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Royal Roads University

Biotechnology and Sustainability Development

A Dynamic Intersection?

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Moderated by Ann Dale and Art Hanson

Participants

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This e-Dialogue is research undertaken by an independent expert working party, as part of their project on biotechnology, sustainable development and the economy. As such, neither the opinions expressed nor the information provided in this on-line conversation is in any way associated with the Canadian Biotechnology Advisory Committee (CBAC) or the advice it offers government.

Dialogue

Ann Dale

Welcome to this e-Dialogue of the Working Party on Biotechnology, Sustainable Development and the Future of Canada's Economy. We will be discussing some of our ideas around this complex public policy issue that we think has possibilities for more sustainable futures.

Our format tonight is the e-panel working party will converse for 40 minutes, followed by questions from the e-audience.

Art, do you want to lead off sharing your understanding about biotechnology, the sectors involved and why this is important for sustainable development?

Arthur J. Hanson

Thanks Ann, and thanks to everyone on the panel and audience who are participating. Here are some opening thoughts:

Fundamental Premise: We are entering a time of the Biological Economy. Use of biological knowledge and materials to create goods, services, and maintain life on our planet will become much more significant in our personal and societal decisions. But we are not well prepared for the transformations, just as we were unprepared for the Information Economy three decades ago.

Biotechnology is one key area of the Biological Economy. Another is management of ecosystems.

Biotech (BT) & Sustainable Development (SD): SD is a goal; Presumption is that BT may help to achieve the goal...only one of several means.

Ann Dale

Can you give me some examples of a biotechnology you consider would move us towards a sustainable future, what sectors are involved? Linda, how do you think biotechnology could contribute to greater sustainable community development? David, your thoughts?

Linda Lusby

I think biotechnology has tremendous potential to contribute to sustainable community development. We talk about a sustainable community as being a healthy community and biotech can help us reduce pesticide use and grow crops with selected nutrient advantages.

Arthur J Hanson

Biotech covers a lot, and so does SD. What has been missing is much of an attempt to connect the two, especially in a comprehensive way. A simple way to think of biotech is:

‘Red’, ‘White’ and ‘Green’ Biotech: Medical; Industrial; Food crops and Environmental applications of biotech. The new kid is Bioproducts such as

ethanol for use in cars and trucks.

David Punter

Any processes that would reduce our reliance on fossil fuels, e.g. bio-fuels, but the full life cycle must be evaluated.

Arthur J. Hanson

The example many people are following now is production of ethanol from crop wastes (or dedicated crops of corn, etc.) Canada and others are trying to get off oil and reduce carbon dioxide. GM enzymes can help to break down the materials into simple sugars, turn out intermediate and final products into chemical stock and ethanol. Plastics, fuel can be produced. Bio-refineries in rural areas give new sources of income, and it is all better for the environment, according to product life cycle assessments. Sounds rosy!!

Peter Brown

Hi Peter Brown checking in just got back from class. On ethanol we have to look at the full cycle from growing the crop to how it is used and the waste along the way.

David Punter

I recently heard a comment that the use of pelletized native grasses would be much better as a fuel replacement for heating oil or natural gas than ethanol from corn.

Arthur J Hanson

However, as an environmental scientist, I keep reminding myself that there is "no free lunch."

Linda Lusby

Absolutely. Biotechnology could have just as many disadvantages as it has advantages - that's why we do need to discuss it in the context of sustainable development - including ethics and healthy communities.

Ann Dale

As Art says a 'rosy picture' indeed, but is there any dark side? Peter, do you have any thoughts and others?

Peter Brown

Well we have to be sure that we have independent testing of the products that will be coming along, and it is my impression that many of the tests we would like to have not been done, and that there is a problem with some of tests in how independent they were from those with financial interests in the outcome. So we have to be cautious about assessments.

Arthur J. Hanson

...and that the challenges are long term:

Tasks we face: what policies, investments do we need to consider now (2005-2010) in order to achieve sustainability objectives by 2020-25? Where might biotechnology make a contribution? What should we be cautious about, or trying to protect? What should we be trying to bring to market? And what barriers need to be removed? Who gets access and shares benefits? What should be the process for good decisions, and for good dialogue?

Stuart Lee

Having just come back from a UN forum that focused, largely on community health, I can say that the social structures in which biotech is introduced and developed will be very crucial to its community impact.

Ann Dale

Stuart raises a very important point, social structures. It seems to me that many of our inventions have paradoxical effects, like thinking the computer would reduce paper, and yet, it has taken about 20 years for some reductions to occur, at first it increased paper. Is the working party looking at governance issues?

Ann Dale

What is your definition of sustainable development?

Linda Lusby

I guess my definition of SD is pretty much the traditional one - meeting the needs of today without compromising the ability of future generations to meet their needs. We get into trouble when we can't distinguish "needs" from "wants". Biotech could help us achieve things that we need and could help us do it a non-damaging way.

David Punter

Where do you draw the line between needs and necessities of life. Much of the world's population lacks the latter?

Peter Brown

One of the problems with the Bruntland definition of SD that Linda just referred to is that is completely centered on humans. Other living things have only instrumental value.

Linda Lusby

That's interesting Peter. I tend to think of this in a very holistic or all inclusive way - needs of all species and future generations of all species.

Stuart Lee

This brings us to the challenge of "ecocentric" thinking - we need to depend on our ability to know, to sense other creatures. Our ability to perceive others is limited. As genomics, especially environmental genomics, is showing us, there are manifest life forms out there, who provide crucial ecosystem services, and who are largely out of our "window of perception" -- an example that comes to mind are the marine viruses, who participate in a life cycle that kills off something like 20% of all photosynthetic organisms in the sea per week.

Arthur J Hanson

SD definition: simplest for me is "leave our planet in a better way for our children (indeed, for the Seventh Generation), and ensure that we share the wealth with others in our own generation" Neither of these conditions is being met adequately at present.

Robert Slater

We could spend a long time debating the merits of different definitions of SD. Could I suggest that it would be useful to pursue the issue of the terms and conditions that should be associated with the introduction -or not- of the products of biotechnology into trade and commerce?

Arthur J. Hanson

Very important concern. It is without a doubt a key factor in the issue of what products of innovation move ahead. Will it be within a framework of SD criteria (as the preamble to the WTO would suggest)? Will non-tariff trade barriers be erected, etc? The recent draft ruling concerning GM foods imported into the EU is a good example of the future. But I also have some other takes on this issue. For example, EU countries are interested in biofuels. Will they take the feedstock ethanol from Brazilian or Thailand's cassava. And if so what are the environmental implications. And do we have the assessment framework and tools?

Ann Dale

David, do you see any possibilities for the adoption of biotechnology to help us sustain ecosystems?

David Punter

Yes, bacteria and fungi can be used to clean up contaminated sites, mycorrhizal fungi can be introduced to promote recolonization of degraded sites, enzymic processes can complement and partly replace those relying heavily on fossil fuels.

Arthur J Hanson

And this requires us to think of how to apply innovation and ingenuity: how can we apply knowledge, management, technology to drastically reduce our ecological footprint, provide for more equitable distribution of benefits, and to ensure the world is a better place for future generations?

Ann Dale

Peter, can you give us a more inclusive definition of sustainable development and then an idea about how the intersection of biotechnology and sustainable development would secure our future?

Arthur J Hanson

The Millennium Ecosystem Assessment is an important bridge for thinking about development and preservation, because it recognizes both intrinsic values of maintaining life and also the value of services.

Ann Dale

Art, do you see some urgency to adoption of the bio-economy, I guess in some ways we are talking about industrial ecology, systems thinking? Bob, can we

innovate our way out of this?

Arthur J. Hanson

I would bring us back to the broad notion of Biological Economy, because we then have to think across the whole spectrum from big global scale ecosystem issues, to the smaller, our landscapes and resource bases, and the tiny, the molecules, genetic material, etc., of life. That helps me a lot with trying to understand linkages between biotechnology, environment and development.

Stuart Lee

Art, I think you've identified one of the most important considerations in the debate and is very pertinent to Bob's earlier comment about defining conditions etc.

How do we think productively across these scales when they are 1) arbitrary, when it comes down to operationalization 2) linked by such varied, redundant and differently time-sensitive connections?

Ann Dale

Bob, can you give us some idea of these terms and conditions?

Robert Slater wrote:

we could spend a long time debating the merits of different definitions of SD. could I suggest that it would be useful to pursue the issue of the terms and conditions that should be associated with the introduction - or not- of the products of biotechnology into trade and commerce.

Ann Dale

Stuart, does this mean that biotechnologies and I guess nanotechnologies that mimic the processes of nature would be preferable?

Stuart Lee wrote:

This brings us to the challenge of "ecocentric" thinking - we need to depend on our ability to know, to sense other creatures. Our ability to perceive others is limited.

As genomics, especially environmental genomics, is showing us, there are manifest life forms out there, who provide crucial ecosystem services, and who are largely out of our "window of perception" -- an example that comes to mind are the marine viruses, who participate in a life cycle that kills off something like 20% of all photosynthetic organisms in the sea per week.

Peter Brown

I think it is important to notice that we already have a biobased economy, it is just old life stored in the ground. The earth has a range of possibilities to produce life by using sunlight and DNA to convert other substances into long carbon molecules. Ultimately this capacity is limited, and switching from old life--fossil fuels--to new life --biomass still has to live within the solar budget which is relatively fixed through time. Nuclear fission and fusion may offer an escape, but mainly we need to recognize that are working within limited systems and not go from one energy debauch to another. The biomass that is out there in corn stalks and tree branches is being used to build the top soil for the next crop and the regenerated forests. We should explore these options but with care and respect for the systems on which we are intruding. As economists are fond of saying there is no free lunch.

Linda Lusby

Ann, a bit ago you asked us if we are looking at governance. Bob has also referred to this. Personally I think this is one of the most important things our group can offer to the discussion. We have introduced many technologies and innovations indiscriminately - without full understanding of what we can allow them to "do" in our society. It comes back to the questions - "not what can we do, but what should we do."

Stuart Lee

...and how we decide it and who decides!

Ann Dale

Linda, you raise a critical, critical point. In terms of traditional evaluation we often ask are we doing things right, when the more important question if are we doing the right thing? What kinds of governance issues has the working party been discussing?

Robert Slater

You have already heard that a life cycle approach is required. Easy to say and

extremely hard to do for a new technology where by definition your knowledge of long term, cumulative effects is unknown. There is already an established process of looking at product by product and there is considerable experience in the drugs field for example. what is needed in the field of ecosystem science is an equivalent ability to forecast patient health and population health. You cannot do that at the moment and that inability is at the root cause for many mismanaged toxic chemicals.

Arthur J. Hanson

Governance is still quite primitive for some of the key areas of biotech and SD. We do not have a full national SD strategy, and we are learning day-by-day how to deal with the broader aspects of SD. It is not an easy business for any sectors, public, private or civil society. And as the bio-safety negotiations have shown us, it is even more difficult at the global level.

Arthur J Hanson

I meant to say...learning day-by-day how to deal with the broader aspects of biotech and SD. I think it is important that we treat the two together in this discussion.

Peter Brown

Question to Bob:

So if we cannot make these predictions what do you suggest?

David Punter

One of the key distinctions we have to make is between organisms used in industrial biotech processes - those that are contained and can be killed after use - and those that are released into the environment e.g. GM trees. Many studies indicate that the latter cannot be contained and we need much better baseline data from which to try to predict their ecosystem impacts.

Robert Slater

But these contained systems always seem to fail.

Peter Brown

So David do you suggest a moratorium on this kind of thing for now?

David Punter

I think the only responsible approach is to have a moratorium on releases until such time as we can ensure that the altered genes are not transferable to natural populations, i.e. no dispersal of viable seed or pollen can occur.

Ann Dale

Dr. Slater, it seems to me that you talking about integrated decision-making and interdisciplinary research? But the current structure of the academy and governments work against this integration?

Robert Slater wrote:

You have already heard that a life cycle approach is required. Easy to say and extremely hard to do for a new technology where by definition your knowledge of long term, cumulative effects is unknown. There is already an established process of looking at product by product and there is considerable experience in the drugs field for example. what is needed in the field of ecosystem science is an equivalent ability to forecast patient health and population health. you cannot do that at the moment and that inability is at the root cause for many mismanaged toxic chemicals.

David Punter

The only mechanism we have at present is the monitoring and audit function established during EIA, often not well devised or executed.

Linda Lusby

One of the exciting - but very challenging - aspects of this project is that we are looking at biotech within a context or framework. We have chosen the framework of SD, in its many connotations. That helps with some of the governance decisions. The who is not yet clear but I would submit it should be citizens and communities. We decide what to adopt from biotech in terms of how it will promote SD. A very complex web but perhaps we have been avoiding complexity!

Arthur J Hanson

Linda, I agree with both the excitement and the challenge of biotech and SD governance. My belief is that we need a model of governance that provides for continuous learning and opening decision processes to knowledge as it is created or comes forward.

This involves adaptive assessment and management. We do not expect even to get all the questions right the first time round in dealing with innovation. And applying innovation is always an experiment, where we are unlikely to know the full extent of either problems or benefits immediately.

Stuart Lee

Linda, may I speak a word for the gentle voice of Don Dewees, who, as I imagine, is reacting to your suggestion -- should not the market (regulated or not) decide? Should not those who are willing to risk time and energy to seek better solutions be the ones making the decisions, as long as their products are shown to be safe through rigorous evaluations?

Linda Lusby

Stuart, in response to your "disguised as Don query", I would say that the market is the citizens. Although corporations and innovators may invest in different technologies, it is still the buyer that decided.

Robert Slater

New technologies and more informed societies dictate new approaches. And to Peter I ask what is the route to the ethical dilemma?

Ann Dale

We have questions building up from our colleagues. If you want to wrap up your comments, Art, do you want to answer "Does it make sense to try and use resources grown or produced within one's region?" Or in other words, is there a relationship, if any, between bioregionalism, biotechnology and sustainable

development?

Arthur J Hanson

The quick answer to your question Ann is yes. There has to be, otherwise farmers and others will not bother to grow crops, provide waste materials, etc. And for bio-products in particular, it does not make sense to move "wet" materials very far. This morning you and I talked about that good European term "subsidiary". That implies decisions taken at the lowest possible level where they can be effective. It means cooperative efforts in rural areas between producers and industry, government.

David Punter

It certainly makes sense with regard to food. I believe 25% of fossil fuels used in transportation are used to transport food.

Ann Dale

Another question from the e-audience, "Given we live in a world where groups of people want to hurt other groups of people, how do we endure that biotechnology is not making us vulnerable? How do we prevent bio-terrorism? It seems to me a fuel source grown from a crop might be a very tempting target."

Bob, do you want to try and answer this one?

Ann Dale

An example, what if we genetically engineer a crop for fuel, plant monocultures, and someone engineers a virus to kill it all at once? In other words, some people believe that any time we add a complex technology, it opens up new opportunities for vulnerability?

Arthur J. Hanson

Clearly we wish to build resilience--ecological and societal. I look at the two, vulnerability and resilience as opposites, but always a dynamic is going on

between these two properties. I would presume that they can be analyzed within a framework of assessing sustainability.

Robert Slater

That is absolutely correct and unavoidable-human nature being what it is. You can minimize if not eliminate the risk and ask yourself whether the distribution of costs and benefits makes this a good deal or not for present and future generations. That discussion is underway again in the case of nuclear power so we learn that the question can rarely be definitively answered.

Arthur J Hanson

On bio-terrorism...an enormous amount of money is being spent on this topic in the USA. It is hurting funding otherwise to be allocated for health research, and some areas of what I would consider sustainability science. We need to take into account the possibilities, but not go overboard. And at another level, we could have a long discussion about ways in which investment for sustainable development might reduce other threats.

Ann Dale

Bob, thanks for the nuclear example, their report talked about the need for long-term continuous learning cycles and adaptive management, are there any lessons there for biotechnology?

David Punter

I doubt that biotech crops are any more vulnerable than conventional ones.

Ann Dale

Peter, a question for you from the e-audience, "It seems that we also might be pushed to early commercialization by considerations of rights attached to some new innovations. Maybe we need to consider this relationship as well when we determine how long a product must be tested before it is declared safe?"

Peter Brown

Not sure what is meant by rights--rights to commercialization? If so it is the responsibility of government to ensure that there has been thorough INDEPENDENT testing. There are no rights without responsibilities. We have to ensure that the government sees the citizen and life on earth as what it protects, often government agencies are captured by those they are supposed to regulate.

Stuart Lee

Hi Peter:

I asked the same question in the audience section, and the answer was, yes, IP rights. I have run up against the vigorous argument to your proposal of independent testing of - "...and who pays for this? Why should taxpayers pay for a company to test their product?" I take this point as a reasonable one.

I think that there must be somehow a better solution than the one currently in place -- perhaps a third-party independent group that is mandated by gov't but funded by industry, so as to remove the threat of losing their business if they give industry answers it doesn't like to see.

Peter Brown

Something like this could help, the universities used to do this but their credibility has declined.

Ann Dale

Another question, and in the absence of our economic colleague, who would like to answer, "Question: I would like to know what the working party is gleaning, if anything, from the field of ecological economics?"

Arthur J Hanson

Quick answer is not enough. We need to set our goals modestly at this point on the relationship between economics, ecology and biotech interventions. The case

of pricing ecological services is an important example. Very difficult. And life cycle analysis of bio-products, where issues such as biodiversity maintenance are involved, is likely to produce some strange and perhaps rather unsatisfying numbers. There is a need to build stronger environmental economics around many of the current areas of interest such as bio-fuels. But also to recognize the limitations.

One key area is analysis of subsidy impacts. And how we can compare impacts of fossil fuel subsidies (think tar sands) and bio-product subsidies.

Peter Brown

We are using ecological economics econ as an important element in our assessment of biotech--starting with idea of keeping ecological rough balances on substances from the earth's crust, and in terms of compounds made by humans, allowing neither to build up in the biosphere. These ideas are from the natural step, but are very compatible with the general approach of EE.

Ann Dale

Another question, "Do you think that without changing the social relations that underpin the mechanisms of environmental degradation that biotechnology, or technology, can be expected to have any measurable positive impact on environmental degradation? Many of these social relations are not explicitly challenged by models of SD..." Linda? Art?

Linda Lusby

Social relations is indeed another part of the complexity. SD may not directly address social relations but we have also been talking about healthy communities and our definition of health includes social health.

Arthur J Hanson

On the question of social relations...We should recognize that a virtue of sustainable development is that it explicitly tries to identify social concerns and approaches, and a cornerstone is to enhance participation of stakeholders in decision-making. The fundamental issue is really how behavior change can be brought about, and also to ensure that biotech or any other innovative technology

is not seen as "the fix" in the absence of improved social structures, impacts, etc.

Ann Dale

We are certainly getting some interesting questions? This one is open to the entire e- panel. . ."We have developed many, many new technologies, continuously for longer than the lifetimes of any of us. I'd be interested to ask the panel: which of these technologies have in practice helped to decrease inequality and/or saving the environment? In particular, for improving the lives of the poor majority of the world. If it's hard to think of any, then why will biotech will be any different?"

Ann Dale

Another question, "It seems every time we learn how to do more with less we wind up consuming the more we save and it perpetuates existing dysfunctional systems. Is there a role for governments in trying to push biotech to achieve its full potential? We have seen some notable failures – aquaculture, forest management among others..." Bob and Stuart, do you want to answer this? And others . . .

Robert Slater

A good question at the crux of the dilemma. We face immense challenges which are not going to be solved by the same thinking that created them. New instruments [technologies] always come with attendant risks. How can we give our best shot at Biotech while not eliminating our options for a more equitable distribution of the benefits.

Arthur J. Hanson

Not sure that I agree fully with the observation in all cases, but it is certainly true that tech innovations alone will not guarantee success. We need systematic approaches to the problems and long-term commitments to solutions. And we should expect surprises. Again, why we need adaptive planning and management.

Robert Slater

I think it is useful to differentiate between the approach taken by the Nuclear Waste Management Organization and the nuclear industry in general. In the former their approach to citizen engagement, risk management etc has been exemplary. The same cannot be said about the rest of the life cycle.

David Punter

Biotech is not likely to be a panacea for the evils of financial, ecological and resource deficits that have been accumulating. Education, self restraint, even legislation, may be more effective in the long run if extinction does not get there first. Sorry to be so cheerful.

Linda Lusby

Adaptive management has been mentioned a couple of times in this discussion. I see this as a very effective means of management that, if properly done, brings in the views of scientists, governments/regulators, and citizens throughout the process. We are constantly reviewing and revising and hence we are able to adapt as we learn more. Given the very little we know about biotech, this is a good approach.

Stuart Lee

Linda -- I introduced this term to a group of regulators today (who were discussing monitoring for long term effects!), and got an excited but suspicious reaction. It just reminds me how important the constrictions of government's legally mandated duties (i.e. to determine product or process XX is safe) are, how seriously people take them and the serious public perception/ business environment risk that governments see in revising their decisions about health and safety. I think that for adaptive management to move forward, the bureaucracy would need the full support of the people who would have to live with the changing regulatory climate... -- otherwise, one can just hear the charges of incompetence and corruption flying!

Linda Lusby

Stuart I can certainly see how you'd get that reaction. But I think we need to come to terms with the fact that we don't know everything all at once for all time. I've been having a similar discussion with my students and we've agreed that since science does not actually prove anything, a regulatory notion that we get things right the first time is false. I think our system needs to adjust to this reality. Perhaps idealistic but better than pursuing a false perception of infallibility.

Stuart Lee

I agree Linda, Dave and Bob - my comment was intended to highlight the seriousness of the changed ways we must adopt to implement it.

Arthur J Hanson

We must remind ourselves that governments are there to protect the public good and to enable sensible change. The regulators are a special part of government and we have some good ones. But they form only part of the bigger picture we need to build sustainable development. Good example for me is to see the struggle of how to implement Canada's Oceans Act, meant to enable aspects of SD, and the regulators role under the Fisheries Act, a supremely punitive and important piece of legislation.

David Punter

We already have adaptive management but we often do not look for the right adverse effects and when we find them we take far too long in responding to them, e.g. DDT. Courage in decision-making is not a strong point in governments with short terms.

Robert Slater

What is the alternative if you acknowledge, as I thought we had, that we do not know all that we would like to know in order to make a fully informed decision. Adaptive management is a sensible way forward.

Ann Dale

An interesting question from our health expert, "I wonder if the obesity epidemic is one area where biotechnology can help produce food that is less fattening but meets the taste demands of our reptilian and mammalian brains - salt and sugar?" David?

Linda Lusby

I would think this is a perfect example of looking for a technological fix for issues that we should be able to approach through behavioural change. It strikes me that if we are talking about appropriate use of biotech, we should be considering higher calorie foods for those who do not have enough. That comes back to governance.

Robert Slater

I thought that the idea was to eat less and exercise more rather than invent the thin pill.

Ann Dale

This will be the last question we have time for and any questions not brought forward, I will ensure the committee has access to them. I know this is from a post-doctoral scholar who loves science fiction. "Is the panel looking at all at how biotech might change what it means to be human? I wasn't exactly surprised when the US president spoke against "animal/human combinations" in the State of the Union speech, but how will we handle the demand for longer life, smarter children, or, perhaps, infrared vision for soldiers. Any thoughts?"

Linda Lusby

Read this book: Greenfield, Susan. 2003. Tomorrow's People. How 21st Century Technology is Changing the Way We Think and Feel. Allen Lane Penguin Books, London. 284 pp.

Peter Brown

Many thanks to Darren and Ann for introducing me to this technology. all the best, Peter

Arthur J Hanson

Ann: Thanks again for making this possible!

Robert Slater

Ditto, Bob

Ann Dale

Thank you, e-panel and e-audience for an interesting and informative conversation and penetrating questions. Any final comments, and good night to all.

Linda Lusby

Thanks to Ann and the audience – it's been a very interesting experience! Good night!

David Punter

Thanks to all for the opportunity to participate.