuals or small groups of investigators, while others provide funding for research centres, instruments and facilities that allow scientists, engineers and students to work at the outermost frontiers of knowledge.

NSF’s goals of discovery, learning, research infrastructure and stewardship all provide an integrated strategy that advances the frontiers of knowledge, cultivates a world-class, broadly inclusive science and engineering workforce and expands the scientific literacy of all citizens, as well as building the nation’s research capability through investments in advanced instrumentation and facilities. NSF also strongly supports excellence in science and engineering research and likes to say that they are “where discoveries begin.”

During the past few decades, NSF-funded researchers

have won some 223 Nobel Prizes as well as other honours too numerous to list here. These pioneers have included the scientists or teams that have discovered many of the fundamental particles of matter, analysed the cosmic microwaves left over from the earliest epoch of the universe, developed carbon-14 dating of ancient artefacts, decoded the genetics of viruses, and created an entirely new state of matter called a Bose-Einstein condensate for example.

NSF also funds equipment required by scientists and engineers, but is often too expensive for any one group or researcher to afford. Examples of such major research equipment include Antarctic research sites, giant optical and radio telescopes, high-end computer facilities and ultra-high-speed connections, sensitive detectors of very subtle physical phenomena and gravitational wave observatories plus ships for ocean research.

Another crucial element in NSF’s mission is support for science and engineering education. The research NSF funds is thoroughly integrated with education, to make sure there will always be plenty of skilled people available to work in new and emerging scientific, engineering and technological fields, as well as sufficient capable teachers to educate the next generation.

No single factor is more important to the economic and intellectual progress of society, and to the enhanced well-being of its citizens, than the continuous acquisition of new knowledge NSF believes and as such, they are proud to be a key player in that process.

Research areas

NSF is divided into the seven directorates that support science and engineering research and education:

1. Biological sciences;

2. Computer and information science and engineering;
3. Engineering;
4. Geosciences;
5. Mathematical and physical sciences;
6. Social, behavioural and economic sciences and;
7. Education and human resources.

Every section named above is headed up by an assistant director and each is further subdivided into divisions, such as materials research, ocean sciences as well as behavioural and cognitive sciences. Within NSF's Office of the Director, the Office of Integrative Activities also supports research and researchers and other sections of NSF are committed to activities such as award processing and monitoring, financial management, award processing and monitoring, legal affairs and outreach.

The main research areas of the NSF are summarised below:

Biological Sciences (BIO)

- Biological Infrastructure (DBI);
- Environmental Biology (DEB);
- Emerging Frontiers (EF);
- Integrative Organismal Systems (IOS);
- Molecular and Cellular Biosciences (MCB).

Computer and Information Science and Engineering (CISE)

- Office of Advanced Cyberinfrastructure (OAC);
- Computing and Communication Foundations (CCF);
- Computer and Network Systems (CNS);
- Information and Intelligent Systems (IIS).

Education and Human Resources (EHR)

- Graduate Education (DGE);

- Research on Learning in Formal and Informal Settings (DRL);
- Undergraduate Education (DUE);
- Human Resource Development (HRD).

Engineering (ENG)

- Chemical, Bioengineering, Environmental and Transport Systems (CBET);
- Civil, Mechanical and Manufacturing Innovation (CMMI);
- Electrical, Communications and Cyber Systems (ECCS);
- Engineering Education and Centers (EEC);
- Emerging Frontiers and Multidisciplinary Activities (EFMA);
- Industrial Innovation and Partnerships (IIP).

Environmental Research and Education (ERE) Geosciences (GEO)

- Atmospheric and Geospace Sciences (AGS);
- Earth Sciences (EAR);
- Ocean Sciences (OCE);
- Office of Polar Programs (OPP).

Integrative Activities (OIA)

International Science and Engineering (OISE)

Mathematical and Physical Sciences (MPS)

- Astronomical Sciences (AST);
- Chemistry (CHE);
- Materials Research (DMR);
- Mathematical Sciences (DMS);
- Physics (PHY);
- Office of Multidisciplinary Activities (OMA).

Social, Behavioural and Economic Sciences (SBE)

- Behavioural and Cognitive Sciences (BCS);
- National Center for Science and Engineering Statistics (NCSES);
- Social and Economic Sciences (SES);
- SBE Office of Multidisciplinary Activities (SMA).

Chemistry (CHE) focus

One of the above areas is explored here, as we take a closer look at the Chemistry (CHE) division, within Mathematical & Physical Sciences (MPS). This section of the NSF envisions:

- Being a global leader in transforming chemical innovation and discovery, whilst also advancing chemistry education, literacy plus America's competitive edge.
- Encouraging chemists to lead multi-disciplinary efforts that expand humanity's knowledge and address both short- and long-term societal problems;
- To be a major voice in the communication of the value of chemistry to the public and;
- Being comprised of outstanding staff, all of whom are dedicated to the vitality of the chemistry field.

In addition, the Division of Chemistry (CHE) strongly supports innovative research in chemical sciences, integrated with education, through strategic investment in developing a globally engaged U.S. chemistry workforce that reflects America's diversity.

Reflecting NSF's values, CHE believes in:

- The importance of fundamental scientific research for society's benefit;
- Empowering future generations in science;
- Maintaining the highest standards of both integrity and ethical behaviour;
- Fairness, openness and clear communication as well as;

- The diversity of America's scientific workforce and broadening participation in all CHE activities, at every level.

Biological Sciences (BIO)

Another division of the NSF worth looking at is the Directorate for Biological Sciences (BIO), which sets out to enable discoveries for understanding life. BIO-supported research advances the frontiers of biological knowledge, increases understanding of complex systems, and provides a theoretical basis for original research in many other disciplines of science.

The Directorate supports research to advance understanding of the principles and mechanisms governing life. Their research extends across systems that encompass biological molecules, cells, tissues, organisms, organs, populations, communities, and ecosystems up to and including the global biosphere.

On NSF's website, we learn more about the Directorate's important work. "Comprehensive concepts that bridge and unify the diverse areas of biology include complexity, robustness, communication, resilience, adaptability and cooperation. Achieving a coherent understanding of the complex biological web of interactions that is life is a major challenge of the future.

"This challenge will require that knowledge about the structure and dynamics of individual biological units, networks, sub-systems and systems be compiled and connected from the molecular to the global level and across scales of time and space. Integral to all activities across the directorate is a commitment to integrate research and education, broaden participation, and promote international partnerships"¹.

The Directorate of Biological Sciences is organised into a number of divisions, which you can learn more about at: <https://www.nsf.gov/dir/index.jsp?org=BIO> , but they are listed in summary below:

- The Division of Biological Infrastructure (DBI);
- The Division of Environmental Biology (DEB);
- The Division of Integrative Organismal Systems (IOS);
- The Division of Molecular and Cellular Biosciences (MCB) and;

- The Emerging Frontiers (EF) Division.

In recent news, we discover that NSF funds the future of materials science, as evidenced in news that eight new 2017 Materials Research Science and Engineering Centre (MRSEC) awards will drive cutting-edge science and engineering in the future. Totalling a staggering \$145 million, these six-year grants aim to support innovative work in materials science and help train the next generation of materials researchers.

“These awards are representative of the incredibly broad, highly multidisciplinary research portfolio spanning all Division of Materials Research priority areas,” Linda Sapochak, director of the NSF Division of Materials Research (DMR) says. “These centres will forge new research frontiers through team-based development of novel materials that are relevant to future high-tech applications” she adds.

The centres address a national priority: fostering collaboration among universities, national laboratories, industry and international scientific organisations to address complex fundamental research challenges. Such challenges include extreme miniaturisation, atomically thin “paper” materials that self-fold into functional structures, and control over the assembly and reconfiguration of nano particles connected at the molecular scale.

We read that the MRSEC awards will have far-reaching impact on fields ranging from telecommunications and clean energy, to quantum information sciences. “Research outcomes from these awards could revolutionise computer memory and wearable medical devices,” Sean L. Jones, DMR’s deputy division director comments.

“The MRSEC centres provide leadership for the country concerning new materials and new materials phenomena addressing national needs, including sustainability and innovation,” Sapochak says. “We are especially excited about the international, industrial and national laboratories’ collaborations that will give junior researchers in the centres experiences valuable to their lives as scientists and engineers, and the incredibly diverse and highly skilled personnel participation.”

Of the eight awards, three are for new centres: The University of Texas at Austin, the University of Illinois

Urbana-Champaign plus the University of Washington. The other five awards support centres that have stood out for successful, collaborative and ongoing research. You can read more about the 2017 MRSEC awards at: https://www.nsf.gov/news/news_summ.jsp?cntn_id=243377&org=NSF&from=news

Funding

One final point to highlight is that when it comes to the all-important subject of funding, it is certainly true to say that NSF funds research and education in most of science and engineering fields. It does this diligently through grants, and cooperative agreements to no less than 2,000 colleges, universities, K-12 school systems, businesses and other research organisations all over America. NSF accounts for about one-fourth of federal support to academic institutions concerning basic research needs.

According to NSF’s website, NSF receives around 40,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, NSF also receives several thousand applications for graduate and postdoctoral fellowships.

In addition, it is well worth noting in closing that the agency operates no laboratories itself, but does fully support national research centres, user facilities, certain oceanographic vessels and Antarctic research stations. NSF also supports co-operative research between universities and industry, as well as US participation in international scientific and engineering efforts, plus educational activities at every academic level. ■

1 <https://nsf.gov/about/>

2 <https://www.nsf.gov/dir/index.jsp?org=BIO>

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The natural world – Why field studies matter

Thomas L. Fleischner, Ph. D, Executive Director of the Natural History Institute discusses the critical importance of direct engagement with the natural world

Most major leaps in understanding the complex workings of the natural world have been discerned by naturalists, in the field, engaged in careful observation of plants, animals, and their interactions in natural settings. Experimental manipulations, laboratory-based inquiries, and theoretical models often yield exciting and important information. But frequently, such studies represent attempts to sharpen insights that came initially from the direct observation and description at the core of natural history – “the practice of intentional, focused attentiveness to the more-than-human world, guided by honesty and accuracy.”

The unifying theory of modern biological science – evolution through natural selection – was famously developed independently by two astute field naturalists, Charles Darwin and Alfred Russel Wallace. Only direct field study of real organisms in real landscapes offered a clear enough view into the phenomena of nature for this unifying theory to be revealed. As the renowned ecologist Paul Dayton has noted: “There is simply no substitute for actually experiencing nature, to see, smell, and listen to the integrated pattern that nature offers an open mind.”

Today, in the grip of climate change and the sixth mass extinction, our need for understanding how nature



works is more urgent than ever. But the startling fact is that fewer and fewer biologists have the opportunity to develop the skills of field biology and natural history. Over the past few decades, academic field studies have diminished on both sides of the Atlantic, as institutions and funding agencies have privileged theory over empirical field studies.

The American conservationist Aldo Leopold lamented the loss of field studies in biology education more than 70 years ago – and the situation has only grown more critical. Biologists with the skills to identify plants and animals have become the exception rather than the rule. How can we recognise human impacts on biodiversity if we can't recognise the species that comprise it?

I've had the honour of directing a

working group – representing a broad diversity of academic institutions and other NGOs – focused on the decline of field studies in biology education. This project was supported by the U.S. National Science Foundation, and coordinated through the Natural History Institute.

The benefits of study

The value of field study is vast: field experiences not only contribute to better science, but also create better scientists, citizens, and people, thereby substantially affecting the human-nature relationships that form the basis for sustainability.

Observing nature is the touchstone for understanding how life works, and thus field studies serve quite literally as the grounding for the biological sciences. At the same time, field experiences often force observers to

question and to re-evaluate their assumptions about how the natural world operates.

Accordingly, field observations can lead to re-calibration of research strategies for exploring biological phenomena, explanations for which are often subsequently tested using information collected by observational approaches in the field. Field observations reveal patterns, and these often lead to development of formal hypotheses. Theoretical models are only as solid as the field natural history foundations on which they rest.

Field-based education is particularly critical to the biological sciences, providing fundamental training for key disciplines such as behaviour, ecology, evolution, systematics, and conservation science. Field studies underlie the conceptual and technical bases for these disciplines and are required to ensure their healthy growth.

Now, as society struggles to respond appropriately to losses of biodiversity, range shifts due to climate change, and emergence of new human pathogens, the decline in opportunities for field study means that subsequent generations of biologists will be increasingly divorced from the primary setting – the natural environment – in which the phenomena that they study occur.

As the capacity to modify biological systems expands – from genomes to ecosystems to global cycles – it is imperative that scientists and the broader public can critically evaluate the outcomes of these changes in the context of complex natural settings. Within academia, this need also applies to the educators charged with training future generations of problem solvers. Field studies are an essential

component of every scientist’s training.

Field education also promotes development of place-based understanding. Students who engage in field experiences have greater opportunity to cultivate the critical connections to real places that transform abstract concepts into tangible realities. This outcome extends to the cultural, social, and political settings in which field studies occur. A sense of place can be a powerful motivator for learning and stewardship and thus individuals who become strongly connected to a specific setting, tend to become more effective advocates for all elements of that environment.

On an individual level, field studies often spark a “sense of wonder” that can launch students on a path of discovery-based science, resulting in life-long commitment to careers in natural, environmental, and medical science. Field experiences – in particular residential and other immersive experiences – also provide unparalleled opportunities for development of intra- and inter-personal skills that are critical to effective leadership. There is also empirical evidence that field courses contribute to improved academic performance and cognitive learning in undergraduate biology students.

Challenges to study

Higher education has changed dramatically since Aldo Leopold wrote about the importance of field studies in the 1930s. Institutional challenges to field studies include decreasing financial resources and increasing regulatory concerns. Institutions, presuming high costs, fearing legal liability issues, too often construct administrative obstacles to faculty offering field experiences for students.

Accommodating study

Collectively, these factors contribute to a significant decline in field study opportunities for students and lack of pedagogical guidance for instructors interested in conducting field courses. At many institutions, instructors interested in providing field experiences must negotiate a complex suite of financial, logistical, legal, and attitudinal hurdles.

Sometimes, something as simple as the lack of a vehicle for transporting students is what denies them field study opportunities. Over time, these hurdles may sap the energy and morale of even the most dedicated instructors, thereby reinforcing the cycle of decline for courses that include a field component.

More than ever, the world needs the passion, insight, and wisdom that come from field studies. Academic institutions must recognise that field experiences are more crucial, not less, in the 21st century, and work to encourage, rather than obstruct, field education. Funding agencies have an important role to play by supporting this critical foundation of learning how nature works.



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How communities are strengthening their food systems

Assistant vice president of programmes at American Farmland Trust, Julia Freedgood explains the challenges around the increasing demands to food systems

In the United States, as across the world, increasing demands to feed a growing population are challenged by urbanisation, climate change and an ageing farming population. While the U.S. is blessed with exceptional natural resources to support agriculture and food production, these are often taken for granted with little foresight or planning.

As the old adage goes, “a failure to plan is a plan to fail” and this is certainly true for food systems. Many communities have policies to protect farmland. But planning for the land base is not enough. It is also important to plan for local food economies and to support the people who produce our food.

A team of researchers and practitioners just completed Growing Food Connections, a 5-year USDA funded project to enhance community food security while ensuring sustainable agriculture and food production. Our approach included research, education and practice to increase local government capacity to strengthen community food systems by supporting small/mid-sized farmers and underserved residents through planning and policy.

A survey of planners at the start of the project found limited local government engagement in food systems. However, we did find inspiring examples, where local governments played a lead role developing plans and implementing food and farming policies. We identified 19 “Communities of Innovation” (COI) for further study. Many were big cities with active planning departments: New York, Baltimore, Minneapolis and Seattle. But we also found more rural examples including Marquette County, Michigan and Region 5 in central Minnesota.

The practice part of the project involved eight “Communities of Opportunity” (COO), which we selected



Julia Freedgood
Assistant Vice President
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after a competitive application process, and supported as they developed their own visions, goals, strategies and plans. Urban, rural and in between, all the COOs were dealing with poverty and food insecurity, and most of their farms were small and struggling to survive.

Farm survey

We worked with the COOs over a 2½ year period to advance plans, policies and public investment. They were especially interested in creating food processing and distribution infrastructure, improving food access and increasing local food production. This included developing food hubs and mobile markets, supporting urban agriculture, and incentivising food insecure populations to shop at farmers markets.

These experiences led to Growing Local: A Community Guide to Planning for Agriculture and Food Systems, which showcases examples from COIs and COOs and includes the most comprehensive collection of local food system policies ever assembled. The practical guide highlights real life examples of ways communities can create connections between field and fork.

According to Susan Whitfield, director of operations for No More Empty Pots, the guide “Is an excellent resource



because it pulls best practices from all regions across the country that have been battle-tested and successful. We will use it to assist us in working with local government entities in both urban and rural communities when recommending policy development and planning strategies to strengthen our regional food system.”

Growing Food Connections was made possible with a grant from the USDA/NIFA AFRI Food Systems Program NIFA Award # 2012-68004-19894. Led by the University of Buffalo, American Farmland Trust, Cultivating Healthy Places, and Ohio State University, the core team partnered with American Planning Association and a National Advisory Committee to conduct research, advance graduate level planning education and to extend to communities through on-the-ground policy and practice.

American Farmland Trust is a national conservation organisation, dedicated to protecting farmland, promoting sound farming practices and keeping farmers on the land. Learn more at www.farmland.org. ■

Copies of *Growing Local: A Community Guide to Planning for Agriculture and Food Systems* are available for free download at: growingfoodconnections.org/wp-content/uploads/sites/3/2013/06/AFT_GFC_Community-Guide_lo_res_04-2017.pdf

To learn more about Growing Food Connections and explore its many resources including case studies and policy briefs, visit growingfoodconnections.org/

Print versions of *Growing Local* also are available for sale. For information on purchasing, please contact Peggy McCabe at pmccabe@farmland.org.

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The quality of beef and consumer preferences

Genomic research is addressing consumers demand for a high quality of beef, in the view of Mateescu's Animal Genetics and Genomics Lab

Consumers evaluate the quality of beef at the point of purchase with respect to freshness, marbling, colour and other attributes, and at the point of consumption where the focus is on quality of eating experience, or palatability. The eating experience is an important factor guiding consumers' attitude toward a particular food and the ability to deliver a consistently superior eating experience we believe is important if the beef industry is to maintain or expand its share of the market.

There is an opportunity here for the beef industry to respond to consumers through an increased emphasis on producing beef of high quality, nutritional value and healthfulness. In addition, selection is an obvious option to generate a permanent and cumulative improvement of these traits.

Current evaluation system for quality of beef

The USDA (U.S. Department of Agriculture) grading system established in 1996, was designed to separate beef carcasses into groups with uniform quality. In the absence of any other system to predict eating quality, the beef industry is using the USDA grading system based on marbling and maturity as an indicator of palatability of the meat from a beef carcass.

Although the USDA grading system has served the industry well, changes in consumers' preferences, limitations

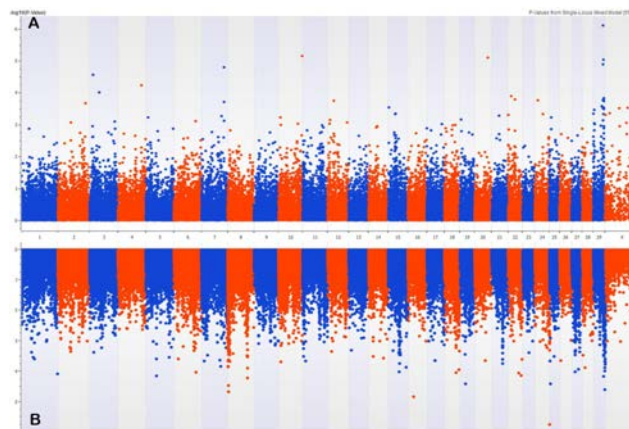


Figure 1. Genome wide association results for tenderness in two different beef cattle populations. Manhattan plots from beef cattle genome-wide association study for tenderness measured by Warner-Bratzler shear force in an Angus population (panel A) and AngusxBrahman crossbred population (panel B). Each dot represents one SNP across all 29 chromosomes of the bovine genome.

in the ability of the system to predict eating quality and limited consumer understanding of the USDA grading system are some of the shortcomings associated with the system.

Improving the eating experience when consuming beef and the ability to accurately inform the consumer of the expected eating quality when the product is purchased – are critical challenges. Meeting these challenges would increase consumers' confidence in the quality of the product and allow the industry to more accurately align the value with the quality of the product – for marketing purposes.

How can genomic tools help with evaluating and improving quality of beef?

All the components defining eating quality are quantitative traits, controlled by many genes and impacted

by environmental factors. Visual and sensory traits describing meat quality are measured post-harvest, but are difficult and costly to measure on a sufficient number of close relatives of selection candidates. These characteristics make classic approaches – based on pedigree and performance records, successfully implemented for growth and other easily measured traits – impractical for improving meat quality. Reliable genomic prediction leveraging recent developments in genome re-sequencing, genotype imputation and high-throughput genotyping all offer the only real promise to address this goal.

Genomic research for meat quality

Numerous genome-wide association studies have been performed in different *Bos Taurus*, *Bos Indicus* or crossbred beef cattle breeds, and with

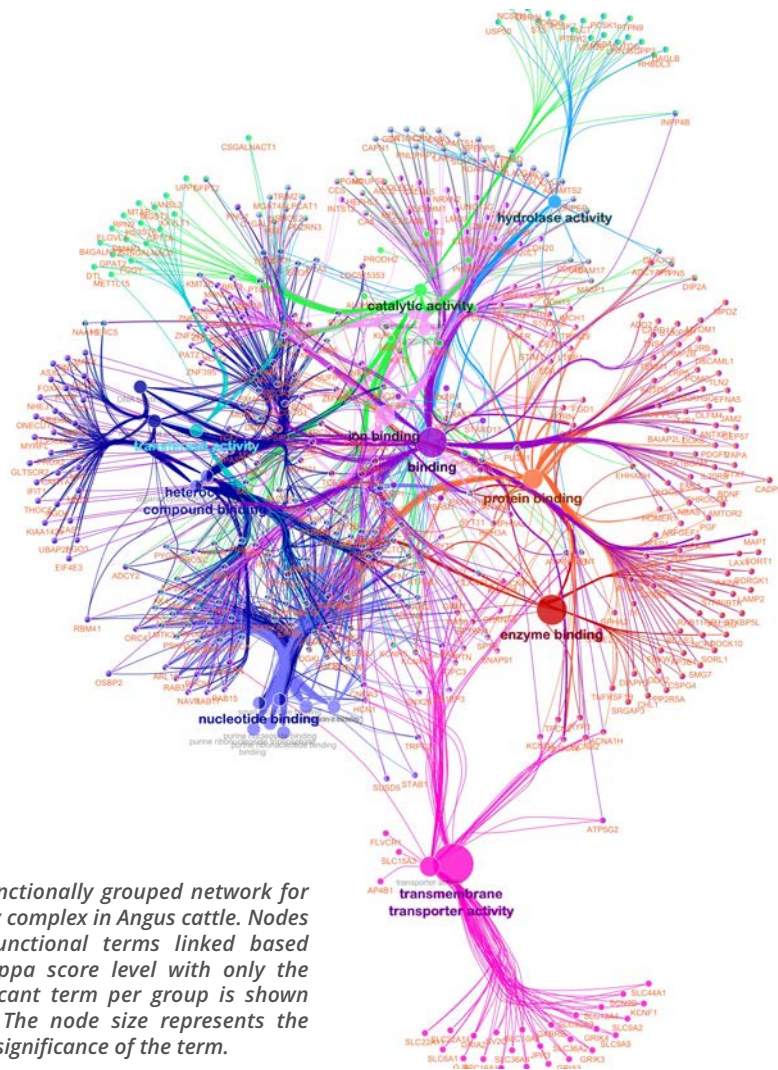


Figure 2. Functionally grouped network for meat quality complex in Angus cattle. Nodes represent functional terms linked based on their kappa score level with only the most significant term per group is shown as a label. The node size represents the enrichment significance of the term.

different phenotypes describing meat quality, from carcass characteristics to specific measures of eating satisfaction. These studies contribute to our present understanding of the genetic regulation for many of these traits, but they also highlight the challenges and limitations associated with genome-wide association studies.

Many chromosomal regions identified are unique to the specific population in which they were discovered and were not replicated in other studies. More importantly, very few functional mutations have been identified and most of the genetic variation controlling these traits remains unknown. Recently, new methodology combining traditional genome-wide association studies with gene network interactions theory has been developed to address this limitation – and allow for

a better understanding of the genetic architecture of complex traits.

Our research group used phenotypic measures of 23 traits, reflecting carcass characteristics, components of meat quality, mineral and peptide concentrations along with Illumina 54k bovine SNP genotypes to derive an annotated gene network associated with meat quality in 2,110 Angus beef cattle. The same approach was used in a different population of 673 multibreed AngusxBrahman cattle, ranging from 100% Angus to 100% Brahman genotyped with the Bovine GGPF250.

The result of genome-wide association studies in these two populations (figure 1) shows that, although many chromosomal regions have a significant effect in both populations, there

are also considerable differences. These differences underscore the importance of developing the necessary genomic tools within the target population. Genomic correlated regions were identified by partial correlations and used along with an information theory algorithm to derive gene network clusters.

Correlated SNPs across all component traits were subjected to network scoring and visualisation. Significant pathways implicated in the meat quality complex through Gene Ontology term enrichment analysis – included angiogenesis, inflammation, transmembrane transporter activity and receptor activity (figure 2).

These results suggest that network analysis – using partial correlations and annotation of significant SNPs – can reveal the genetic architecture of complex traits and provide novel information regarding biological mechanisms and genes that lead to complex phenotypes, like meat quality. Knowledge of the genetics controlling these traits, along with a precise understanding of the biological networks and interactions underlying the meat quality complex, will increase the ability of the industry to improve cattle to better meet consumer expectations.



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A fusion future

Laban Coblentz, Head of Communication, ITER gives an absorbing insight into all things fusion and the future of fusion energy

From its earliest history, the human animal, among all species, has been the most ambitious to dominate its environment: to conquer the earth, the seas, the skies, and – more than half a century ago – making its first forays into space. If Elon Musk and other visionaries have their way, humans will soon become an interplanetary species.

Harnessing nuclear fusion is an equally ambitious goal, but in reverse: bringing a star to Earth.

Fusion accounts for more than 99% of the energy of the universe. The fusion reaction powering our Sun at its core – 600 tons of hydrogen converted every second – is our engine of sustained light and heat: the source of all life on our planet. But the Sun accomplishes this feat using gravitation – 300,000 times that of Earth – and a temperature of 15 million degrees. The puzzle of how to replicate this phenomenon, how to “create a star on Earth” as a controlled energy source, has been a science and engineering quest for more than six decades. Many methods have been tried.

The front-runner, by a good measure, is the Tokamak: a toroidal or doughnut-shaped vacuum chamber encasing a second, invisible cage formed by magnetic fields. A gaseous soup made of two forms of hydrogen – deuterium and tritium – is injected into the chamber and heated until it becomes plasma: the fourth state of matter, with the electrons stripped away from their nuclei.

At a temperature of 150 million degrees, 10 times hotter than the core of the sun, the speed of these hydrogen nuclei overcomes their natural repulsion, allowing them to collide and fuse. Two new products result: helium and a neutron so energised that, in free space, it would reach the moon in less than 9 seconds. In a commercial Tokamak, these intense bursts of

energy will heat water and drive a turbine to generate electricity.

Fusion energy is desirable because of its near-perfect characteristics. Fusion releases no carbon or other greenhouse gases. The fusion reaction, while difficult to create, is inherently safe; unlike nuclear fission, there is no possibility of a Chernobyl or Fukushima-style meltdown. Nor does a fusion reactor produce any high-activity, long-lived radioactive waste.

And fusion energy is incredibly concentrated. Consider this: if the world were entirely powered by coal, at current consumption rates, it would require 24 billion tonnes per year; if powered by fusion, the same output would take a mere 867 tonnes of hydrogen.

Best of all, fusion fuel is abundant. Deuterium is easily extracted from seawater, and lithium, used in the Tokamak to breed tritium, is similarly plentiful. This translates to millions of years of supply. With this fuel accessible to every region and country, fusion visionaries foresee a transformed geopolitical landscape, an energy-rich global community unscarred by conflicts over access to petroleum resources.

Since the Russian invention of the Tokamak in the 1950s, hundreds of successively larger Tokamaks have been built and operated. The science and engineering challenges have largely been overcome, their solutions proven. What remains is to demonstrate and study a “burning plasma,” meaning a plasma that is largely self-heated by fusion.

In fusion physics, the critical parameter is referred to as “Q”: the ratio of thermal output from fusion power versus the thermal input power used to start up the plasma. With all other factors equal, Q is directly proportional to the size of the Tokamak vacuum chamber.



ITER

Which brings us to ITER: the first full-scale Tokamak, a project of 35 countries now taking shape in the picturesque heart of Provence in southern France. ITER will have a Q of 10 or greater: 50 megawatts of thermal power heating the plasma to produce, via fusion, a thermal output power of 500 megawatts or more. The ITER mission is to demonstrate the feasibility of fusion on a commercial scale through the production and study of this burning plasma.

Arguably, ITER is the most challenging science and engineering project humans have ever attempted. ITER's superconducting magnets, some as large as 24 metres in diameter, will be supercooled with liquid helium to -269°C , the temperature of interstellar space. A few metres away, the resulting magnetic cage will keep the superheated plasma – the hottest point in the universe – away from the walls.

"ITER," in Latin, means "the way"; and the complicated multinational collaboration at the heart of the ITER Agreement is seen by many as foreshadowing "the way" that future 'big science' must adopt to be successful. Each ITER Member supplies most of its financial support in the form of components: massive, delicate pieces of the Tokamak and support systems that must be shipped to Provence and assembled into this intricate, supersized fusion platform.

ITER's complexity demands extraordinary managerial and systems engineering performance; but the resulting benefits – new industrial expertise, spin-offs, and groundbreaking innovation in fields as diverse as materials science, robotics, electromagnetics, cryogenics, vacuum systems, and power electronics – accrue mutually to each of ITER's partners.

The ITER worksite is abuzz. Massive structures are emerging from the ground. Giant components are arriving weekly. Fast-paced construction has been proceeding for several years, and the assembly phase begins in 2019, with the operational machine – "First Plasma" – on schedule for December 2025. Stay tuned. ■

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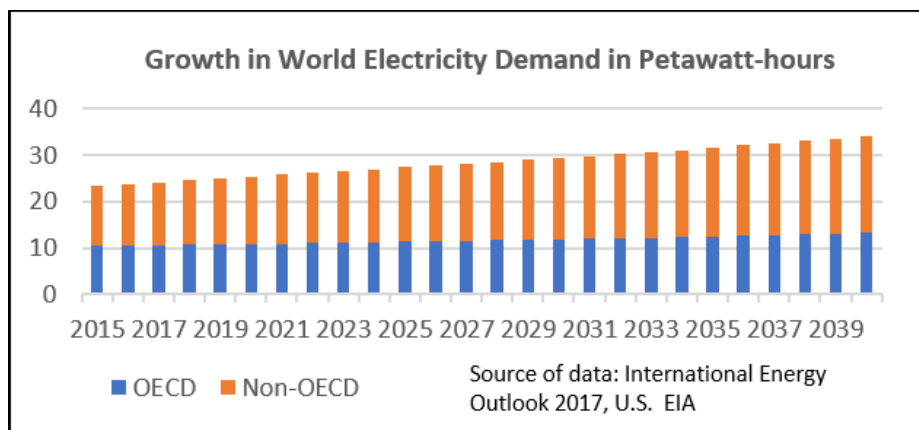
Entrepreneurial opportunities in fusion energy development

Dr. Y. C. Francis Thio and Dr. F. Douglas Witherspoon turn the spotlight on how lower-cost pathways to fusion energy can be attractive to investors

In the first article in this series on fusion energy, Dr. Scott Hsu of Los Alamos National Laboratory explained why low-cost pathways to economical fusion power are needed to accelerate its development (1). Conventional wisdom has it that fusion-energy development necessarily involves tens of billions of dollars and thirty years or longer, and thus must be the domain of government-sponsored “big science.”

While that belief is valid within the framework of conventional magnetic confinement fusion (MCF) and laser-driven inertial confinement fusion (ICF), we argue in this article that the conventional wisdom is not necessarily valid due to the emergence of an entirely new class of fusion approaches called magneto-inertial fusion (MIF) (2,3), which could reduce the R&D cost by one to two orders of magnitude (3) and the timeline to perhaps twenty years or less.

The reduced cost of modern fusion approaches, the vast knowledge and technological base for fusion energy science, and the extraordinary potential market size of fusion power taken together make the risk and the potential returns on investment arguably commensurate for private development of fusion (e.g., the pharmaceutical industry, involving private development of new drugs, has similar costs, market potential, and time scales.)



The world is moving rapidly towards energy sources that are free from carbon emission. In principle, fusion can be a very attractive source of carbon-free energy because its fuel cost is near zero. A one-gigawatt fusion power plant uses annually only 200 lbs of deuterium (an isotope of hydrogen that occurs naturally in sea water) and 600 lbs of lithium.

Compared to renewables such as wind and solar, fusion can provide relatively compact, gigawatt-class, baseload power, and does not require expensive energy storage and complex load-balancing techniques. Compared with nuclear fission, fusion energy has reduced weapons-proliferation risk, produces manageable short-lived radioactivity, and is passively safe, i.e., in the case of equipment failure due to human or natural causes, the fusion reactor simply quenches. Fusion, together with wind, solar, and other clean-energy technologies, will max-

imize the probability that the global demand for carbon-free energy will be met.

Replacing existing power plants

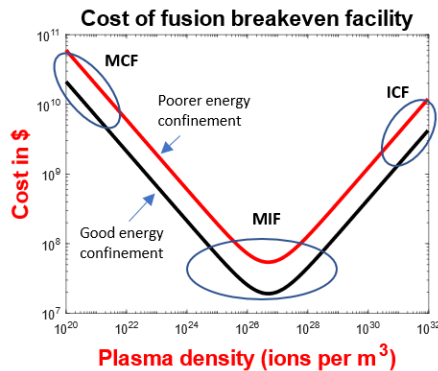
By 2040, the world demand for electrical power is estimated to surpass 4,500 GW. A mere 2% replacement of this power annually by fusion power plants plus the annual growth in global energy demand will create a market size for fusion power plants of nearly half of a trillion dollars annually for decades.

Since the time that fusion reactions were dramatically demonstrated in thermonuclear weapons, the developed countries of the world have engaged themselves in developing controlled fusion energy. Over the last 60 years, this research has developed a broad and deep knowledge base of plasma science, as well as the engineering capabilities for generating, heating, compressing, confining and

manipulating plasma, powerful computational tools and diagnostic techniques. Building on these achievements, vectored and rapid progress towards developing an economical fusion approach suitable for commercialisation can be made. The technical challenges of fusion development are formidable and require creative innovations and patient funding to overcome them. These attributes can be met by privately funded enterprises.

The vast knowledge and technology base of fusion plasma science accumulated over the last 60 years was gained mainly by studying two diametrically opposite and extreme approaches to controlled thermonuclear fusion. At one extreme is MCF, which attempts to create a fusion burning plasma at extremely low densities ($\sim 10^{20}$ ions per m^3) and to confine it in steady state using magnetic fields. This approach is exemplified by the tokamak and stellarator configurations. At the other extreme is laser driven ICF, which attempts to create a fusion burning plasma at extremely high densities ($\sim 10^{32}$ ions per m^3) in a pulsed mode on a nanosecond time scale, by compressing a frozen pellet of isotopes of hydrogen with high-intensity lasers, heavy ion beams, or other drivers.

It became clear by the mid-1990s that creating a burning plasma with either of these two extreme fusion approaches is prohibitively expensive, for reasons rooted in the fundamental principles of plasma physics and engineering. On the one hand, when the plasma density is low, the plasma volume needs to be large in order to keep the loss of thermal energy through its boundaries sufficiently low to create a burning plasma, leading to the use of large volumes of expensive magnetic fields to confine the plasma,



as well as costly hardware to heat the plasma. On the other hand, when the plasma density is very high, the heat loss from the plasma is very rapid, and a very high implosion velocity is required, thus demanding nanosecond-scale drivers of very high-power density which again is extremely expensive.

Integration of energy forms

It gradually became clear that the potential lowest-cost pathway for practical fusion energy based on thermonuclear fusion reactions is to combine the best features of MCF and ICF in a new class of fusion approaches called MIF, by exploiting the intermediate-density regime (10^{24} to 10^{29} ions per m^3); see figure showing the cost of a fusion breakeven facility versus the burning plasma density³ and for two different qualities of thermal insulation (energy confinement) of the burning plasma configuration. Better energy confinement generally leads to lower cost of the reactor. MIF uses a heavy material shell (called a liner, which could be initially plasma, liquid, or solid) to compress a magnetised target plasma to achieve fusion conditions. It combines the effectiveness of magnetic thermal insulation of MCF with the pulsed, compressional heating of ICF. The heavy liner in MIF provides enhanced inertial containment of the burning plasma pressure more effectively than conventional ICF without such a heavy

liner. MIF is indeed a super hybrid of MCF and ICF. Using a much higher-density plasma than MCF, MIF reduces the size of the fusing plasma from meter scale to centimetre scale. Furthermore, by using a magnetic field in its target plasma and a much-lower density than ICF, MIF can be implemented with low-cost, pulsed-power drivers (microsecond-to-millisecond timescales), potentially lowering the R&D cost and the reactor cost by up to two orders of magnitude compared to MCF and ICF.

Different target and liner formation schemes and their integration are possible, giving rise to a number of embodiments of MIF being currently pursued, presenting a number of opportunities for private investment. In future articles, we will report on a few of these opportunities and the private ventures already underway, and discuss the role of governments in facilitating and accelerating these privately funded fusion ventures.

- (1) Scott C. Hsu, Open Access Government, August 4, 2017. <https://www.openaccessgovernment.org/exploring-lower-cost-pathways-economical-fusion-power/35785/>
- (2) Y. C. Francis Thio, "Magneto-inertial Fusion: An Emerging Concept for Inertial Fusion and Dense Plasmas in Ultrahigh Magnetic Fields," <http://www.osti.gov/scitech/biblio/1159661>.
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A renewed relationship with Indigenous peoples and Indigenous affairs

In this article, Minister Carolyn Bennett details her key priorities concerning the advancement of Indigenous Affairs in Canada

This year, Canada is celebrating the 150th anniversary of Confederation. Understandably, Indigenous people in Canada are feeling that there is little to celebrate, 150 years of colonial policies, 150 years of racism.

The late front man for a famous Canadian rock band “The Tragically Hip” helped us through this year with his observation: “We’ve got 150 years behind us to learn from and 150 years ahead of us. So, we’d better just get to work” (Gordon Downie).

As a government, we are determined to work with First Nations, Inuit and Métis people to ensure that the next 150 years is focused on reconciliation and righting the wrongs of the past.

Colonizing policies insisted that the ‘settlers’ ways were superior. From the *Indian Act* which divided nations into largely unsustainable villages to taking the children from their families, and placing them in heartless residential schools to ongoing patriarchy, Indigenous people in Canada have paid a terrible price.

The recent Truth and Reconciliation Commission issued 94 Calls to Action. Our government has committed to honour and implement all of them. We have also committed to implement the UN Declaration on the Rights and to breathing life into Section 35 of our Constitution, which enshrined the treaty and inherent rights of Indigenous people in Canada.

Our Prime Minister, the Right Honourable Justin Trudeau, has stated clearly that no relationship is more important to him and to Canada than the one with Indigenous peoples. He has affirmed that it is time for a renewed relationship with Indigenous peoples, based on recognition of rights, respect, cooperation and partnership.



In Canada, discriminatory policies and programmes have far too often led to tragic consequences for First Nations, Inuit and Métis individuals, families and communities.

Improving the relationship: changing structures

A bold example of this transformative change occurred last August. Prime Minister Trudeau announced that our government would seek to dissolve the federal department of Indigenous and Northern Affairs, which is charged with implementing the *Indian Act* of 1876.

In its place, we are creating the Department of Crown-Indigenous Relations and Northern Affairs and the Department of Indigenous Services – a reform that was



Minister Carolyn Bennett

suggested 20 years ago by the Royal Commission on Aboriginal Peoples.

The recognition of rights – the right of self-government and the right to self-determination – is fundamental to transforming the relationship between Canada and Indigenous peoples.

Through the creation of bilateral mechanisms with national Indigenous organisations and self-governing nations, for the first time in our history we are sitting as government Ministers with Indigenous peoples to identify priorities and co-develop solutions together.

Improving the relationship: other critical efforts

The government is also changing the way it works towards resolving legal matters with Indigenous peoples, from land claims to class action lawsuits. With a focus on righting past wrongs, negotiation rather than litigation is the government's preferred route to advance reconciliation.

In this vein, the government signed an agreement-in-principle with Indigenous people who were part of the "Sixties Scoop". Beginning in the 1960s, Indigenous children were taken from their homes by child welfare authorities and placed in foster care or adopted out to non-Indigenous families.

Another critical step in renewing the relationship has been the launch of the Inquiry into Murdered and Missing Indigenous Women and Girls. A national,

independent Inquiry that will do the work needed for Canada to put in place the concrete actions necessary to put an end to this national tragedy. Our government is also taking immediate action with investments in women's shelters, housing, education, and child welfare, and in improving safety on remote highways.

The Government of Canada has also made a historic investment in the last two Budgets – \$11.8 billion to begin to close the gap in quality of life and health, education and economic outcomes.

Whole-of-government approach

A Working Group of Ministers, led by my colleague the Honourable Jody Wilson-Raybould, Minister of Justice, is currently reviewing laws, policies and operational practices that affect Indigenous peoples and their rights and interests.

The Prime Minister said in his address to the UN General Assembly in September 2017: "There is no blueprint for this kind of change. There is no road map we can follow. But neither can we wait. The time has come to forge new paths together – to move beyond the limitations of old and outdated colonial structures, and to create in their place something new, something that respects the inherent right of Indigenous peoples to self-govern and to determine their own future."

The journey of reconciliation is about all Canadians – Indigenous and non-Indigenous people alike – working together to achieve a fundamental shift in the way we perceive and interact with each other for the benefit of all Canadians.

We know that more has to be done. We will continue to work in full partnership with Indigenous peoples to ensure we continue to make real and meaningful progress on reconciliation, based on recognition of rights, respect and partnership. ■

Carolyn Bennett Minister of Crown-Indigenous Relations and Northern Affairs, Canada

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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.

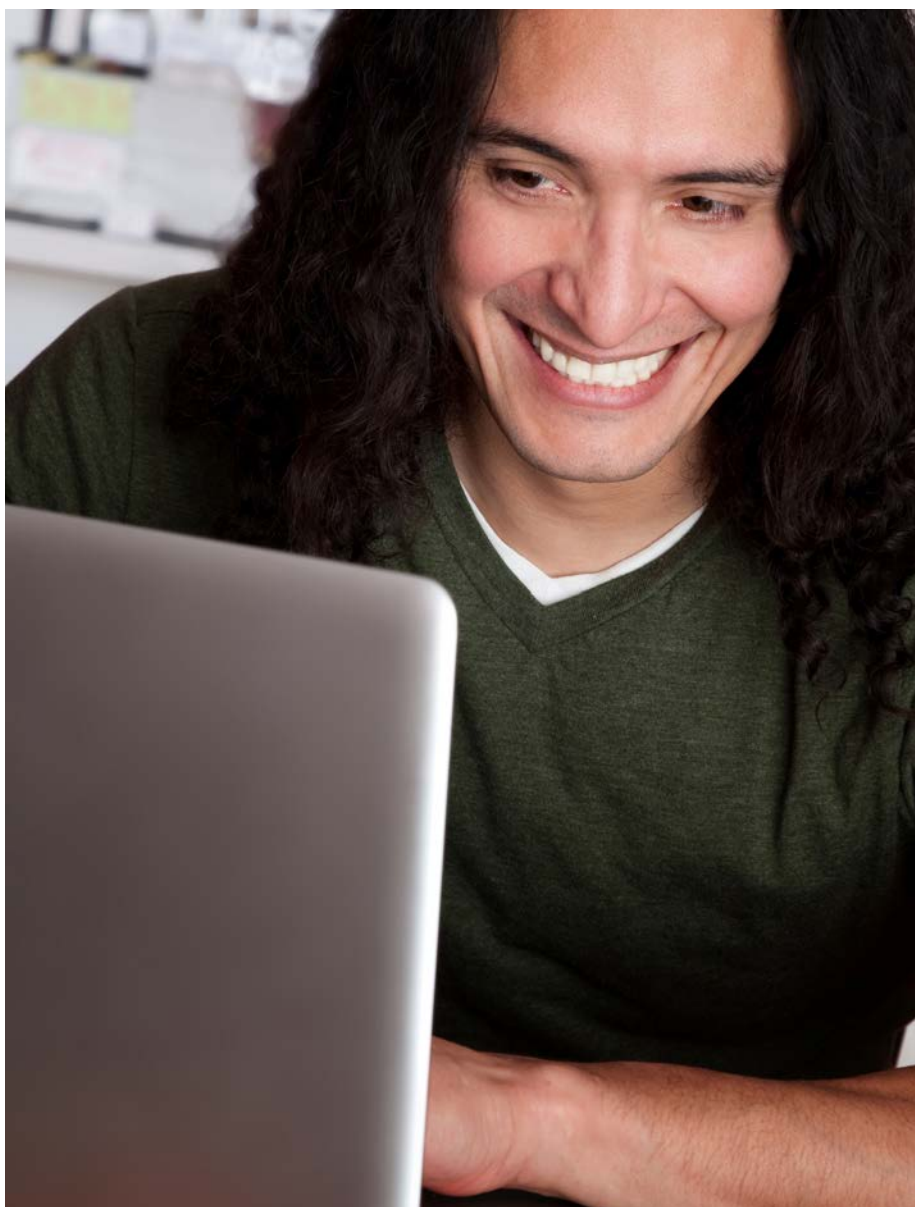
Starting with myself, I am a several-generations-removed immigrant to the ancestral lands on which I reside and I have experienced a position of some privilege in the mainstream structures of society, such as education, health services, and other governmental systems. While I grew up in a blue-collar 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



complexity 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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All My Relations: advancing Indigenous family health

Dr Rod McCormick shares details on the All My Relations Network, a national Indigenous family and community wellness research centre for health and healing

Indigenous peoples of Canada are transforming research so it is now being done by us instead of being done on us. We are starting to use research to search again for what we once knew. This is an important and urgent search for us, as most Indigenous creation stories and traditional teachings provided us with guidance on how to lead a healthy life. As non-Indigenous Canadians celebrate Canada's 150 year birthday, Indigenous peoples of Canada acknowledge how 150 years of Canadian government efforts to assimilate us have resulted in our disconnection from the traditional knowledge that kept us healthy for more than 10,000 years. Failed efforts by the Canadian government to assimilate Indigenous peoples resulted in a disconnection from our sources of knowledge, strength, and wellness which were found in family, community, culture, the land and traditional spirituality. Currently there is a strong movement amongst Indigenous health researchers to reclaim that knowledge.

“The goal of this research centre is to establish a national Indigenous family and community wellness research centre to identify, research and further advance and implement best practices in Indigenous family and community health and healing.”

Although Canada enjoys an international reputation as one of the worlds most admired countries, what is often



not known to other countries are the inequities that exist for Canadian Indigenous peoples. In the field of health alone there exists huge inequities in terms of disproportionate levels of illness and poor access to health care. As previously quoted in this journal, the Canadian Minister of Health summarised the gap in health-care by saying that if you are Indigenous your life expectancy is up to 10 years shorter than for other Canadians. For non-Indigenous health policy makers who often have a future oriented focus and hope that technology and western science will find the solutions to health care problems, it is difficult for them to understand why anyone would want to look to the past in order to guide present or future actions/solutions to existing problems.

To provide some context to this differing worldview, the Indigenous peoples of Canada's far north have encapsulated their experience, traditional knowledge, and wisdom into what is called in Inuit Qaujimagatuqangit. It is their belief that this collected body of knowledge prepares Inuit for future success. Inuit Elders use the bow and arrow analogy to explain the relevance that these teachings have for the future. If you do not draw back the arrow in the bow, it will drop a short distance in front of you. Non-Indigenous people may understand this metaphor as a back swing as in golf or in tennis. The backswing is needed to generate the power to move an object forward. For Indigenous peoples the backswing involves activities where people review and identify past

resources, strengths, energy and accomplishments. Without gathering energy the arrow or the golf ball will not travel far. As our present becomes our past and our future becomes our present we recognise that cultural teachings and traditional medicine are always evolving to meet the challenges that we face. What we must not forget is that the connection we have to family, community, culture, the land and spirituality is what provides us with this source of knowledge. Unlike a western/European focus on the value of independence, Indigenous people's worldviews focus on inter-dependence or Interconnection. This philosophy is summarized by many First Nations in the expression: All my Relations. Our relations do not just refer to our family, communities and nation but to mother earth, sky father, grandmother moon, and our brothers and sisters in the plant and animal regions. "All my relations" also encompasses the spirit people – those who came before us and those not yet born.

All my relations

Thompson Rivers University (TRU) in British Columbia is located on the traditional unceded territory of the Secwepemc people. As an Indigenous Professor and BC Government health research chair at TRU, I am developing, along with Indigenous professors in Education, Social Work, Nursing, and Tourism a research centre called 'All my Relations'. The goal of this research centre is to establish a national Indige-

nous family and community wellness research centre to identify, research and further advance and implement best practices in Indigenous family and community health and healing. Although the centre itself does not yet have funding there are numerous funded research projects affiliated with All my Relations that address the reclamation of traditional healing ceremonies and practices, as well as a network for providing students and new investigators in health research with national and international opportunities to obtain mentorship in Indigenous traditional knowledge and medicine. The centre will be based on a number of core principles that will guide research that we hope will have an impact upon government policies in terms of Indigenous health care. Using the example of mental health, it is necessary for governments to shift their energies and resources from intervention and postvention to focus on prevention. This will require a shift to looking at a backswing or drawing back the bow. This leads to the second principle and that is that the solutions to preventing Indigenous mental health crises must come from the real experts i.e. those communities and Individuals who have successfully recovered from their own crisis. In general, governments within Canada must support Indigenous communities in their efforts to rediscover, reclaim, and to utilise the natural occurring healing resources, teachings and practices that have worked in the

past and that can be adapted for use in the present and in the future.

"Although Canada enjoys an international reputation as one of the worlds most admired countries, what is often not known to other countries are the inequities that exist for Canadian Indigenous peoples. In the field of health alone there exists huge inequities in terms of disproportionate levels of illness and poor access to health care."



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Energy efficiency a win-win for Canada and industry

The Honourable Jim Carr, Canada's Minister of Natural Resources, looks at the potential of energy efficiency for the future

Energy efficiency has been called the “invisible fuel” – and for good reason. As the world makes the transition to a low-carbon economy, much of the focus has been on expanding our use of cleaner, renewable sources of energy and making traditional sources of energy greener. Both of those are worthy goals, but they overlook the most obvious starting point for lowering greenhouse gas emissions: using less energy, period.

The potential of energy efficiency cannot be overstated. According to the International Energy Agency, reducing our energy consumption through greater efficiencies could get us almost halfway to our Paris commitments for combatting climate change. That has caught our government's attention, which is why Budget 2017 included more than \$300 million in new investments for a wide range of energy-efficiency policies and programmes. Industry is a good case in point.

Making strides in industrial energy efficiency

In Canada, the industrial sector is the most energy-intensive of our economy, accounting for approximately 37% of our country's greenhouse gas emissions. Unfortunately, industry investments in energy efficiency were once viewed primarily as an added expense, something that increased operating costs while producing only an ancillary benefit of lower energy bills.

In fact, between 1990 and 2014, energy use in the industrial sector jumped 33%. Some of that increase can be attributed to economic growth, but it also highlights the great, untapped potential that energy efficiency still holds for industry.

Many Canadian companies are discovering just how substantial the opportunities are. They are increasingly recognising that energy efficiency, the invisible fuel,

can generate significant value through enhanced competitiveness, profitability, production and product quality – not to mention an improved environment for workers and lower operational costs.

Our government's investments build on this growing momentum for new ways to conserve energy.

Recognising top energy performance

In August, we launched the ENERGY STAR® for Industry programme to help Canadian factories and manufacturing plants reduce their energy needs and, in the process, improve their productivity, environmental performance and bottom line.

“The value of investing in energy efficiency is clear. By accelerating the adoption of energy management systems, such as ISO 50001, Canadian industry can play a leading role in helping us to realise regional and national climate and energy goals.”

This new programme uses an Energy Performance Indicator – or EPI – to establish the benchmark for energy use in each industrial sector and allows individual companies to compare their energy efficiency against their competitors'. The top performing facilities will be ENERGY STAR® certified.

We've launched this new ENERGY STAR® programme with Canada's steel sector, but we are working to expand it quickly to other industries, such as commercial baking, automotive assembly, and cement and fertiliser manufacturing.

Partnering with industry

ENERGY STAR® for Industry is only the latest advancement in a long history of collaboration between the federal government and industry. The Canadian



The Honourable Jim Carr, Canada's Minister of Natural Resources

Industry Program for Energy Conservation (CIPEC) was established in 1975 to help organisations improve their energy efficiency. This voluntary partnership has played a key role in stabilising energy intensity in Canadian industry.

How? CIPEC supports a network of close to 2,400 facilities and more than 50 trade associations that work together to cut costs, improve energy efficiency and reduce industrial greenhouse gas emissions. It provides technical information and cost-sharing agreements to companies in more than 20 industrial sectors.

Without these types of efforts, that one-third jump in the industrial sector's consumption of energy between 1990 and 2014 would have been even higher, at an estimated 41%.

Managing what gets measured

CIPEC encourages Canadian industry to adopt integrated energy management systems such as ISO 50001, which is Canada's national energy management systems standard. By the end of last year, 31 organisations in Canada had achieved ISO 50001 certification.

Canadian industrial facilities that have implemented the ISO 50001 standard have improved their energy performance by 10%, on average, in the first two years. This is consistent with available data showing that ISO 50001 can improve energy performance by 10%, or more, within the first 18 months, and that most of the improvement comes from low- or no-cost operational enhancements.

Investing in an energy efficient future

The value of investing in energy efficiency is clear. By accelerating the adoption of energy management systems, such as ISO 50001, Canadian industry can play a leading role in helping us to realise regional and national climate and energy goals.

“In Canada, the industrial sector is the most energy-intensive of our economy, accounting for approximately 37% of our country's greenhouse gas emissions. Unfortunately, industry investments in energy efficiency were once viewed primarily as an added expense, something that increased operating costs while producing only an ancillary benefit of lower energy bills.”

Canadians expect no less. We've heard that, repeatedly, since we started a national conversation last spring to talk about Canada's energy future. Canadians want to see government and industry doing their part to enhance energy efficiency in this clean-growth century.

Working together, we can turn energy efficiency – today's invisible fuel – into tomorrow's obvious choice, setting the path for long-term clean growth and a more sustainable, low-carbon future. ■

The Honourable Jim Carr Canada's Minister of Natural Resources

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The 21st Century belongs to Canadian agriculture

Canadian agriculture has deep roots and the government is working to build a future for the next generation of farmers, says Minister Lawrence MacAulay

The Canadian agriculture and food industry is one of the key drivers of Canada's economy. The sector "from gate to plate" generates over \$100 billion of our GDP and over \$60 billion of our exports. With our relatively small population and high productive capacity, Canada is the world's leading agricultural trader on a per-capita basis, and a top-five importer and exporter. At the foundation of this economic engine are over 200,000 farmers and thousands of food processors.

"The future is bright for Canada's agriculture and food industry, with a growing global middle class looking for products our farmers and food processors can deliver. A report by the Finance Minister's Advisory Council on Economic Growth argues that Canadian agriculture can be a key part of Canada's path to prosperity in the coming decades."

Agriculture is a core priority for the Government of Canada. As Minister of Agriculture and Agri-Food, my mandate is to support the agricultural sector in a way that enables it to be a leader in job creation and innovation.

This past July, agriculture ministers from across Canada reached a historic agreement on the Canadian Agricultural Partnership. Agriculture is a shared jurisdiction in Canada. Under the Partnership, the federal government, provinces and territories will invest \$3 billion over 5 years in programmes to help Canada's agriculture and food sector innovate, grow and prosper.

Trade is a key priority of the Partnership. On average, about half of the value of Canadian agricultural product is exported. We are the world's top exporter of canola, flax, pulse crops and wild blueberries, and a top-three exporter of wheat and pork.

Canadian agri-food exports have been climbing at about 10% annually, and the recent Canadian budget set sights on \$75 billion a year by 2025. We continue to strengthen our global trading partnerships, pursuing agreements such as the Comprehensive Economic Trade Agreement with the European Union, as well as discussions with China and other key Asian markets, while strengthening our ties with our largest trading partner, the United States. To ensure our products get to our global customers reliably and efficiently, we have introduced legislation to strengthen Canada's rail transportation system.

Research and development is at the heart of Canada's global agricultural success, dating back to the development of Marquis Wheat, which opened up Canada's Prairies to agriculture a century ago. Our ongoing private and public sector investment in research, including investments in the federal budget, will be critical to Canada's ability to help feed the world.

Action on the environment is also key to helping the sector meet the growing global demand for food sustainably. The government is investing in programming to help farmers practice climate-smart agriculture. As well, new crop varieties with built-in disease and drought resistance, and precision farming technologies, are all helping farmers reduce pesticide and fertiliser use, while conserving water.

Looking forward

The future is bright for Canada's agriculture and food industry, with a growing global middle class looking for products our farmers and food processors can deliver. A report by the Finance Minister's Advisory Council on Economic Growth argues that Canadian agriculture can be a key part of Canada's path to prosperity in the coming decades.



As Canadians celebrate 150 years of our country this year, exciting opportunities lie ahead for the next generation of food producers. Youth is a key priority for the Government of Canada, and we are working hard to inspire young people to become the agricultural leaders of tomorrow.

“Agriculture is a core priority for the Government of Canada. As Minister of Agriculture and Agri-Food, my mandate is to support the agricultural sector in a way that enables it to be a leader in job creation and innovation.”

Young Canadians have the talent and drive to lead the future growth of Canada’s economy – and to do that, they need practical work experience. Under the federal Youth Employment Strategy, the government has invested over CAD\$7 million in the Agricultural Youth Green Jobs Initiative, which brings young people and farmers together to gain job experience and improve the environment. The government also offers an agricultural internship program, and we are proud supporters of 4-H Canada, including their recent global

summit in Ottawa. The government also offers loan guarantees and Young Farmer Loans to help new and beginning farmers get established in this capital-intensive industry. As well, youth will be key focus of the Canadian Agricultural Partnership.

Over a century ago, Canada’s Prime Minister Wilfrid Laurier said that the 20th century belongs to Canada. Well, I firmly believe that the 21st century will belong to agriculture. ■

Lawrence MacAulay
Minister of Agriculture and Agri-Food

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Today's leaders working for tomorrow's youth

Fédération de la jeunesse canadienne-française on the role of today's youth in every aspect of modern life

Unlike what certain persistent (and erroneous!) stereotypes would have you believe, today's youth are far from lazy, cynical or jaded. They are involved in every aspect of citizen life, at the political, economic and social level, and are actively reshaping the world in their image. At the Fédération de la jeunesse canadienne-française [Federation of French-Canadian Youth] (FJCF), we know this to be true, as we've had the privilege of working alongside these youths for the past 43 years, and have seen first-hand the impact they have had in the youth network and well beyond.

Contributing to the sociocultural and identity development of young French-speaking (Francophone) Canadians aged 14 to 25, mainly evolving in a minority language landscape, the Federation serves as an exchange platform through pan-Canadian events, youth employment programs and advocacy for youth interests. The FJCF not only works with organisations that hold dear youth and Francophonie from near and afar, it acts as a springboard for Francophone youth across the country.

The FJCF is a key player when it comes to youth, thanks to its network of eleven associated members from nine provinces and two territories. It is the very structure of the FJCF, as well as its BY YOUTH, FOR YOUTH philosophy that allows us to be a strategic partner



in concretely implementing public policy at the grassroots level.

“The FJCF is a leader in youth engagement and development, a pillar for Francophone youth in a minority context, and a trailblazer when it comes to building up the next generation of citizens.”

The FJCF is a leader in youth engagement and development, a pillar for Francophone youth in a minority context, and a trailblazer when it comes to building up the next generation of citizens. The FJCF is also the voice of youth, addressing issues that affect them, such as language insecurity, citizen involvement, social innovation, employability and entrepreneurship, etc. This explains why the Government of Canada is one of our main

supporters, as they recognise the importance of investing in youth, as well as the expertise the FJCF has acquired in the matter, namely through the projects it develops.

Our projects

Jeux de la francophonie canadienne – Canadian Francophone Games

The Canadian Francophone Games are among the largest gatherings of Canada's French-speaking youth. In addition to encouraging hundreds of young people to exercise their talents in one of three sectors (art, leadership and sport), the Games showcase cultural pride, self-confidence and leadership abilities in a friendly, competitive setting. Since the first Games in 1999, no fewer than 20,000 people have been involved. The Games provide

extraordinary encounters; an exciting francophone experience; and a schedule rich in festivities!

Le Parlement jeunesse pancanadien – Pan-Canadian Youth Parliament

A mock parliament that brings together over one hundred aspiring young MPs, journalists and pages inside the halls of the Canadian Senate to debate bills over an entire weekend.

Le Forum jeunesse pancanadien – Pan-Canadian Youth Forum

The Pan-Canadian Youth Forum gathers over a hundred young Francophones from across the country to provide them with an opportunity to discuss an issue they are concerned about and find solutions that could be put into place to make a concrete impact.

Jeunesse Canada au travail – Young Canada Works

Access to jobs and enriching experiences for youth is at the heart of the FJCF's objectives. Through the Young Canada Works (YCW) program, we offer students and recent graduates the opportunity to test their skills, establish solid career foundations, earn money for their studies and broaden their career horizons in both official languages.

The program also gives employers the opportunity to benefit from new ideas and competitive skills from youth aged 18 to 30 from across the country. Nearly 2,300 salary subsidies are handed out each year by the FJCF and

five other program delivery organisations, thanks to our partnership with the Ministry of Canadian Heritage.

Langues et travail – Languages at work

This program is aimed at students who have received the Explore bursary, and who therefore have the opportunity to learn a second official language in a professional environment. Managed by the FJCF, Languages at Work is a joint initiative of the Explore program and the Young Canada Works in Both Official Languages program. After the student's participation in the Explore program, they have the opportunity to continue their learning through a work placement of three to eight weeks.

Green Jobs Initiative

With over twenty years of experience in youth employment, the FJCF is in a prime position to act on passing opportunities and transform public policies into concrete grassroots initiatives. It did just that when the Canadian government announced it was establishing Green Jobs, which allowed youth to combine two of their greatest passions, the economy and the environment, by gaining work experience in a sector tied in with environmental improvements. The FJCF was able to secure ten positions in the first year, in 2016, and has just successfully filled 29 positions for the summer of 2017.

Conclusion

The Fédération de la jeunesse canadienne-française is first and foremost an organisation BY YOUTH, FOR YOUTH. It is the will and involvement of its members that allow it to speak on behalf of

French-Canadian youth across the country, and to assist in their development. The FJCF and its members are natural allies of the government and its public policies, and can play an even greater role in the elaboration and implementation of initiatives for youth by ensuring they truly have a seat at the table. For more information on our various projects and initiatives, visit our web site at www.fjcf.ca, as well as our Facebook, Twitter and Instagram accounts.



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Promoting the issues affecting Canadian Youth

Jonathan Miles from Open Access Government profiles the work the Minister of Canadian Heritage, The Honourable Mélanie Joly, and what she does for Canadian youth

The Honourable Mélanie Joly is not only the Member of Parliament (MP) for Ahuntsic-Cartierville in Canada, but she is also Minister of Canadian Heritage. Her main responsibilities, under this ministerial portfolio are arts and culturalism, official languages plus the media and multi-culturalism.

In terms of the Minister's background, Joly is a lawyer by training, and as such, she has worked for major law firms in Montreal before moving into the world of communications as associate director of the Montreal office for international communications agency, Cohn & Wolfe.

Joly is the founder of the Real Change for Montreal party, and has run for Mayor of Montreal. On this interesting note, she finished the race as runner-up with 26.5% of the vote and 8 councillors elected under the banner of her party.

The Minister has a firm belief in the importance of community involvement, and as such, she has served

on numerous boards of directors, including the CHUM Foundation and the Musée d'art contemporain de Montréal. Joly also co-founded the think tank Génération d'idées, targeted at youth.

Minister Joly's leadership has been recognised on many occasions, including the time when in 2008, she was chosen as Woman of the Year in the Emerging category by Elle Québec. In addition, she became the first Quebec personality to be awarded the Arnold Edinborough Award for her involvement in the cultural community, back in 2010.

In terms of Joly's academic background, she holds a Bachelor of Laws from the Université de Montréal and a Master's degree in European and Comparative Law from the University of Oxford. ⁽¹⁾

Investment in education

Looking at some of the Minister's activities this year, one interesting example is when on behalf of the Honourable Navdeep Bains, Minister of Innovation,

Science and Economic Development, Joly announced significant investment into helping equip young Quebecers with quality post-secondary education, to help them achieve their goals.

The Minister was pleased to announce that The Government of Canada is investing \$840,000 in a project at Collège André-Grasset in Montréal. The funding aims to help institution give the students there the training they need for high-paying middle-class jobs.

Due to the investments made in Quebec, students, professors and researchers will enjoy working in state-of-the-art facilities that will assist with the aim of advancing Canada's research. Joly revealed her own thoughts on the joint investment being made by the government, along with Collège André-Grasset and other partners.

"We know that strategic investments in jobs and innovation help our communities grow and prosper. I am proud that our government is investing to help students in Ahuntsic-Cartierville gain the skills they need to land good, well-paying jobs. Through the Post-Secondary Institutions Strategic Investment Fund, we are strengthening the foundation of Canada's middle-class and working to make the country a global centre for innovation."⁽²⁾

Funding for youth

In other news, we learn that for the second consecutive year, Joly announced a grant of \$1,003,530 to enable 300 students from her constituency to find a summer job. Around 100 public sector employers, non-profit organisations and small businesses applied for funding through the Canada Summer Jobs program.

In summary, Canada Summer Jobs is a part of the Government of Canada's Youth Employment Strategy, which aims to assist young people, especially those encountering challenges in the employment sector. It also helps young people to learn and acquire skills that will facilitate their integration into the world of work.

Joly said: "I am especially proud to assist Ahuntsic-Cartierville small businesses and organisations invest in our youth by providing them with the opportunity to expand their knowledge and to acquire significant experience for their career path."⁽³⁾

The Ahuntsic-Cartierville's Constituency Youth Council

It is also worth mentioning The Ahuntsic-Cartierville's Constituency Youth Council (CYC), who gathered together for the first time in February this year. At this meeting, 6 youths met with Joly to discuss issues such as, social media, Canadian culture, economic growth in the Chabanel area, as well as community development.⁽⁴⁾

In June, CYC met for the second time at the Joly's constituency office where the mood was an upbeat one. The young counsellors were particularly enthusiastic to have the chance to discuss with the Minister several issues, that impact upon their everyday lives. Tax evasion, the legalisation of marijuana, Canada-US diplomatic relations (including the imminent NAFTA negotiations) and future of Canadian content in the digital age were among the topics covered.

In short, the aim of the CYC is to educate and expand the knowledge of young leaders in Ahuntsic-Cartierville concerning the federal government, as well as to provide their MP the opportunity to understand and consult on issues that are important to them. Through the examples in this article, it is clear that Joly is very enthusiastic to push forward youth issues and to help this group of people into the world of work. ■

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Green jobs, bilingualism, and youth: A winning combination

A group of experts from *Fédération de la jeunesse canadienne-française* lift the lid on English and French linguistic minorities and bilingualism in Canada

The current Canadian Liberal Party's election platform commitments included proposals to support English and French linguistic minorities and bilingualism in Canada⁽¹⁾, to create 5,000 youth green jobs each year for the next three years,⁽²⁾ make it easier and more financially rewarding for Canadian businesses to invest in creating clean jobs,⁽³⁾ and to restore Canada as a leader in the world.⁽⁴⁾

Furthermore, under the Paris Accord, Canada has pledged to reduce greenhouse gas emissions to 30% below 2005 levels by 2030.⁽⁵⁾ The Young Canada Works program, an initiative of the Government of Canada's Youth Employment Strategy,⁽⁶⁾ plays a key role in realizing these goals by providing career opportunities for young Canadians to work in their second official language, subsidising upwards of 70%, and in rare occasion, even up to 100% of employee wages, and offering a wide range of green jobs to which youth can apply.

The *Fédération de la jeunesse canadienne-française* manages two summer job programs: Young Canada Works in Both Official Languages and Languages at Work. In either case, students work in their second official language in a community where that language is the majority, e.g. a French-speaker works in English in an English community. Both programs are administered in part by the FJCF, on behalf of the Department of Canadian Heritage.

In the search for new, interesting, and diverse work placements where youth can gain meaningful experience in their second official language, it is above all important to strategically recruit employers who offer green work placements. One of the four pillars of the Pan-Canadian Framework on Clean Growth and Climate Change is to support clean technologies, inno-

vation, jobs, and Canada's vision for a, "clean, innovative economy that embraces both economic growth and environmental protection."⁽⁷⁾

A greener economy is driven by a reduction in ecological footprint – via sustainable development and consumption. The result is a growth in national income and increased employment, with a diminished exposure of future generations to significant environmental risks and ecological scarcities. It is today's youth who will be living in this future, and to green world leaders in the fight against climate change, it is important that they are equipped with professional experience in a green environment.

The Government of Canada has chosen to invest \$2.24 million to create green jobs over a two-year span in the YCW Program, which was created in 1997, thus ensuring the quick implementation of public policy. In doing so, the government also utilises the expertise of the program's delivery organisations – (i.e. local associations, non-profits, and post-secondary institutions across the country) – to deliver quick results on current pressing issues.

Green jobs

The Department of Canadian Heritage defines green jobs as "jobs within organisations or companies that are specifically involved in the green economy, and those that are not part of the green sector but require an expertise to produce an environmental benefit, whether for the organisation, its users, or the community as a whole."⁽⁸⁾ Most industries produce both green and non-green goods and services, so these jobs are spread across traditional industry definitions.

In the 2017 Languages at Work Program, 195 jobs were created, of which 29 (14.87%) were "green", (compared

to 10/195 or 5.12%, in 2016). Examples include: bicycle mechanic, camp counsellor, bicycle trail patroller, tour guide in a nature park, and sales clerk in an eco-responsible boutique, among many others.

These work placements are also a preliminary step toward gaining meaningful work experience and improving second language skills. Many students participate in the program because they are working towards a career that requires bilingual candidates – public servants, doulas, social workers, etc. By providing these youth with green job opportunities, they are oriented on a path that will raise their awareness and interest in environmental issues, making them more environmentally conscious in the long-term.

One success story is that of Nessim Boudghene, who has a Certificate in Management from Laval University, and was employed as an administrative assistant at Lighthouse Sustainable Buildings Centre, in Vancouver. This student says, “The impact that Languages at Work had on my position in the job market was remarkable. It gave me an opportunity to find a job in a city that I enjoy. Vancouver is well recognised for making green efforts and it is a cause that I’m glad to work for. I also think that it is very important to learn both official languages – to get the most benefits of what a bilingual country like Canada has to offer.” Nessim is now working part-time for the non-profit organisation, while completing a Certificate in Marketing.

Chantal Martin, youth programs coordinator at the Vancouver Botanical Gardens Association adds: “Our association has a mission to inspire understanding of the vital importance of plants to all life. Languages at Work provided an opportunity for a student to foster children’s environmental curiosities, and help to create connections to the natural world. Children explored diversity in language and culture, while discovering that environmental awareness and appreciation links all Canadians. Green jobs such as this equip Canadian youth with the skills and training that they can incorporate into any field.”

The Fédération de la jeunesse canadienne-française welcomes the prioritisation of environmentally-responsible endeavours, and hopes that these efforts will con-

tinue to grow and expand in the future. This approach, while promoting official bilingualism, helps to raise awareness among a generation of young Canadians about the benefits of environmental responsibility.

In addition, it allows for a greater outreach to employers, who are in turn exposed to the benefits of this economic diversification. It’s a win-win solution for all the players involved, and ultimately, it’s the whole country that comes out on top! ■

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Child and Youth Studies (CHYS) is one of the most popular programs at Brock. Students learn from a broad-based approach that considers the individual child or youth within the context of the family, school, peer group and community. With interdisciplinary roots in psychology, education, sociology, cultural studies and criminology, the degree gives academic background to pursue a wide variety of careers or to pursue further studies in a Master's program and the new transdisciplinary PhD program.

CHYS will be hosting a multidisciplinary conference on conceptualizing children and youth October 11-13, 2017.

Watch the CHYS website for more details:

<https://brocku.ca/social-sciences/departments-and-centres/child-and-youth-studies>

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