

“Beyond Human Health”: *Third Annual GE³LS Symposium Held in Toronto*

Issues related to genomics research and applications in the fields of agriculture, environment, fisheries and forestry take centre stage.



The 3rd Annual GE³LS Symposium brought together experts to discuss genomics in agriculture, environment, fisheries and forestry.

More than 115 experts gathered in Toronto at the 3rd annual GE³LS Symposium to discuss and examine GE³LS issues – ethical, environmental, economic, legal and social concerns – sparked by genomics research. For the first time, the symposium’s focus went “beyond the sphere of human health” to examine issues arising from genomics research and applications in the fields of agriculture, environment, fisheries and forestry.

Held in March 2005, the three-day symposium attracted philosophers, sociologists, lawyers, economists, anthropologists, genome researchers, and many other scientists from Canada and around the world, including Kenya, France, the UK and the US, to discuss and debate issues arising from “tensions between those who support genomics and proteomics research and those who oppose it”.

“The symposium attracted a very high calibre of speakers,” said **Lyne Létourneau**, symposium chair. “A friendly, relaxed atmosphere was created, in which the group of speakers and participants were able to connect and have substantive discussions.”

The symposium opened with a lively presentation by **Lawrence Busch**, Distinguished Professor of Sociology and Director of the Institute for Food and Agricultural Standards at Michigan State University, who drew analogies between fairy tales and some of the claims made by genome scientists.

“Genomics is declared to be the right way to address many issues...” said Busch. “There is a notion here that genomics in an undiluted good – that if we just do genomics, wonderful things are going to happen. Unlike physicians who argue that first one should do no harm, these stories suggest no harm can possibly be done – in fact, only good things can come from genomics.”

For example, Busch said, genomics researchers often make claims about increasing agricultural productivity to help end world hunger, when problems actually originate with the food distribution system, not low crop yields.

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Ontario Genomics Institute Explains the Science in Biotech Drama, *ReGenesis*

Airing on Global TV this fall, Canadian-produced drama series *ReGenesis* delves into human cloning, genetically engineered viruses and radical gene therapy.

The Ontario Genomics Institute (OGI) is helping viewers of a new 13-episode television drama about biotechnology gone awry to understand the science behind the show. The OGI has penned a series of Science Fact Sheets for *ReGenesis*, a Canadian production that will be broadcast on Global TV in September, having previously aired on Pay-TV’s Movie Central and The Movie Network, and on Britain’s Sci-fi Network.

The series centres around the work of NorBAC, a fictitious transnational organization formed to investigate “questionable advances” in biotechnology. Starring Toronto native Peter Outerbridge as molecular biologist “David Sandström”, who runs the NorBAC lab, and Montrealer Maxim Roy as NorBAC executive director “Caroline Morrison”, the slickly

produced show takes futuristic science to its potentially dire conclusions.

“The Pandora’s box of biotech is wide open,” states promotional material for the program, which is produced by Toronto-based entertainment company Shaftesbury Films Inc. “It’s a modern gold rush, where billions will be made and geo-power will be staked. And everyone’s involved: governments, multinational drug companies, rogue states, and terrorists. But ideas can’t be put back in — once they’re out, they’re out.”

But how real is the science behind the show? Where does the science stop and fiction begin? Curious viewers who visit the *ReGenesis* website (www.regenesistv.com) can get answers to these questions by clicking *Get the Facts*

behind the Fiction, which brings them to the *ReGenesis* section on OGI’s website (www.OntarioGenomics.ca). The section includes a comprehensive fact sheet for each episode, as well as a glossary of key terms related to genomics. OGI has produced this material as part of its mandate for education and outreach.

“There is so much going on in the area of science and I believe it is important that we ‘lay people’ learn as much as we can,” said **Christina Jennings**, *ReGenesis* creator and executive producer and Shaftesbury’s founder. “Drama seemed the way to do it. However, that being said, we are a dramatic show, not a documentary series. I imagined that many viewers would be interested in learning more about the science in the show, so we came up



ReGenesis will air on Global TV this fall

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GE³LS Websites to watch

Genome Canada: www.genomecanada.ca
Genome British Columbia: <http://gels.ethics.ubc.ca>
Genome Prairie: www.genomeprairie.ca/gels/
Ontario Genomics Institute: www.utoronto.ca/jcb/genomics/index.html
Genome Quebec: www.humgen.umontreal.ca/en/projects.cfm

An excellent source
of knowledge

www.genomecanada.ca



GenomeCanada

GenomeBritishColumbia
GenomePrairie
OntarioGenomicsInstitute
GenomeQuébec
GenomeAtlantic

with the idea of having a factual component as part of the website."

For example, in Episode 1, NorBAC tries to contain an outbreak of a deadly hemorrhagic virus that's discovered to be caused by the genetic engineering and combining of camelpox and Ebola viruses. The OGI fact sheet explains the difference between Ebola and camelpox viruses, and answers questions about whether Ebola can be genetically engineered to cause an epidemic, asking "Is it possible to engineer the "mind" of Ebola virus into the "body" of camelpox virus to cause human infection?" The fact sheet, written by science writer Audrey M. Huang, concludes that "No, engineering a new virus to replicate and infect as efficiently as naturally occurring viruses is not likely to

happen right now – the science isn't there yet."

"We thought it would be an interesting way to entice people to learn more about genomics and help create a more informed public," said OGI President and Chief Executive Officer **Christian Burks**, adding, "We could have just written several short essays on different aspects of biotechnology and posted them to the OGI website, but a lot more people will see the show and might be asking, *Could it be true? How real is it?* OGI's ability to analyze the scientific information and present the facts behind the fiction might predispose people to read more about the science."

Burks' involvement with Shaftesbury Films actually dates back to the summer of 2003, soon after **Aled Edwards** became the show's scientific advisor.

(Edwards is professor at the University of Toronto and project lead of the Genome Canada-funded Structural Genomics Consortium.) The show's producers and writers wanted to see a 'real' biotech company in action, so Edwards referred them to Burks, then Chief Scientific Officer at Affinium Pharmaceuticals.

"They wanted some verisimilitude in the NorBAC lab," said Burks. "They wanted to see the scientific tools, how people in the lab looked – essentially, the look-and-feel of a biotech lab." Burks' background in informatics later inspired the character of "Mayko Tran", the show's informatics specialist.

Fast-forward to fall 2004, when Edwards and Burks, who by that point had become CEO of OGI, bumped into one another at a convention and discussed the idea of providing viewers with more in-depth information about the science.

"Through this partnership, OGI is able to raise awareness of genomics and proteomics research," said Burks. "More importantly, by explaining the science behind the show, we hope to provide viewers with insights they can bring to bear in their own evaluation and discussion of the social and economic impact of fundamental research in the life sciences."

At the end of every episode, viewers are directed to the *ReGenesis* website has logged over 85,000 visits and many of the visitors have followed OGI's *Get the Facts behind the Fiction* link.

The first season of ReGenesis will air on Global TV in September 2005. A second season is already in production and is scheduled for release in March 2006 on TMN and Movie Central. ♦

"As the originator of the series, I wanted to make a dramatic series that was 'authentically' set in the world of science. It was important to me that the ideas for the series be plausible. If they were not happening now, then it was plausible that they might be happening soon. This is not science fiction."

Christina Jennings, ReGenesis creator and executive producer

REGENESIS TV: FROM PLASTIC-EATING BACTERIA TO GM MOSQUITOES

A partial list of topics explored on *ReGenesis*: groundbreaking leukemia trials; prion disease in humans; athletes who genetically modify themselves to stay at the top of their game; religious fanatics who try to clone Christ from the blood on a 2000 year old nail; a plastic eating bacteria that causes power outages; research using nanotechnology on water purification systems that caused bacteriophages to invade the body; trying to find a vaccine for the Spanish Flu should it re-emerge; genetic testing to determine the likelihood of developing breast cancer; genetically modifying mosquitoes to find a cure for malaria.

"Promises and Perils": New Book Examines Impacts of Biotechnology on Social Cohesion

Is biotechnology threatening the social fabric by weakening, even if temporarily, the social cohesion of society? That question lies at the heart of *Biotechnology Unglued: Science, Society and Social Cohesion*, a new book edited by the University of Saskatchewan's **Michael Mehta**.

Published by UBC Press in March 2005, the book uses eight case studies to illustrate how certain biotechnologies in agriculture, medicine, and forensics are affecting the social cohesiveness of agricultural communities, the developed and developing world, consumer groups and scientific communities. The case studies chart the "promises and perils" of biotech at regional and state levels, as well as in the global arena.

The idea for the book was conceived after Mehta observed that, while much of the debate surrounding biotech was driven by "macro" issues of trade, regulation and the principles of "sound-science", or by "micro" issues of consumer trust and labeling – economic and social criteria were conspicuous by their absence. This significant gap prompted Mehta to send out a call for papers in 2001 on the impact of biotech on community, a "meso" level heretofore mostly ignored in the literature.

Mehta, who presented some of the book's findings at the GE³LS Symposium in March 2005, defines social cohesion as "a measure of how tightly coupled, robust, and unified a community is across a set of indicators", adding that "a community with a strong sense of identity and shared goals is considered to be more cohesive than one without these qualities."

Mehta's own case study examines how the introduction of herbicide-tolerant canola and Bt corn has affected farming communities in western Canada. He concludes that such innovations benefit more large-scale farmers, lead to a culture of surveillance, deskill farmers and generate conflict. All of these factors, he

argues, are contributing to a decline in the social cohesion of agricultural communities.

"Some may argue that this decline began many years before the introduction of agricultural biotechnology," says Mehta, who received a grant from Genome Prairie's GE³LS program to cover his research on farmers' perceptions of risk and technological change. "However, it is worth noting that herbicide-tolerant canola and Bt corn were the innovations of an agricultural system in which international actors such as Monsanto benefit from weakly cohesive agricultural communities."

While much of the book investigates the impacts of new technologies on social cohesion, one chapter, on the Canadian DNA Data Bank, explores how "enabling conditions" in the community, such as fear of crime, have served to encourage the uncritical acceptance of certain forensic biotechnologies.

"What is the nature of the DNA data banking and warrant system in Canada," asks author Neil Gerlach, "and how did it come to enter the justice system in its particular form? What are the enabling conditions that have allowed a potentially revolutionary technology of social control to enter so quickly and unassumingly into Canadian society?"

Another case study deconstructs biotech's use in the developing world, arguing that

claims routinely made by life sciences companies about biotech's potential for combating hunger and ensuring food security have induced a sense of "skepticism" in the development community. Authors Jacqueline E.W. Broerse and Joske F.G. Bunders conclude that current innovations are mostly "inappropriate" for small-scale, resource-poor farmers and outline an "interactive and participatory approach" to guide the development of biotechnological innovations for small-scale farmers.

"...if biotechnology is to benefit the poor," argue Broerse and Bunders, "a double shift in the research paradigm is needed – biotechnology R&D should be specifically (1) focused on agro-ecological systems and products important to poor people and (2) contextualized within the broader socioeconomic and cultural situations of the poor and with a deeper understanding of sustainability issues."

Other chapters investigate social questions raised by the introduction of GM foods into the US and Norway marketplaces, the creation of the Iceland Genetic Database, the practice of collecting DNA for corporate gain, and scientific collaboration when intellectual property is an issue.

"The glue that holds us together as a society is in danger of dissolving due, in part, to the way that some innovations in biotechnology are currently being developed, marketed, and used."

Michael Mehta, Biotechnology Unglued: Science, Society and Social Cohesion



"The book's case studies show the cross-cutting effects of various kinds of biotechnologies on the social cohesiveness of communities," says Mehta. "Social cohesion offers a unique lens through which to see the technology. If we had had this kind of lens when the automobile was first introduced, we'd probably have different cities and may not have the problems with the environment and urban sprawl that are now facing us."

To order a copy of *Biotechnology Unglued* and to read the book's first chapter online, visit www.ubcpress.ca. ♦

Open-Source Biotech: Science as a Tool for Social Justice

If you can't win the game, then change the rules. That could be the mantra of **CAMBIA**, an organization of scientific paradigm-shifters who have spent the better part of the last decade challenging the biological innovation status quo.

Turning their keen eye for social justice inequities first to the IP system, they developed what may well be the world's largest, free, full-text searchable database of life sciences patents. As part of this "Patent Lens", their vision is to make the opaque world of patents more "transparent", so that small and mid-sized enterprises and scientists in the developing world can more easily understand and penetrate complex patent thickets surrounding biotech innovation.

A self-described "public-good based scientist", CAMBIA founder Richard Jefferson, whose presentation closed the 2005 GE³LS Symposium in Toronto, has little taste for patent practices as they currently stand. "Transparency is our catchword in trying to make IP, which is clergy-ridden, opaque and, in my view, very unpalatable, into a more intuitive and navigable system that doesn't require as many interlocutors," said Jefferson, a molecular biologist who holds patents to the popular GUS gene reporter system and worked with the UN's Food and Agriculture Organization prior to founding CAMBIA in 1991. "It allows us to analyze the landscape of technology and distill the truth of what really is owned and controlled and what isn't. Armed with that dynamic information, we can cooperate to make tools that are not restricted and withheld only for personal or institutional wealth gain, but rather are forces for community wealth creation."

As if that weren't enough to cause a collective flinch on the part of patent lawyers everywhere, CAMBIA has used this "lens" to analyze the patent landscape and come up with alternatives to the transfer of genes to plants. Up to now, the only microbe considered capable of such transfer – *Agrobacterium tumefaciens* – was covered by complex patenting laws, preventing its use by many smaller organizations around the world.

CAMBIA's new *TransBacter* gene transfer system has not only neatly sidestepped its patent-riddled rival, earning the group a publication in *Nature*, it has now become a cornerstone technology of CAMBIA's new open-source "protected commons" for biological research, called BIOS, which stands for "Biological Innovation for an Open Society". These concepts have captured the imagination of the public and the press, with features in the *New York Times*, *The Economist*, *Newsweek* and scientific journals.

Developed in parallel with the open-source software movement, BIOS allows scientists to collectively invent and share new biological tools and technologies. Members can add, change, improve upon, and even use BIOS technologies as a basis for patentable products – so long as they agree to share their findings with other members. It's a virtual 'cone of silence' that levels the innovation playing field, giving smaller organizations and those from the developing world a leg up. Jefferson maintains that new and better technologies will emerge through distributed and collaborative innovation using Internet-based facilities such as BIOS' BioForge.net.

Although comparisons to Linus Torvalds or Richard Stallman, creators of the open-source GNU/Linux operating system, seem inevitable, Jefferson equally admires Brian Behlendorf, a super-hacker and co-founder of the collaborative, consensus-based Apache Software Foundation and the software development platform Collabnet, as well as fellow Australian Andrew "Tridge" Tridgell, the force behind the subversive Samba project.

What drove you to create CAMBIA?

CAMBIA emerged as a response to a great opportunity to bring many more people into the problem solving equation and focus on 'enabling technologies', the underlying tools of innovation. CAMBIA was not so much institution building, as concept building – that there should be a capability to invent methodology and distribute it so that it would fit the hands of the users who need to solve problems, and fit the problems themselves. And that this capability should be itself a dynamic and evolving one.

How did you come to that realization?

Much of what people are calling an "open-source biology" concept that we're promoting was shaped by my experiences since 1974 in wonderful laboratories that developed many key enabling technologies. These ideas were crystallized during the course of my own designing, inventing, distributing and troubleshooting an enabling technology – the GUS gene reporter system. Until we started distributing that system, many scientists were constrained by reductionist approaches to studying plant molecular biology – they'd chuck things in a blender and grind them up. Nobody knew where in cells things were happening, when they were happening, or how much was happening, simply because the tools weren't there yet.

GUS allowed you to see when, where and how much a gene was acting. Well before publication, I sent out tens of thousands of DNA samples and vectors around the world to many hundreds of labs. We sent it out without contracts, materials transfer agreements or licenses – just a thick user's manual where I had written every single bit of know-how and every trick that I could think of to make it work better, and a letter stating our goals and intentions.

Were people shocked that you freely distributed your invention?

The people in the private sector were certainly pleasantly surprised. The people in the public sector were pleased, but most took it as a matter of course. The ones who were truly shocked were in the developing world because they got them at the same time as anybody in, say, Berkeley got them ... instead of the usual cliquey distribution of technology and capabilities in science, which is a really powerful tool for reinforcing the 'old boys' club and the status quo.

What happened next?

Within a year or so, everything in the field had changed. Papers were being published all the time on cell and developmental biology, and new crops could be transformed, which had been very difficult until the ability to visualize gene action was in hand. For instance, the first genetic engineering of soybean, which is of no small interest to Canada, was done because GUS had been distributed for free to all these companies and institutes.

I learned that methodology or 'enabling tools' – properly designed and distributed – can change the direction of an entire field. And that when treated with respect, businesses by and large would respond respectfully, with only a few exceptions.

Apart from methodological issues, what other issues inspired CAMBIA?

There were also scientific and sociological issues coming to a head. When I was developing the GUS technology, reductionism was ruling the roost. Almost all of plant molecular biology evolved in laboratories by laboratory scientists, and so unfortunately did the questions being posed. They came out to be extraordinarily simplistic questions, not about field biology or, god forbid, field agro-ecology, but about the subset of questions that could be reformulated or redrafted into lab-level experiments. What was also horrifying for me was that virtually none of the agronomists, physiologists, plant breeders or of course farmers – people who

understood field biology and field performance – were well integrated into the question formulation. It was a massive untapped opportunity.

And finally, virtually all of my colleagues, post-docs and grad students, were from the developing or less wealthy world: Kenya, China, India, Mexico, Poland. This is another huge untapped resource of creative people who have high motivation to solve problems, but we were not engaged in crafting any of the methodology to work within their operating constraints. We weren't extending an inclusionary hand to say, 'come on, help design the science'. Just fellowships to say 'come do our pipetting, get a paper and go home'.

BIOS was launched in February 2005. What have been some of the early results?

It's extraordinarily gratifying the number of people who are excited about working together for a change. Most scientists are fed up with the current system, with the idea that you've got to patent, you've got to own, you've got to squabble like rats in a bag instead of sharing what we know and watching society – and economies – flourish.

Most people talk about patents as incentives to inventors. That is simplistic and usually wrong. Every inventor I have ever known would invent in a vacuum, they would invent in a cave. It's impossible to hold them down, impossible to keep them from talking. Really inventive people thrive on the performance of invention. You couldn't pay them enough NOT to invent! The incentive – the limited monopoly of a patent grant – is captured by 'owners' of invention. In the private sector and indeed most of the public sector, the inventor assigns entire right and title to the employer.

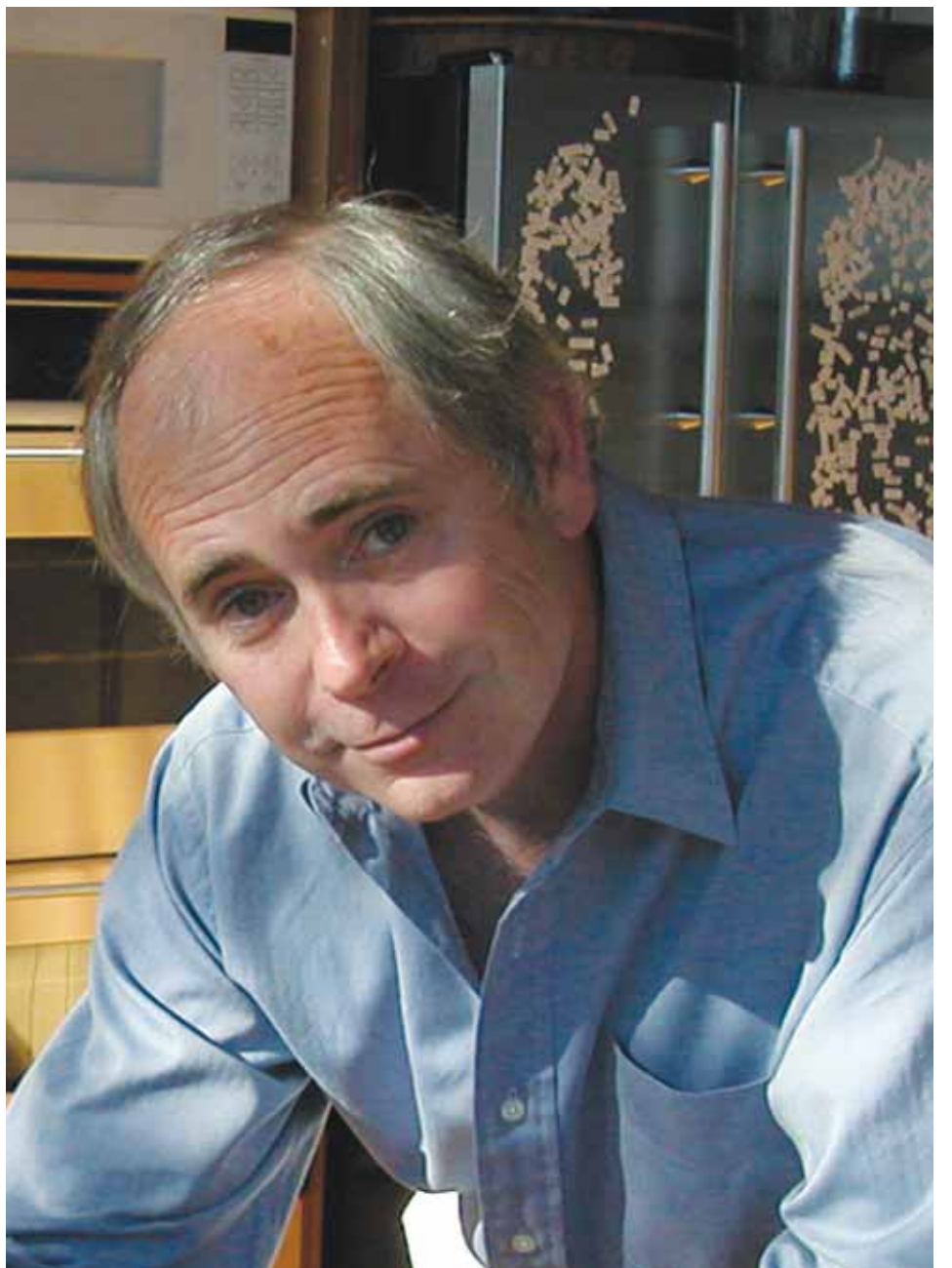
Patents are more cogently argued as being needed to stimulate all the capital recruitment that is needed downstream to turn an inven-

tion into a real deliverable innovation, but they're certainly not required to stimulate most invention per se. But we lose sight of the self-reinforcing barriers to entry this provides. Those who can use patents as tools to recruit financial capital (through exclusion of competitors) have little incentive themselves to make that value chain more affordable to others. Real competition and transparency is often suppressed, and only the 'low hanging fruit' of high-margins or large markets become priorities – leading to very unfortunate social alienation from innovation.

Have you been accused of promoting genetic engineering and GMOs?

Not really. We're not actually promoting genetic engineering, just promoting options and honesty. Genetic engineering is a modest approach to solving a lot of the important problems we have in world agriculture and nutrition, especially with current technology. *TransBacter* is not about promoting GMOs at all, it's about promoting cooperative activity to help get rid of the fear, uncertainty and doubt, what IT people call "FUD", that confuses everybody into thinking we can't solve problems by using science where science works well. *TransBacter* may lay the groundwork for collectively evolving much more context-sensitive, socially responsive toolkits. Then decisions about GMOs, or no GMOs, can be unpacked from the emotive, and trenchant, criticisms of industry domination and can be viewed as an option for social, environmental and economic interventions to be chosen or not, but based on it being 'ours' not 'theirs'.

We're neither railing against the machine nor being apologists for science and techno-fixes. We're trying to create alternative paradigms using modern communications, modern informatics and the life sciences as an opportunity to unleash creativity and reconsider how we look at the world. ♦



Richard Jefferson

WORDS FROM THE WISE: SYMPOSIUM QUOTATIONS

"We found that, compared to the general population, when asked about their concern about the BSE crisis [in France], the scientists say they are less concerned. But when we ask about actual changes in consumption patterns following the crisis, we find that on the average the scientists have changed their behaviour *more* than the general population."

Claude Fischler, Centre National de la Recherche Scientifique, Paris

"With the approval by the European Commission of two GM products in 2004, officially the so-called 'moratorium' might be said to have ended, except that, officially, it never began. Yet, despite extensive regulatory changes, conflict over the risk assessment of GM products remains."

Susan Carr, Open University, UK

"In [the US], we have what some people like to call the 'induced fiscal crisis of the state', where we can therefore stop paying for almost everything, except, of course, for national security. That means that the kind of public science that we need not only for the market, but also for the state and civil society, will tend not to be done."

Cornelia Butler Flora, Iowa State University

"Social cohesion is very important to East Africans. In the three countries of the Lake Victoria region – Kenya, Uganda and Tanzania – people share common environments and ecologies, while indigenous people have the same culture and lifestyles."

Monica Opole, Centre for Indigenous Knowledge Systems and By-products (CIKSAP), Kenya

"In Argentina, Brazil and Paraguay, Monsanto may be losing \$300 to 400 million a year. Because of the difficulty of selling seed legally, establishing an end-point royalty payment is an alternative – collecting at the elevator. This royalty is paid by farmers to elevators, with some portion going to research foundations, which could eventually bring royalties to the same level as those paid in the United States. The endpoint royalty system could be a good way to engage the private sector. Monsanto is meanwhile obligated to share royalties with public research foundations and to reinvest some of their royalties in each country."

Greg Traxler, Auburn University

"Seed saving is just part of the deskilling equation. Farmers able to choose seeds can match them to soil conditions, climate and local issues. With ag biotech, industry has created a one-seed solution to all growing conditions. This could encourage less skilled farmers to come in and take advantage of high turnover staple crops, including canola, sometimes at the jeopardy of the land itself and neighbouring farmers."

Michael Mehta, University of Saskatchewan

"From a farmer's point of view, the question is really what you would rather have – a longer term of protection and the right to save seed, or a shorter term of protection and no right to save seed. If farmers can save seed, which is therefore more valuable to them, then there will be a price effect. This can be understood on the analogy of bull semen: once a breeder has bought a vial for \$10,000, he can then do whatever he wants with it."

Norman Siebrasse, University of New Brunswick

"Most literature on patents sees them as incentives granted to individuals, who are then 'cabinéd' so that we gain access. But some incentives may be imprudent, while access may be ineffective. It is not clear that individuals need incentives for positive externalities. There are many positive externalities that happen in life, without people charging for them."

Scott Kieff, Washington University

"Open access has been available in agriculture for more than one hundred years. In the United States, many people think that effective research is only undertaken in the private sector. But if we look at the very impressive performance of agricultural research over the last half-century, it is clear that the public sector also undertakes effective research in areas where IP rights have played no role. For example, people used to think that China, Bangladesh and India would never feed themselves. Today, thanks largely to public sector research on increasing grain yields, China has seen a significant increase in life span and nutrition, while obesity among children is a growing problem."

Brian Wright, Berkeley

"What's happening now is that a large number of organizations in Europe are pushing a particular point of view – animal rights, pro-hunting, anti-GM – and if they don't get what they want, they resort effectively to non-parliamentary methods."

Julian Kinderlerer, University of Sheffield, UK

"From an ethics perspective, what we have to discourage is the notion that we have a conclusion that we're trying to justify. What we want to know is, 'what are the appropriate methods to shed light on the ethical issues?'"

Michael Burgess, University of British Columbia

"['GM Nation?'] has gotten a whole lot of criticism and a whole lot of praise. But it certainly was a very innovative participatory mechanism, however we look at it."

Sarah Hartley, University of Toronto

"It's frustratingly called the 'developing' world, but it's really an untapped resource. Our teams want to give them the tools to create their own cropping systems suited to their environment, their societies and their economies."

Richard Jefferson, CAMBIA

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"Ending hunger is a noble goal," he said, "but through genomics? Hunger is widespread in the United States, despite huge agricultural surpluses. 11.2% of US households experienced hunger in 2003, according to the USDA. Clearly, genomic research has little to offer these persons."

He urged both social and genomic scientists to "develop collectively a compromise story that leads us beyond the current dilemmas."

On the symposium's second day, a series of distinguished speakers began with a discussion about **Conflicting Worldviews**, specifically "Beliefs, values, attitudes and norms: Conceptions at play in the genomics landscape".

Europe was well represented, with talks by longtime food studies expert **Claude Fischler**, of Paris' *Centre National de la Recherche Scientifique* and **Susan Carr** of the UK's Open University.

Fischler spoke about how people generally perceive risk, before presenting research results from a 6000-sample, four-language study comparing food attitudes and perceptions in the US, UK, France, Germany, Italy and Switzerland. Such perceptions can be linked to support levels for GM food, he argued. For example, English-speaking countries tend to share similar food perceptions along with higher support levels for GM.

Carr, who discussed the regulation of GM crops in the EU, noted that only two GM products have been approved in the EU for import and processing as food and feed since the controversial end of the moratorium on such products, but only after the EU Commission intervened. She blames a relatively narrow view of precaution for the ongoing conflict between the EU Commission and some member states, and predicts that upcoming proposals for GM cultivation are likely to be "even more contentious" unless a different approach to risk assessment is followed.

Cornelia Butler Flora, Charles F. Curtiss Distinguished Professor of Agriculture and Sociology at Iowa State University, gave a big-picture presentation on the current discourse surrounding GMOs. "Scientists think of themselves as 'above the fray'," said Flora, "yet science is part of market, state and civil society. When those are in balance, the discourse leads to decisions that make sense for all concerned. But when we look at the current discourse around GMOs, we're seeing that the *market* seems to be driving the discourse, the *state* seems to be in the pocket of the market, and *civil society* is on the edges, saying, 'hey, wait, have you thought about this?'"

Later that afternoon, discussion centered on **Social Cohesion**, particularly "Unity, community and solidarity: Genomics' impact on social fabric".

Monica Opole, of Kenya's Centre for Indigenous Knowledge Systems and By-products (CIKSAP), focused on the effects of genomics research on the "indigenous unity" in the East African environment (*see story on page 005*), while Auburn University's **Greg Traxler** focused his talk on the use of transgenic technology in Latin America, noting an "immense gap in the use of genetically modified organisms in developed and developing countries."

The University of Saskatoon's **Michael Mehta** spoke about the "meso" level of biotech's impacts on the social fabric of Canadian farming communities (*see story on page 002*): "Companies like Monsanto affect how people and communities relate to each other. Percy

Schmeiser is a living example of the breakdown of rural communities, showing how farmers are willing to turn on each other, to address the perceived free-rider problem."

On the symposium's second and final day, the morning session focused on **Ownership** – "Innovation, control and economic reward: Winners and losers in the genomics game".

Norman Siebrasse, from the University of New Brunswick, compared patent rights to plant variety rights in a bid to determine the best system of private IP protection, while **Scott Kieff**, of Washington University in St. Louis, examined biotech developments from a "New Institutional Economics" perspective. Berkeley's **Brian Wright** argued for a reconsideration of the structure of intellectual property protection for life forms and associated technologies.

"I was quite surprised by the morning session on ownership," said Létourneau, who is with Laval's *Centre de Recherche en Biologie de la reproduction*. "Here we had respected academics with marked differences of opinions on the role of patents. The same 'song' was not being sung by all speakers. And yet, we tend to take for granted our assumptions about the need for patenting and we hear this same discourse from government, expert committees, and industry. What the presentation from the speakers made clear is that we need much more research on the impact of patenting on the innovation and commercialization processes" (*see story on page 003*).

In the final session, the topic was **Empowerment/Disenfranchisement**, specifically "Participation, decision-making and political discourse: Genomics in the public sphere."

Julian Kinderlerer, from the UK's University of Sheffield, described the grassroots anti-GM movement in Europe and wondered if it could be undermining representative democracy. University of British Columbia's **Michael Burgess** outlined a consultation approach for searching out underlying moral interests related to GM, and identifying "the range of perspectives and concerns that is inclusive of the interests reflected in the population". A PhD candidate at the University of Toronto, **Sarah Hartley** finished off the fourth and last session with a comparison of the plant biotechnology debate in Canada and the UK.

"In terms of participatory models," Hartley argued, "it's really been extremely limited here in Canada. The decision to use science as the sole decision-making criteria in the policy and regulatory framework has, while providing a parsimonious and predictable regulatory framework for industry, really excluded 'extra-scientific' concerns from decision-making, which have been the primary concerns of the public ... And expert opinion is of the mind that the public is irrational and uninformed, so, if the public is irrational and uninformed, what's the point of consulting them?"

Closing the symposium, CAMBIA founder **Richard Jefferson** described work on the BIOS Initiative, which expands the open-source metaphor to biological sciences and patents, in order to "better integrate social priorities with research opportunities". In his talk, he warned that we must "reorient the dialog away from merely genomics and the 'gee whiz' of what information we can glean and instead focus on how we ensure that these efforts achieve the social, environmental and economic benefits they hint at". ❖

GE³LS SYMPOSIUM 2005 REPORT OF PROCEEDINGS – NOW ONLINE!

Don't miss the chance to peruse the depth of the views expressed by checking out the online Report of Proceedings for the 3rd Annual GE³LS Symposium, which was held in Toronto last March. The report, supplemented by select video clips and PowerPoint slides, summarizes each presentation and captures breakout discussions. It also includes a listing of the entire program, abstracts and bios, descriptions of current large-scale GE³LS research projects from across Canada, and poster submissions.

To view the report, go to www.genomecanada.ca.

Developing Countries Need to Flex Their Biotech Muscle

“In the developed world, the life expectancy rate is 80 years and rising. In Africa, it’s 40 and falling.”

Those blunt words came from **Halla Thorsteinsdóttir**, an Assistant Professor at the University of Toronto’s Joint Centre for Bioethics who gave a presentation at this year’s GE³LS Symposium, and they vividly underscore the stark realities faced by many developing countries.

Many people believe that biotechnologies could play a critical role in stemming the growing tide of disease in the developing world. Starting from that assumption, Thorsteinsdóttir and her research team at the Canadian Program on Genomics and Global Health, along with a team of international experts, identified a “Top 10” list of biotechnologies that have the potential to improve health in the third world. Published in 2002, the list includes such biotechnologies as modified molecular technologies for afford-

able, simple diagnosis of infectious diseases, recombinant technologies to develop vaccines against infectious diseases, and technologies for more efficient drug and vaccine delivery systems.

During her presentation, Thorsteinsdóttir conceded that developing countries don’t just need high-tech healthcare solutions, but also a better dissemination of existing treatments and more public health education. However, she cited Professor Calestous Juma, the Coordinator of the UN’s Task Force on Science, Technology and Innovation, who said that it is “inconceivable” that significant gains can be made in meeting health and environment concerns, without a focused policy for science, technology and innovation. “We need to use all the tools we can,” Thorsteinsdóttir said.

While researching the Top 10 list, the partially GE³LS-funded team heard a consistent message from developing countries: they need to be active participants in developing these potential solutions in order for them to become reality. The team decided to find out firsthand how some countries in the developing or recently industrialized world are succeeding in the realm of health biotechnology. That second study resulted in a series of case studies on Brazil, China, Cuba, Egypt, India, South Africa and South Korea, which were published as a supplement to *Nature Biotechnology* in December 2004, entitled “Health Biotechnology Innovation in Developing Countries”.

“We wanted to see how they’ve been able to do it and learn from their successes,” said Thorsteinsdóttir, whose team used an innovation system framework to look at contributions of the major actors, such as the education system, research system, private firms and government, and the linkages the

knowledge flow between them. The research also relied on interviews with key informants.

“When people hear the term ‘biotechnology’ they typically think about the major centres of learning in the world and about some of the larger biotech companies ... but we don’t typically think about developing countries and yet, as the case studies suggest, developing countries can actively harness the potential of health biotechnology to improve the health of their peoples and reduce global health inequities.” ♦

Top ten biotechnologies for improving health in developing countries:
<http://www.utoronto.ca/jcb/research/documents/top10ng.pdf>

Health Biotechnology Innovation in Developing Countries:
<http://www.nature.com/nbt/journal/v22/n12s/index.html>

Genomics Research Ignoring Indigenous Knowledge, says CIKSAP Director

Spider weed. Bush okra. Buffalo weed. You’d be hard pressed to find these in the produce section of grocery stores in the developed world, but they’re nonetheless some of the most popular leaf vegetables in Africa, Asia and some parts of the Middle East. Often cultivated by subsistence farmers, these local plants bear edible shoot tips and leaves that are high in protein, fiber, calcium, iron, and carotene.

Yet little research and development work has been done to sustain indigenous knowledge of local food and medicinal plants, or to improve production techniques. And with the increasing focus on producing fewer and more mainstream crops, such critical knowledge could eventually be lost.

The Centre for Indigenous Knowledge Systems and by-Products (CIKSAP) aims to stem that potential demise. Established in March 1995, the Kenya-based NGO works to sustain local indigenous knowledge of traditional food plants by developing user-friendly production techniques, as well as new products and by-products based on traditional plants. The organization has spent the last four years evaluating farmers’ knowledge, particularly the knowledge of women, who typically cultivate these local plants.

“Agriculture is really in the hands of women in the traditional context in Africa,” said **Monica Opole**, Director of CIKSAP and a GE³LS Symposium presenter who was interviewed by *GE³LS Newsletter* following her presentation. “It is women who are concerned with the harvesting of edible food plants and trying to maintain them on farms. They have an intimate knowledge on the use of local vegetables as a food, and also as medicine. That’s why we decided we’re going to concentrate on the plants that women know and which ways they can improve family health and nutrition.”

The NGO employed graduate students in plant genetic science, agronomy and applied human nutrition from the University of Nairobi to evaluate local indigenous knowledge. They studied a set of seven crops commonly used in the region, including the popular spider weed, bush okra, and buffalo weed. With support from Canada’s International Development



Monica Opole (left), Director of CIKSAP and a GE³LS Symposium presenter, and Lyne Létourneau (right), the chair of the GE³LS 2005 Symposium.

Research Centre (IDRC), the students were able to synthesize the knowledge and develop users manuals that can be used by farmers growing the same wild food plants.

The group has also lobbied hard for a national policy for protecting indigenous knowledge in Kenya. A policy document is presently being negotiated with the ministry of environment and natural resources. The fact that Wangari Muta Maathai, a longtime environmental activist who became the first African woman to win the Nobel Peace Prize in 2004, is Kenya’s deputy environment minister gives Opole hope. Maathai’s mostly female Green Belt Movement has planted about 30 million trees to halt deforestation in parts of Africa, a campaign that has created thousands of jobs

while providing a sustainable source of firewood for families. “Indigenous knowledge is being threatened,” said Opole. “Modern agribusiness has tended to focus on a few crops worldwide. That is not only a threat to crops, but also a threat to humanity. Humans are not fed on one plant. Diversity is very, very important. We don’t think that trying to push for one kind of technology or plant is the way to go about it.”

Opole believes that while genomics provides a “fantastic opportunity” to preserve plant genetics, it’s overly focused on mainstream crops.

“There are other plants that they also need to look at. What about the minor crops?”

We need to leave basic information for the people that will come after us, after this generation.”

The Centre for Indigenous Knowledge Systems and By-Products (CIKSAP) was established in Kenya in 1994, in order to improve the livelihoods of the rural and urban poor. CIKSAP recognizes that indigenous/local knowledge is based upon religious, philosophical and cultural concepts and principles which are in harmony with the natural environment. CIKSAP seeks ways to work together with communities in order to tap that knowledge, and to utilize it to create self-sustaining habitats.
Email: ciksap@nbnnet.co.ke ♦

GE³LS Symposium 2005 Poster Winner Earns Fulbright Scholarship

Growing up, she was considered the “mellow middle child” by family members, but mellow isn’t a word that first springs to mind when you meet Vancouver native **Zosia Bornik**. “Driven”, “goal-oriented”, and “highly organized” maybe, but not “mellow”.

Within two short years, the UBC student’s hectic schedule has seen her combine the completion of a Masters degree in resource management and environmental studies with work as a research assistant on the large-scale “Democracy, Ethics and Genomics” (DEG) GE³LS project. During that time, she co-authored several publications stemming from her DEG research, and successfully defended her Masters thesis on salmon farming and protecting the long-term sustainability of B.C.’s coastal ecology.

Remarkably, the twenty-four-year-old also found time to train and compete for several triathlons, coming 7th of 58 women in her age division during the 2004 World Triathlon Championships in Madeira, Portugal, where she enjoyed the ‘best bike ride’ of her athletic career. Oh, and she also teaches first aid, kayaks, mountain climbs, and sings in an A Capella group she co-founded. It’s a full and active life that makes just about everyone seem like a veritable couch potato.

In May, Bornik received news that she had won a Canadian Graduate Scholarship from the Social Science and Humanities Research Council. A week later, she discovered she had also won a prestigious Canada-US Fulbright Award. Part of a joint bi-national educational exchange program, the Fulbright award will allow Bornik, while maintaining enrolment in her program at UBC, to undertake doctoral field research at Carnegie Mellon University in Pittsburgh, home of the oldest interdisciplinary program in science and public health. She will spend some five months at CMU as a Canada-US Fulbright scholar.

Winning both scholarships will allow Bornik to continue to follow her keen interest in “how social norms shape the context in which the public makes their individual decisions”.



Zosia Bornik with her winning poster at the GE³LS 2005 Symposium

It’s an interest sparked by her work as a GE³LS project research assistant on the DEG project, the objective of which is to compare three methods of ethical analysis for the development of genomics public policy – consultation, deliberative democracy and computer modeling. It’s the latter, computer modeling, which has captured Bornik’s attention since the project’s inception in 2003. Her research on population health interventions for the blood disorder β -Thalassaemia in Cyprus served as background work for the first “NERD” web-based survey, which offers respondents the opportunity to seek advice from various knowledgeable sources.

Bornik submitted a poster abstract on the NERD project to the GE³LS Symposium 2005, held in Toronto in March, earning her a 1st place cash prize. Along with the NERD team, which also includes Peter Danielson, Hadi Dowlatabadi, Edwin Levy, Rana Ahmad, Holly Longstaff and Jennifer Wilkin, Bornik was invited to present those findings at the First International Conference on e-Social Science, held in Manchester in June 2005.

“We’re looking at the influence of social feedback on individuals’ opinions,” said Bornik of the NERD project. “We divided survey participants into two groups: those who could see

NERD POSTER WINS

Zosia Bornik, a UBC graduate student, was awarded first prize for her poster, “Evidence of social feedback affecting public opinion on genomics” at the GE³LS Symposium 2005, held in Toronto in March 2005. The poster details initial findings from the NERD project.

NERD is a web-based survey instrument that offers respondents the opportunity to seek opinions from various sources, while trying to answer questions about which they are unlikely to have prior knowledge or experience. The survey not only records participants’ answers, but also their patterns of advice-seeking and the role of group feedback in decision-making.

According to the NERD website, “Traditional polling tools (e.g., phone surveys, public forums) try to gauge public opinion by using “unbiased” methods. Such approaches tend to generate quick, top-of-the-head responses, and risk misleading policy-makers in their predictions of how the public will respond to unfamiliar issues.”

NERD, which stands for “Norms Evolving in Response to Dilemmas”, has been described as a critical first step towards developing computer modeling tools for a more informed and democratic public consultation process.

NERD surveys are located at <http://yourviews.ubc.ca>. The current survey focuses on salmon and will be followed by a version on poplar genomics.

To read a working paper about NERD, part of UBC’s Centre for Applied Ethics Electronic Working Paper Series, see <http://www.ethics.ubc.ca/workingpapers/deg/deg010.pdf>.

how others responded and those who couldn’t. One surprising finding was that while the feedback group gave more polarized answers than the non-feedback group, in general respondents were very independent-minded.”

Before embarking on her PhD, Bornik – who also has an ardent interest in ‘green’ design and sustainability – will take some well-deserved rest and relaxation this fall. But no all-inclusive resorts or lazy beach vacations for her. R&R, Bornik-style, means cycling across Northern Europe, from Paris to Istanbul, for two months.

“The team at UBC has been excellent,” said

Bornik, adding, “It’s been such a group effort. I’m not ready to let go of the NERD project quite yet and will remain involved. It’s quite addictive.” ♦

INVITATION TO READERS

Do you find this Newsletter interesting? What is your perspective on ethical, environmental, economic, legal and social impacts of genomics and proteomics? Would you like to receive more copies and distribute it to colleagues and friends?

Drop us a line at info@genomecanada.ca

NERD: Evidence of social feedback affecting public opinion on genomics
Dr. Peter Danielson, Dr. Hadi Dowlatabadi, Dr. Ed Levy, Rana Ahmad, Zosia Bornik, Holly Longstaff, Jennifer Wilkin
University of British Columbia, Vancouver, Canada

ABSTRACT:
Genomic progress in democracies occurs within a legal and political framework defined in part by public opinion. Therefore, it is necessary to ensure public consultation is meaningful, transparent, representative and accurate. Traditional methods of polling the public can suffer from limitations, which makes this difficult. Our team, NERD: Norms Evolving in Response to Dilemmas, has developed an online survey instrument that allows us to provide more information than polls, control for social structure, and obtain ethically deep data. The structure of our survey allows us to explore social feedback through an examination of individual responses. Participants are divided into two groups: those who can see how others have responded and those who cannot. Results from NERD-I confirm the influence of social feedback on the types of answers given, advice-seeking and textual contributions of participants.

DESIGN:

- Modeled on a real-life case study (β -Thalassaemia)
- Web-based, allowing for voluntary participation from home, work, library or internet cafe
- Anonymity protected (IP address and optional demographics)
- 12 questions, taking 15-20 min to complete
- Fictitious expert advisors provide useful information and representative views
- Quantitative and qualitative data: multiple choice answers with option to elaborate
- Participants stratified into feedback and non-feedback groups
- Time spent by each participant answering questions and seeking advice is recorded in the database

SAMPLE SIZE:

Total participants	702
Total completing survey	523
Total completing survey and saving answers	410

RESEARCH QUESTIONS:

- Does social feedback influence participants’ answer choices, advice-seeking and optional written input?
- Are certain expert advisors frequented more often than others?
- Does the NERD platform foster ethical depth in participants’ responses?

CONCLUSION:

- There is a need for new instruments to improve public consultation on genomics.
- We know very little about the social norms and other heuristics that people use in making decisions about important technologies.
- Existing tools have evident shortcomings, especially in terms of cost, controlling for their own induced social structure, and motivating participations.
- Computer communication and modeling offer opportunities to improve the quality of public participation in all three respects.
- The use of feedback as a proxy for social norms showed significant effects on participant’s choices, advice-seeking and contribution of optional comments.
- Expert scientific and financial advice was sought most frequently for questions on research or funding issues.
- No Advocate was the most popular advisor overall, possibly due to participants seeking out the opposing position before answering questions.
- NERD fosters ethical depth in participants’ responses in terms of time spent contemplating answers, amount of advice sought, and textual contributions made.

FUTURE RESEARCH:
 NERD-II Salmon and Genomics (March, 2005)
 NERD-III Poplar Trees and Genomics (May, 2005)

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The winning poster Bornik submitted to the GE³LS Symposium 2005

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