

Entrevista com Richard Jefferson (on line since October, 10th , 2008)

Jefferson, molecular biologist, works with Cambia, initiative that is part of a wider movement (BiOS), inspired by the software universe. They want to make open access biology contributing to free, for example, small farmers and enterprises that use biotechnology and are extremely dependent on the monopoly practiced by large corporations.



Por Marta Kanashiro

Richard Anthony Jefferson is already part of the history of transgenics, for his contributions in the field, and the founder of the Australian initiative Cambia, born in 1991 and hosted in Canberra. His work joins the experience in molecular biology with his performance at the *Food and Agriculture Organization* (FAO) of the United Nations and the contact established with developing countries. In this interview, given to ComCiência by email, Jefferson deals with the challenges of the patent and opened access universe, and criticizes the process to monetize synthetic biology. According to him, the real value of this field can only be understood if it is seen as a toolkit that potentially contains solutions for many daily problems, as well as, for the development of science and technology that is not blocked by the current conception on patents.

ComCiencia: Could you describe how does Cambia work?

Richard Jefferson: CAMBIA is an autonomous, international non-profit institute. Our name - cambia - was once an acronym (*Centre for the Application of Molecular Biology to International Agriculture*). But for the last ten years we have only used its 'true' meaning, from Latin -which means Change. Cambia is focused on creating social change through increasing the equity of science-enabled innovation. Our original focus was the targeted development and broad dissemination of core 'enabling technologies', biotechnology tools that would allow biological scientists to more effectively contribute to solving problems in agriculture. During that journey, we soon recognized that it was not the technologies themselves, nor even the scientists, but the complex 'ecology' of innovation that was proving the most serious bottleneck to equitable engagement in science-enabled innovation. Molecular biology and biotechnology weren't limited largely because of the science or the technologies, but rather the social structures and business practices that were evolving around them. In particular, as we explored new ways of sharing our science, we learned about new blockages to actually making use of that science and we learned that they way the industry and academic communities were using intellectual property was at the heart of the dysfunction.

So we became very active in shedding light onto the complex and ecclesiastical literature of patents. With funding from the Rockefeller Foundation and later the Government of Norway, as well as our own licensing income, we started the Patent Lens. The 'Lens has become the preferred public, open access resource for searching patents and understanding the landscapes of rights they cover. Its an open architecture patent knowledge facility with the ambitious aim of integrating the worlds' patent, and relevant business and technical information, in a form and on a platform that allows worldwide, language and sector independent understanding of the true state of play in any patent-effected field of enterprise. We seek to provide a tool for evidence based decision support for anyone - citizens, institutions, companies, civil society, and policy makers - to gain informed and helpful knowledge of the state-of-play in patent-space. And we plan to open this facility to worldwide participation in the 'markup and analysis' of these patents and their impact on innovation.

So we do lots of IT and lots of patent analysis and lots of thinking about strategies for democratizing innovation. But we're unusual in many ways because we also walk the walk, and still invent molecular technologies. This allows us to blend culture in unusual ways. Science, software, patents, social entrepreneurship all informed by a passion for humane and shared application of science for public good. And all of this grounded in reality.

While doing this patent analysis work, we were able to identify examples of how there were complex thickets of patent rights, mostly controlled by large corporations, that were major impediments to small enterprise using biotechnology. So we used patent informatics, and targeted 'invent beyond', new ways of doing these things (such as gene transfer) that wouldn't be covered by patents owned or licensed by multinationals. Then we invented the technologies. One prominent one was called Transbacter and allowed genes to be transferred into plant cells efficiently. And we decided to share this very widely in a way that would keep it free. We patented it. And we invented new kinds of licenses called BiOS or Biological Open Source licenses to provide the technology to anyone who would respect the rights of others to use the tool. These open source licenses, and our BiOS initiative generated a good deal of attention, but were not and are not the whole solution.

ComCiencia: What is the scenario of intellectual property in synthetic biology

Richard Jefferson: Synthetic biology is an increasingly fashionable term used to describe the intentional engineering of biological systems, with an increasing focus on the use of synthetic components. It is in some way just an incremental but accelerating change in the way biotechnology and molecular biology has already been used in industry for some time. As the quality and affordability of chemically constructed DNA and RNA continues to increase, there is a migration to using these prepared reagents rather than amplifying or modifying existing genes and polynucleotides. Re-badging this activity as 'synthetic biology' with some high-profile practitioners has been a boon to funding and investment, but is not creating really new opportunities in the short to medium term. Most of the constraints that SB will face in creating real economic value will occur 'when the rubber hits the road', when the interventions in a laboratory have to come up against the realities of mature and sophisticated sectors with high capital costs and regulatory burdens, including those of health, medicine, agriculture and even diagnostics. The real constraints will lie at these levels, not the technology.

However, one of the great strengths of SB will be the ability to routinely experiment with genetic circuitry to better understand how living systems are controlled. And this strength relies on a substantial engineering tradition that has not been well represented in the life sciences to date. And that very engineering or 'inventive' approach actually makes SB more problematic for intellectual property rather than less so.

IP in the form of patents, requires the disclosure of the 'teachings' of an invention. One can argue that many biological discoveries really are not inventions and should not deserve a patent to cover them. But curiously, synthetic biology - by definition - is a constructed or built system. It really is more about invention than discovery, and the molecular devices that will emerge (circuit components for instance) will actually be more prone to patenting than the 'natural' bioscience components that are already rife with patent claims. So it may be that IP becomes more prominent in SB than it is in other biology fields!

The early promoters of SB, particularly Drew Endy and Rob Carlson, who are academics, were outspoken and articulate in their personal desire to see an 'open source' inspired community evolve around the tools, circuits and 'biobricks' of synthetic biology. But I fear that their early enthusiasm and good intention is becoming swamped by the harsh realities of the pack mentality as almost everyone and their dog rebadges their work as synthetic biology and companies spring up to monetize SB. I think the real value of SB is at what we call the 'low end of the stack' of problem solving. It's a toolkit. And those who try to maximize revenue capture from the toolkit - especially one that is evolving so quickly that the initial patent grants made over these tools may prove unhelpful in informing improvements - will impose absurd costs on those industries really wanting to USE SB to make products or services for real markets. If the building blocks - or more importantly the rights to practice them - are

proprietary, why should a company which faces a ten year product development life cycle costing tens or hundreds of millions of dollars take on the extra burden?

The IP situation in SB could actually slow down its usefulness to real industries that make real products or services.

ComCiência: Is the model of sharing, using and developing scientific information similar to Free Software? What the differences? We would like to know especially about the biological products (or results) done from open information.

Richard Jefferson: There is a fundamental difference between sharing 'information' and sharing the 'capability to act on that information'. Ironically - especially to their critics - patents are designed to be tools of sharing information, often without even copyright protection over the documents. But the rights to actually practice - to make use of - the technologies disclosed in the 'open access' document are withheld. In fact patents are simply put, the right to exclude others from using the claimed invention. The problem is that patents don't give one the right to use, only the right to exclude.

And yet in modern science-enabled innovation, it takes an assembly of dozens or even hundreds of patented technologies to produce a product or service that can impact our lives, economies and environments. And withholding the rights to even one of these may be enough to hold up the innovation. There is thus a strong incentive for patent holders to charge as much as possible for access to their one piece of the big puzzle. So assembling the entire puzzle - the right to create a product - becomes hugely challenging, and terribly expensive. And this results in the situation we see now, where only 'big ticket' priorities get attention - big markets or big margins. And increasingly only the wealthiest corporations can assemble the constellation of (expensive) rights to do so.

This leaves all the small-margin innovations - mostly those for poorer people, or where the outcomes are broadly shared such as in environmental improvements - neglected and languishing when they could in fact be benefiting from science and technology informed solutions.

This is an intolerable situation. We can look at the four billion very poor people in the world, or the nearly one billion malnourished as a huge problem. Or we can look at them as a huge opportunity: a community of problem solvers and creative, if impoverished, contributors. Motivated and locally knowledgeable.

In a sense, this is the core beauty and the practical impact of open source thinking. To view a broadening of the demographic of problem solving as a powerful tool to improve those solutions, and the fairness of their access.

Free software and open source are not the same thing. There is simply no room in this brief interview to cover the complexity and nuances of the differences, but from my perspectives, the pragmatic nature of many modern 'open source' software licenses can offer some lessons for migrating the strengths of this paradigm to more complex, slower and more expensive innovations for health, environment, energy and agriculture.

It is crucial however to remember that the 'sharing' in open source is not just the software (for free, typically) that is important, but the explicit permission to practice it commercially and the responsibility to protect others' rights to do so. This balance of a right to practice (not just play with) and responsibility to preserve is uniquely part of the open source licenses and the covenants of behaviour they impose.

So we must not think about 'Open' everything about simply sharing information. It is not really the issue. It is providing the ability to practice that technology, to combine the diverse pieces of a technology into a whole, and to render it safe and secure as a platform to move forward in industries and applications. Everything in our life - the food we eat, the clothes we wear, the shelter we seek and the medicines we use - derive from the migration of knowledge into practice, almost always through business. It is critical then if we wish to see open innovation practices improve the real world, to accommodate the real constraints of business

while remaining passionate about social equity. This can happen and is the main driver for the BIOS Initiative and BIOS - Biological Open Source.

But don't doubt there will be some very interesting biological understanding that emerges from engineering experimentation in SB. Probably some very helpful insights. But to make it truly open? It simply won't happen. There will be too many dominating patents that can stop an SB implementation that never even contemplate SB.

This situation results from a unique property of patents. One can dominate another. And another, and another. And they don't have to spell out exactly how the invention is practiced. So if someone has a patent covering the production of an antibody, it may cover that antibody even if its produced through SB, even if it doesn't explicitly claim that. Many useful compounds and processes are covered by patent claims that are worded in a way that can dominate the use of NB (Natural biology??) or SB.

ComCiencia: Is this model (open information) a new way that accelerate the development in many areas of science? Is this model compatible with a science done into certain limits? Is this way better to the development of developing countries?

Richard Jefferson: Again, there is a fundamental confusion in many quarters about Open X. It is not mainly the availability of open information that is the bottleneck to seeing practical impacts of science for society, especially for developing countries. It is the ability to create an innovation ecology that can engage more people to solve their problems using science to inform. The openness we must cleave to is the openness of transparency and inclusion, of course, but it is also the openness to practice, to acquire the capability to act on the knowledge obtained.

Getting beyond SB, the BIOS concepts - in fact even beyond life sciences - are hugely important for developing countries and neglected priorities. But it has to be done pragmatically and realistically. The cheerleading rhetoric of open source, open access, open whatever, really is not enough, nor is it sophisticated enough to make the necessary efficiency gains in the innovation processes in poor countries, or for that matter, in rich countries dealing with poor people or neglected priorities.

BIOS can be - if done well - about sharing the costs, sharing the load, making development faster and more transparent. But our experience in the last five years is that it must grow up. It must become a sophisticated part of innovation system reform, and must be built solidly on total patent system transparency.

ComCiencia: How is the synthetic biological area dealing with risks? And about the free use of open information? How should synthetic biology be regulated?

Richard Jefferson: Synthetic biology is dramatically less risky in my opinion, than many concerned individuals and organizations claim. The main reason for this is that synthetic biology is still in its infancy and has not even begun to create novel genetic combinations that have a remote chance of performing well in the environment. So far all SB interventions are simply 'constructed genes' that are not in any substantive way different than 'natural' or 'variant' genes, and are all still totally dependent on a biological system to express themselves. The rhetoric of artificial life greatly outstrips the reality. The most dangerous part of SB is the extravagant hype coupled with a reductionist engineer's hubris. And this danger manifests itself in attracting resources away from mature and thoughtful interventions that can really help.

ComCiencia: Which kinds of industrial or agricultural applications will synthetic biology be able to accomplish in the future?

Richard Jefferson: If we're gracious about how we define 'the future' (and consider many decades down the track), it can of course impact any life sciences enabled innovation. We must not however underestimate the enormous complexity of living systems - in animal (including human) health, in agriculture or in forestry or environmental management. Even individual cell populations - such as those used in industrial fermentation - are vastly more complex than we currently appreciate. Understanding, appreciating, using and modifying the

foundational living systems that have evolved to compete and persist in these ecologies is a critical part of using any kind of biology wisely.

ComCiência: Are we seeing a new kind of scientific race like the mapping of genome?

Richard Jefferson: No. There is a trivial race, to produce longer and ultimately more self-contained genetic constructs, which ultimately can be jump-started into a nominally synthetic living organism. But this has very modest implications for impacts in industry and society over the medium term. Rather, SB - now a buzz word - will become more commonplace as part of the toolkit. It is in fact already commonplace in almost all laboratories and industries in the life sciences, but not called SB.

See also:

Biotecnologia poderá sacrificar patentes e aderir ao código aberto
<http://www.comciencia.br/reportagens/2004/08/05.shtml>