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the water INSTITUTE University of Waterloo Splash Pad

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Guest Editorial

The Role of Public Health in Global Water Security

Susan Elliott

I recently had the pleasure of being on a panel at the United Nations University, Institute for Water, Environment and Health entitled: *The Global Water Crisis: Addressing an Urgent Security Issue.* In actuality, it was a book launch, with a volume of the same name, sponsored by the Walter & Duncan Gordon Foundation and the Inter-Action Council. The keynote speaker at this event was none other than the Right Honourable Jean Chretien himself. Other panelists included experts who had been working in the international field of water security for some time. I honestly felt quite out of my element as a community-based water-health researcher.

But as I thought about what I might say that morning, I realized that the efforts to achieve global water security were similar to many of the substantive issues we deal with in the public health realm and these are based upon the notion of behaviour change (e.g., encouraging people to reduce/eliminate tobacco consumption; encouraging people to wear seat belts or helmets while they are riding a bicycle or motorcycle). That is, if we are going to address this issue of global water security, it is imperative that we encourage behaviour change at the individual and population levels, on a global scale.

So, my comments on that morning panel stemmed around three points:

1) This is not rocket science and we have the evidence to prove that. All we have to do is look at the evidence from the developed world. Thomas McKeown, an historical epidemiologist, uses vast amounts of evidence to illustrate that the major advances in the health of populations in the developed world have historically been shown to be related to changes in ***amenities*** and ***behaviour***, not advances in what we would consider clinical medicine. He illustrates this best with the example of tuberculosis (Tb), an infectious disease linked to poverty. Massive reductions in the incidence and prevalence of Tb were observed well before the identification of the germ that causes it let alone the vaccine. What led to these reductions? Well, McKeown's evidence shows it was improved sanitation, improved nutrition, better spacing of babies (i.e., family planning). While a tremendous accomplishment, we still have Tb in the world, and it is concentrated in our vulnerable populations (that is, the world's most impoverished nations as well as the world's most impoverished populations within our developed nations). The above point is most clearly illustrated through the declaration by the esteemed *BMJ* (formerly known as the *British Medical Journal*) that the sanitation movement was the greatest accomplishment of the 20th century. Such a declaration by such an esteemed actor gives this movement tremendous credibility.

2) We seem to be doing all the right things....we declared (finally) water as a human right. And the UN member states put in place the Millennium Development Goals (MDGs) in an

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Guest Editorial (cont.)

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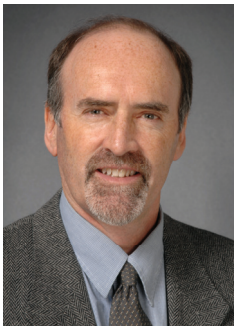
attempt to challenge its partners for change. And we have made substantial progress! We have met the target on extreme poverty, girls are going to elementary school in equal numbers with boys, and we have met the water target early: we have halved the proportion of people who lack dependable access to improved sources of drinking water. BUT – in 2015, 600 million people will still be living without access to safe water and there is no question that these will be the world's most vulnerable populations: women, girls, the poor….So, we're doing the right things but tremendous inequities remain. Not a surprise; think about universal access to health care in the UK or in Canada. We have had universal access to health care in Canada free of financial barriers for about 5 decades, and yet inequalities remain – there is an obvious social gradient in life expectancy and health outcomes based on income. Because the health care system doesn't determine health and well-being, it's all the other things that surround us: access to a living wage, educational and employment opportunities, safe water and sanitation. The often cited population health framework, developed by Canadians and used world wide, makes these links and ties good health to a prosperous population. So too does the recently released Canadian Index of Well-Being (https://uwaterloo.ca/canadian-index-wellbeing/)

3) We have lots more to do – as the UN says, we can't just rest on our laurels because we've met some goals and are close to meeting others. So, what do we do now? Well, sometimes it's a matter of framing….how we frame the question may help us to move closer to action. For example, the WHO is of course primarily interested in the health of the world's population, and with the leadership of Gro Harlem Brundtland and others developed the thinking around the global social determinants of health. As part of this thinking, in 2005, the category of disease known as 'other non-communicable diseases' was re-framed as 'neglected tropical diseases', in order to bring global attention to the illness burden represented by a collection of 17 diseases that impact the health, well-being and opportunities of a large portion of the world's population, larger than malaria and HIV/AIDS when addressed collectively. All of a sudden now there is more focus on these diseases that affect the poorest of the poor. This is the direction that some climate change research is also taking, including the research within my own team. That is, evidence shows that the general public is very aware of global climate change and its potential impacts (although they don't quite understand the science of the whole thing – not an issue) but are reluctant to change their behaviour to address the issue. So some researchers are now suggesting: what if we reframe climate change from an environmental issue to a public health issue? That may give the issue more leverage for the average person, and allow us to use the many years of public health-behaviour change work to further change behaviour in this realm.

How can we re-frame this issue in order to ensure it garners the attention it needs and deserves? Perhaps we can reframe it as the social justice issue – or the environmental justice issue – that it is, and link it to economic prosperity because we will not live in a prosperous world with this anvil hanging over our heads, and we shouldn't live in a world that turns a blind eye to the inequities that presently exist. And the way we do that is through science-policy bridging; undertaking good science so that we have solid evidence to inform policy to change the status quo.

Susan Elliott is currently a Professor in the School of Public Health and Health Systems, with a cross-appointment in Geography and Environmental Management. She is also Dean of Applied Health Sciences at the University of Waterloo. A geographer by training, she works in community-based water-health issues in East Africa in partnership with the Kenya Medical Research Institute and the United Nations University, Institute for Water, Environment and Health.

David Rudolph Selected as 2013 Darcy Lecturer



Dr. David Rudolph, Professor, Earth and Environmental Sciences, and former Director of the Water Institute, has been selected by the National Ground Water Association (NGWA) to be the 2013 Darcy Lecturer. The Henry Darcy Distinguished Lecture Series in Ground Water Science was established in 1986 and has reached more than 70,000 groundwater students, faculty members and professionals over the years. Dr. Rudolph is the 27th Darcy Lecturer and the third from uWaterloo; John Cherry was the first Darcy Lecturer in 1987 and Ed Sudicky had the honour in 1994. The Darcy Lecture is typically presented at universities throughout the world over the calendar year. The 2012 Darcy Lecture was scheduled to be delivered at over 45 sites and Dr. Rudolph's series is expected to have a similar level of interest.

Dr. Rudolph's Darcy Lecture is titled: "*Managing Groundwater Beneath the Agricultural Landscape*". The goal of this lecture is to provide insight on how the nature of groundwater quality has been impacted from agricultural land-use practices at both the local and regional scales, with a specific focus on nitrate and microbial indicator species. A complete abstract can be found at http://www.ngwa.org/Foundation/darcy/Pages/Future-Darcy-Lecturer.aspx

Water Researchers in the News

Keith Hipel to Serve as President-Elect of the Royal Society of Canada, Academy of Science

Dr. Keith Hipel, University Professor, Department of Systems Design Engineering, and Senior Fellow, Centre for International Governance Innovation, was recently elected as President-Elect of the Academy of Science, Royal Society of Canada. Keith will assume the duties of President-Elect for a period of one year commencing in November 2012, and will then serve as President for a period of two years followed by one year as Past-President. This is an exceptional honour—congratulations Keith!

Niels Bols Receives 2012 Lifetime Achievement Award

Dr. Niels Bols, Professor, Department of Biology, was honoured this past summer by the Society for In Vitro Biology with the 2012 Lifetime Achievement Award. The award recognizes those who have achieved academic excellence in their field of study and honours those who have made significant contributions to the field of in vitro biology. The general area of Dr. Bols' research is animal cell biology and toxicology.

Bob Gillham Awarded Queen Elizabeth II Diamond Jubilee Medal

Dr. Robert Gillham, Executive Director, the Water Institute and Distinguished Professor Emeritus, Department of Earth & Environmental Sciences, was recently awarded the Queen Elizabeth II Diamond Jubilee Medal for his contributions to groundwater science.

Pictured are Dr. Gillham and Frank Valeriote, Member of Parliament for Guelph.

Ecology and Innovation: Archaea in Wastewater Treatment

All life falls within three "Domains": Bacteria, Archaea and Eukaryotes. Archaea were discovered in the late 1970s and originally thought to be restricted to extreme environments, characterized by high-temperature or salinity. We now know that Archaea inhabit many aquatic, terrestrial and host-associated environments. The discovery of ammonia-oxidizing archaea (AOA) in 2005 overturned a century of dogma that only selected bacterial groups were capable of aerobic autotrophic ammonia oxidation. Recent research has shown that not only do AOA exist, but they outnumber ammonia-oxidizing bacteria (AOB) in most sampled environments. Although conversion of ammonia (and nitrite) to nitrate is an important function of reactors associated with wastewater treatment, aquaculture and residential aquarium biofilters, few studies have investigated the microorganisms responsible for this process in these systems.

Soon after starting a position in the Department of Biology at the University of Waterloo in 2007, Josh Neufeld hypothesized that ammonia-oxidizing archaea would be associated with nitrifying biofilm treating wastewater, such as those present at the Guelph wastewater treatment plant. Together with PhD student Laura Sauder, they sampled biofilm from the large-scale rotating biological contactors along the treatment flow path. The results demonstrated that both AOB and AOA were abundant, but AOA were increasingly abundant along the flow path, as ammonia concentrations decreased. A serendipitous co-discovery of AOA in residential aquarium biofilters confirmed this association of AOA with low ammonia concentration. Sauder and colleagues sampled aquarium filters from Kitchener, Waterloo and Cambridge and found the same results. In fact, ammonia concentrations were very low in most aquaria and these filters only had detectable AOA.

These results raise many questions and possibilities: do AOA oxidize ammonia and eat carbon dioxide in biofilter environments? Do they compete with AOB for ammonia? Are AOA active in the Grand River downstream of wastewater treatment plant effluent discharge? Can AOA inocula improve biofilter operation? Graduate students Laura Sauder, Puntipar Sonthiphand and Natasha Szabolcs now form an AOA ecology team within the Neufeld lab, culturing Archaea, sequencing genomes, testing the influence of water conditions on AOA/AOB ratios and sampling river sediment and water columns.

Nitrifying rotating biological contactors at the Guelph wastewater treatment plant. (Laura Sauder)

Josh Neufeld's lab explores links between the identities and functions of microbes, studies the structure and composition of complex microbial communities, and discovers new organisms involved in biogeochemical cycling. The Neufeld lab develops and combines molecular techniques for quantifying, visualizing and sequencing microbes, in addition to developing and applying computational methods for analyzing enormous datasets associated with large-scale microbial ecology studies.

Josh Neufeld: http://uwaterloo.ca/biology/people-profiles/josh-d-neufeld

Cyphotilapia frontosa in an aquarium with an AOA-dominated biofilter. (Eric Wheeler)

Water Institute News

Water Institute Graduate Scholarships

The Water Institute is pleased to announce that the ARCADIS Graduate Scholarship and Golder Associates Graduate Scholarship are being offered again this fall to graduate students in the water field. The scholarships will be awarded to students on the basis of scholastic excellence and demonstrated success in water research. Each scholarship is valued at $5,000. Applications can be found at https://uwaterloo.ca/graduate-studies/forms/awards-funding-forms and are due by October 29, 2012.

Water Institute Workshops

For the past two years, the Water Institute has offered financial support to Waterloo researchers to organize workshops or small symposia that address water issues from an interdisciplinary perspective. The purpose of the workshop program is to enhance interdisciplinary knowledge, facilitate the formation of multidisciplinary research and teaching teams, and support the development of new university-external partner relationships. Previous workshops or symposia have included:

- Opportunities for Research Partnerships in Membrane-based Water Treatment Applications;
- Innovations in Water Source Protection;
- Protected Areas and Ecosystem Resilience, Governing Wetlands and Watersheds: Issues, Cases, Practice;
- Complex Systems and Agent Based Modeling: Applications in Integrated Management of Water Systems;
- Resolving Science-Policy Gaps in Transboundary Water Governance.

The Water Institute recently issued a request for proposals for its 2013 workshop series. The proposal deadline is **November 19th**. Details are available on the Water Institute web site. http://water.uwaterloo.ca/news_opportunities.htm

Water Institute External Partners Program

One of the Water Institute's key goals is to facilitate the development of partnerships between Waterloo's water researchers and external stakeholders, such as the private sector, governments, non-governmental organizations or other research institutions. In early 2013, the Water Institute will be introducing its External Partners Program by offering external stakeholders a variety of benefits commensurate with several partnership classes. Benefits will include "one window" access to Waterloo's water researchers, information on water-related activities, invitations to water-related events, access to an annual Water Institute research symposium, access to an annual student job fair and corporate branding opportunities.

Please watch for the launch of the Water Institute's External Partners Program in early 2013.

Water Institute Annual Report

The inaugural annual report of the Water Institute was published in July 2012. The report pays tribute to early faculty members who set the direction for water research at the University of Waterloo and highlights recent Water Institute achievements in the areas of Research, Partnerships and Education. The report also includes an assessment of progress against business plan goals and discusses 2012/13 priorities. The 2011/12 Water Institute Annual Report can be downloaded from the Water Institute's web site, http://water.uwaterloo.ca, or hard-copies are available from Mary Anne Hardy at mahardy@uwaterloo.ca.

Looking Back: H.B. Noel Hynes

Noel Hynes was born in Wiltshire, England in 1917, and from an early age had a strong interest in the natural environment associated with ponds and streams. He was educated at Imperial College, receiving his BSc in 1938 and his PhD in 1941. Noel began his career serving overseas, first in Trinidad, learning tropical biology, and then in East Africa with the locust control program. On returning to England he accepted a lectureship at Liverpool University in 1947. In 1964, he was persuaded to leave Britain, joining the University of Waterloo as its first permanent Chair of the Department of Biology.

Noel's scientific passion was the *Plecoptera*, or stoneflies, the subject of his PhD dissertation, but for most of the scientific community he is known for his contributions to stream ecology. Two books, "*The biology of polluted waters*", published in 1960, and "*The ecology of running waters",* published in 1970, were immensely successful. Almost as influential was the paper he delivered to the International Society of Limnology (SIL) as the Elgardo Baldi Memorial Lecturer in 1974. It was simply titled, "The stream and its valley", and it summarized a holistic view of streams as parts of a larger ecosystem, the drainage basin. He and his students published on many topics, but especially the mechanisms by which terrestrial vegetation supported stream food webs, and the connection between streams and the groundwater through the hyporheic zone below the streambed.

During his long career, and in addition to his books, Noel published 179 scientific papers, along with numerous book chapters, reports and articles. He became a fellow of the Royal Society of Canada in 1978 and was also a fellow of the Institute of Biology (UK) and the American Society for the Advancement of Science. Awards he received include the Canadian Centenary Medal (1967), the Colonel Hilary Jolly Award of the Australian Society of Limnology (1985) and the Award of Excellence from the North American Benthological Society (1988). He was awarded the Einar Naumann -August Thienemann Medal, SIL's highest award, in 1998, and was awarded honorary doctorates from the universities of London, Waterloo and New Brunswick.

Noel Hynes, to many the Father of "running water ecology", retired from the University of Waterloo in 1984 as Distinguished Professor Emeritus. He died in March 2009.

(This article borrows heavily from an obituary prepared by Bill Taylor, Department of Biology.)

Mary Anne Hardy

Students of the Water Institute, Graduate Section

September Successes

September was a busy month for SWIGS! Our first social event, a **Blue Drinks** social on September 19th, was a huge success as we returned to the newly renovated Grad House. On the 20th, graduate students were invited to meet with **Water Institute seminar** presenter Dr. Eran Feitelson who talked about the impact of environmental, social, and political forces on water usage in the Middle East. The first **Journal Club** meeting was also held on September 20th and gave students an opportunity to discuss the article, *The Importance of Stupidity in Scientific Research*, by Martin A. Schwartz.

September's activities culminated in the **Annual SWIGS/WI Welcome BBQ** on September 21st. Jessica Leung, SWIGS Vice Chair Conference, organized the successful and well-attended event. Over 100 students and faculty from SWIGS and the Water Institute enjoyed burgers and sausages for lunch in the courtyard near the Math Complex.

October Occasions

On October 17th, SWIGS hosted two exciting events. The Chair of the Outreach Committee, Allison Bawden, and her team organized a special viewing of the documentary **"Last Call at the Oasis"** at the Princess Twin Cinema in Waterloo. The event was well-attended with around 50 students, faculty, and community members coming out to see this film about the global water crisis and the impact it is having on our world.

Following the documentary, the fun continued at the **October Blue Drinks** event arranged by Ben Plumb, Vice Chair Social and his committee. There was a great turnout at this event with attendees from the documentary eager to discuss their ideas and opinions over drinks and free pizza!

The **Student Lecture Series** got under way for the Fall on October 18th. Hyoun-Tae Hwang and Jason Hamilton Davison, both from the Department of Earth & Environmental Sciences, presented to a full classroom about their research relating to coupled atmospheric and groundwater modelling. Josh King and the Academic Committee did a great job organizing this informative event.

This month the three **intramural teams**, Volleyball, Dodegeball, and Ultimate Frisbee, started their seasons. These teams were organized by the SWIGS Social Committee and the Earth Sciences Graduate Association.

Remember November

We hope to see you and your students at our next events:

- Wednesday November 7th, 1:00-2:00 pm. **Journal Club,** Grad House
- Wednesday November 14th, 5:00-7:00, **Blue Drinks**, Grad House
- Thursday November 15th, 12:30-1:30, **Student Lecture Series,** TBD
- Thursday November 15th, **Water Awareness Day & Ban the Bottle Petition signing**, SLC
- Thursday November 22nd, **Rock Climbing**, Grand River Rocks, Kitchener.

For more information about these and other SWIGS events, please visit our website at http://www.swigs.uwaterloo.ca/.

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Splash Pad Feedback

A new Feedback section will be included in future editions of *Splash Pad* to reflect reader views and opinions, and to elicit discussion. The Water Institute invites your letters on water-related subjects, including, but not limited to, those discussed in *Splash Pad*.

Please submit letters to Mary Anne Hardy (mahardy@uwaterloo.ca). Letters should be brief; preferably 100 words or less.

Other areas where we welcome contributions include:

- Suggestions for engaging guest speakers for our seminar series;
- Offers to provide a technology / innovation profile article for *Splash Pad*;
- Expressions of an opinion about water issues through a guest editorial in *Splash Pad*;
- Submission of photos for our collection of water research images.

"It is water, in every form and at every scale, that saturates the mind. All the water that will ever be is, right now "

National Geographic, October 1993

Kaskawalsh Glacier, Nluane National Park, Yukon Territory

Daniel Guestrin

WWD Student Photo Contest Winner