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Open-Source Practices for Biotechnology

By ANDREW POLLACK

The open-source movement, which has encouraged legions of programmers around the world to improve continually upon software like the Linux operating system, may be spreading to biotechnology.

Researchers from Australia will report in a scientific journal today that they have devised a method of creating genetically modified crops that does not infringe on patents held by big biotechnology companies.

They said the technique, and a related one already used in crop biotechnology, would be made available free to others to use and improve, as long as any improvements are also available free. As with open-source software, the idea is to spur innovation through a sort of communal barn-raising effort.

In their paper, being published today in the journal *Nature*, the researchers said that they had modified three types of bacteria so they could be used for transferring desirable genes into plants and that they had inserted genes into three plants - rice, tobacco and *Arabidopsis*, a weed often used in lab experiments.

The new technology-sharing initiative, called the Biological Innovation for Open Society, or BIOS, is the brainchild of Richard A. Jefferson, chief executive of Cambia, a nonprofit Australian research institute. Both Cambia and BIOS are supported by the Rockefeller Foundation.

The people behind the initiative say that patents covering the basic tools for genetically engineering plants - which are controlled by companies like Monsanto, [Syngenta](#) and Bayer CropScience - have impeded the use of biotechnology in developing countries and also in smaller-acreage crops, like vegetables, in the United States.

The issue has become a larger one in recent years as agricultural research has increasingly shifted from a public-sector activity involving governments and universities to a private-sector one led by companies.

Gary Toenniessen, director of food security at the Rockefeller Foundation in New York, said Dr. Jefferson "has come up with two technologies that basically engineer around two of the tools that the companies really have control of and that are a major constraint to applying biotechnology to crop improvement."

Spokesmen for Monsanto and for Syngenta, a European company, said they welcomed public innovation and had made contributions of data and technology to help improve crops in developing countries.

But Dr. Toenniessen said there was often red tape involved and the process did not always work. He said, for instance, that specialists in some Asian countries want to grow varieties of

insect-resistant rice developed at American universities. But that cannot be done yet, he said, because the universities were granted rights by the patent holders to use the technology only for research, not for commercial purposes.

The main technique now used to splice non-native genes into plants relies on *Agrobacterium tumefaciens*, a soil-dwelling microbe that in its natural form causes crown gall disease by inserting its own genes into plant cells. Biotechnologists remove some of the disease-causing genes from the bacterium and insert the genes they want added to the plant, such as those providing resistance to insects or herbicides. That technique is covered by various companies' patents.

Dr. Jefferson and other researchers at Cambia have modified other types of bacteria so they can also ferry genes into plants. They did this by transferring the necessary DNA from the *Agrobacterium* into the other bacteria through a natural mechanism that microbes use to exchange genes.

Whether this technique, called TransBacter, would withstand a patent challenge is still unclear, although Dr. Jefferson, who has compiled a database of life-science patents, says he is confident that it would.

There are limits to the usefulness of the new technique, because it is not yet highly efficient, and measures beyond gene transfer are required in making biotechnology crops. But one of those measures, a marker system so scientists can tell which plant cells take up the foreign genes, is also being made available by BIOS.

Dr. Jefferson said that if scientists worldwide get behind a collective research effort, the new genetic engineering technique would be quickly improved and new tools developed, just as programmers everywhere are constantly sending fixes and upgrades to Linux and other open-source software programs.

He said that while he wanted to provide competition for Monsanto and other companies just as open-source software did with [Microsoft](#), he hoped that some companies might use the technology. The more corporate participation, the more likely is corporate sponsorship of his foundation.

Dr. Jefferson said that while users of the gene-splicing technology would be required to put any improvements they made into the common pool, companies and universities would be allowed to patent any products they made using the technology, like a genetically modified crop.

BIOS is one of several efforts aimed at more open biotechnology development. Software used for biological analysis has been developed using open-source methods, and certain databases, including the one containing the human genetic code, are freely available. Scientists at the Massachusetts Institute of Technology have been trying to create a catalog of biological components that others could use to impart novel functions into cells. But BIOS seems to be the first instance of applying the model to a laboratory technique.

There are factors that could make it more difficult for the open-source approach to catch on in biology than in software. Writing software usually requires just a computer and a desk, while biological research requires advanced equipment and can be much more expensive.

Patents also seem more important in spurring innovation in biotechnology than in software, said Arti Rai, a professor of law at Duke University. For that reason, Professor Rai said, it was probably wise of Dr. Jefferson to allow crops developed using the tools from BIOS to be patented.

"It's a creative way of thinking how to maintain a commons in the biological research space," she said.