

'Open-source biology' stance earns international honour

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Maverick molecular geneticist Richard Jefferson is in New York this week to accept a prestigious *Scientific American* award as one of the magazine's 50 Global Technology Leaders of 2003.

Jefferson, the US-born founder and director of CAMBIA (Centre for the Application of Molecular Biology to International Agriculture) in Canberra, is being recognised for outstanding achievement in a time-honoured Australian sport: stirring the possum.

The metaphorical marsupial Jefferson has been prodding is a patenting system whose complexity, expense and misuse he believes is stifling innovation and enterprise in the biotechnology industry, not encouraging it.

With his CAMBIA colleagues -- scientists and intellectual property experts -- Jefferson has been building a network of like-minded individuals and agencies to break the stranglehold of multinational agribusiness and pharmaceutical companies on key, enabling patents -- especially those involving genetic methodologies, including gene-transformation systems in plants.

Jefferson's ambition when he founded CAMBIA in 1991 was to give developing nations access to the powerful new tools of molecular biology, so they could apply them to their own economic and social interests. But he says he ran into the same suffocating web of intellectual property rights that restricts efforts by many biotechnology companies in wealthier nations to innovate and attract both public and private investment.

CAMBIA is assembling a growing toolkit of innovative techniques and intellectual property strategies that Jefferson believes will allow developing nations, and small biotechnology companies and public research agencies to innovate without being beholden to the big companies that own the enabling technologies required to transform crop plants.

Poorer nations struggling to achieve food security will be able to use the toolkit, for instance, to introduce protective transgenes into traditional crops long ignored by Western plant breeders, to reduce enormous production losses from pests and diseases, or to exploit new, non-transgenic technologies in the toolkit such as the DArT genotyping method, invented by CAMBIA's Andrzej Kilian.

Jefferson says the toolkit will help liberate farmers and biotechnology companies in developed nations from excessive dependence on a few giant agribusiness companies. He believes it will spawn a host of smaller biotechnology companies intent on applying gene technology in a transparent and responsive manner, rather than locking it up through intellectual property.

Human creativity

Jefferson says breeders have barely started to unleash the potential of modern genetics to improve crops and feed the world. "The key, ironically, is human creativity, and using technology and wise policy to nurture the innate problem-solving capacity within all people."

A Chinese colleague, eminent plant geneticist Prof Zhang Qifa, is leading a China-wide consortium that was founded on one CAMBIA innovation in the toolkit -- a technique called a transcriptional

activator facilitated enhancer trap (TAFET) -- to create nearly 100,000 transgenic rice lines that Qifa is now evaluating for improved vigour, yield, reduced water use, and resistance to pests and diseases.

The enhancer-trap technology is essentially a 'plug-and-play' technique for introducing new genes into plants so they will be expressed only in specific tissues, such as roots, flowers, seed or leaves.

The enhancer-trap technique effectively detects a signal from a nearby, anonymous gene that is expressed in a tissue- or stage-specific manner, amplifies it, and relays it to the new transgene, wherever it has inserted in the plant's genome, causing it to be expressed at high level in the same tissues.

Because there is no physical link between the enhancer construct and the transgene, the technique bypasses a host of patents relating to the use of constructs that rely on physically linking proprietary promoters to transgenes.

CAMBIA's open-access toolkit is central to Jefferson's ambition to develop a biotechnology industry equivalent of the computing community's open-source operating system Linux.

CAMBIA and one of the world's wealthiest philanthropic organisations, the Rockefeller Foundation, are working to create an open-access biotechnology movement, to be called Biological Innovation for Open Society (BIOS). The Rockefeller Foundation was instrumental in helping establish the Green Revolution in the 1960s that helped Asia feed itself.

"Our tools will be free to all, and crafted to unleash the creativity of researchers and farmers," says Jefferson. "In some ways it's 'back to the future'. The ethos of sharing was much more common 40 years ago than it is now".

Open-access genetics will give companies greater opportunities to create and share wealth from new crops and products -- which should help build much-needed community confidence in biotech crops and foods.

Jefferson will receive his Scientific American award on December 11 at the New York Academy of Sciences, alongside other recipients like Apple Computers CEO Steve Jobs, the Bill and Melinda Gates Foundation, and World Health Organisation director Gro Harlem Brundtland.

He has organised a two-day conference in New York on the open-access genetics scheme the following week, entitled 'Biological Innovations for Open Society'. The conference aims to identify parallels between computing and biotechnology and adapt the best ideas of the open-source computer code movement. It will also identify areas of divergence that could be resolved through new licensing policies.

Fee-free

Jefferson says the enabling technologies of BIOS will be made available free of charge to all users. However, users will be required to sign a licence, similar to a general public licence, committing them not to place any stricture on the free use of any improvements of the scheme's core technologies -- the free technology will be self-perpetuating

"Uncoupling the licence from the payment of a fee is very important," he says. "It cuts transaction costs to nil, and eliminates a very contentious issue in patenting -- the valuation of patents.

"Inventors and universities try to establish the value of their patents in very cumbersome ways, and many fine inventors have no mechanism to assign their patents to the public-good arena in a way that prevents them being appropriated.

"By developing normative binding mechanisms, like the general public license has done, we can use the open source concept to bind the biotechnology community to a commons of methodology, distinct from the public domain, which is much abused."

Jefferson says CAMBIA and its allies are now identifying new enabling technologies to be developed in the program, and undertaking a "serious economic analysis" of the likely impact of the BIOS scheme.

"What are the core capacities we need to innovate?" he asks. "We don't want to be collecting the white elephants of others' unwanted intellectual property."

Jefferson says that, far from being opposed to the open-access concept, some of the biggest names in biotechnology and biomedicine are engaged in dialogue to help the network to break the IP logjam. They include staff from DuPont, Dow, Monsanto and Arborgen.

"An analogy is the recent dramatic move of IBM in counter-suing Santa Cruz Operation (SCO) to prevent it undermining Linux, which has taken the IT world by storm," he said.

"Nobody can accuse IBM of Marxist tendencies. They see open source as a real tool to stimulate profitable enterprise. And it works: Microsoft is now pushing itself to make better products because of the competition.

"The big IT companies are coming out in strong support of Linux and the open software community. It has huge legs because it's widely available, and stimulates the development of many new applications. If it's denied, you don't get fair and sensible competition among the providers of IT solutions.

"Few agrochemical companies are making any money out of biotech. They have little room to manoeuvre and recruit new innovations because of the huge costs they have absorbed during vertical integration, and the onerous regulatory burden that reflects public disquiet about such integration. They're facing substantial internal crises and retrenching personnel.

"It's not that they made bad decisions based on what they knew at the time -- it was a vicious, dog-eat-dog environment and the alternatives weren't obvious. It was also a result of a frustrating tendency for offices of technology transfer in US and European universities to be very short-sighted in their licensing -- the public-good standards one would expect universities to adhere to were forgotten.

"Through misinterpretation, and a lack of both oversight and foresight, the Bayh-Dole Act, which promoted IP protection for universities and other public research institutions, led universities to give exclusive licenses for new technologies, when exclusivity was not necessary to stimulate their adoption."

Jefferson says that while exclusive licences for promising drug molecules may be appropriate for pharmaceutical companies, given the high commercial risks of drug development, exclusive licenses are inappropriate for enabling technologies in the biotech industry.

Jefferson believes the BIOS initiative is capable of resolving the mess, but the first requirement is a licensing and enabling technology development system to ensure the next generation of methodologies is available free to any public research agency or company that wishes to use them.

"Our vision is that within 10 years, biotechnologists and biologists of all stripes will be free to develop innovations that will benefit human well-being," he says. "There are so many wonderful things we could do, if we can get enabling technologies into the hands of creative people."

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