in Europe, the numbers are even higher (Figure 4). Up to 5 years after their PhD thesis 78% ($n = 97$) are in Europe. From those that did their PhD more than 5 years ago, 90% have found a position in Europe. This supports the assumption that many young scientists decide to do one or more postdocs abroad to gain additional experience, but plan to return after these *Wanderjahre*.

The prospects for young European molecular biologists may be better than most of them think. For those who decide to pursue an academic career after their PhD thesis, there seem to be enough job opportunities in Europe, which enabled most of the polled scientists to return to their country of birth. Nevertheless, one of the most frequently heard complaints among respondents was the meagre pay and bad job opportunities for postdoctoral fellows. Indeed, while the pay for postdoctoral fellows in the USA is comparable, senior scientists there earn more than their European colleagues. This, and better opportunities for obtaining research

Fig. 6. Percentage of Europeans who returned to Europe.

grants, may still be a compelling reason for younger scientists to leave Europe.

The prospects of European scientists starting a career in Europe seem to be better than they think. But the continuing economic success, good funding and better job opportunities for senior scien-

tists in the USA are still very attractive. No doubt, the European system of doing research has to change and adapt if the EU wishes to compete with the USA. But most scientists feel that these necessary changes will probably come too late because of the inertia of the European research establishment. 'The system is very well entrenched,' commented one, 'and it is my belief that it will not be changed without changes in mentality—especially concerning respect for the human being behind that young scientist.'

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A doorman to keep foreign genes out

A new genetic barrier can protect corn from unwanted genetic modification

In October 2000, news reports in the USA described that millions of bushels of genetically engineered corn approved for animal use only, had found their way into taco shells. The producer, Kraft Foods, had to withdraw the taco shells from supermarkets not only in the USA, but as

buy back the corn, called StarLink, at a premium price of approximately \$100 million. Later, the US Department of Agriculture reported in mid-November that this brouhaha over genetically modified food had resulted in a steady drop in USA corn exports.

corn that grows naturally in Mexico alongside cultivated hybrid corn. When Kermicle bred the genes into modern hybrid corn, they actually prevented foreign genes from entering the corn via cross-pollination. Those genes are now being used to develop a corn hybrid that is resistant to horizontal gene transfer from genetically modified crops.

Corn is particularly prone to problems relating to food contamination with genetically modified relatives as it is notoriously susceptible to cross-pollination with other corn growing nearby. This susceptibility enables corn to pick up genes from nearby GM crops that may be undesirable. It is no wonder therefore that seed companies are interested in using the newly discovered set of genes. It would allow them to control the flow of genes between populations of corn and

The new technology will be used to breed corn with resistance to cross-pollination—which may be a paradox, using genes to confer resistance to further genetic modification

far away as Japan. Only a few days later the media reported that the same corn had been found in other corn products. Investigations to determine how the modified grain found its way into the human food supply are still ongoing, although Aventis has already agreed to

A set of genes from a wild relative of corn could solve the problem of unwanted food contamination by GM crops. Jerry Kermicle, a retired professor of genetics at the University of Wisconsin in Madison, discovered this molecular barrier in teosinte, a weed-like type of

thus ensure that classically bred corn remains genetically unmodified. It could also be used to prevent GM crops from passing on their genes to wild and non-GM relatives. 'This technology can be

Jerry Kermicle discovered the molecular barrier in teosinte, a weed-like type of corn that grows naturally in Mexico

used by farmers to plant buffers around fields of genetically modified corn,' said Kermicle, 'to ensure that cultivated corn remains uncontaminated by genetic engineering, such as the addition of *Bt* genes.'

Dr Kermicle was able to find the gene set because he knew that teosinte rarely acquired genes from cultivated corn, while the converse was not true. He travelled to Mexico at his own expense to locate teosinte growing among corn plants whose history he could document personally. 'Strangely enough, we still don't know how nature keeps her species separate. I thought, here's a way to study this. Somehow, teosinte is a survivor,' said Kermicle.

Knowing that large agricultural companies in the USA were feeling the public pressure not to grow and sell GM corn, Kermicle decided to see whether the defensive trait could be bred into commercial corn by means of traditional breeding methods. About 2 years ago, the University of Wisconsin's technology transfer arm, WARF, indicated that it was interested in commercializing the technology. The new technology will be used to traditionally breed corn with resistance to cross-pollination—which may be somewhat of a paradox, using genes to confer resistance to further genetic modification. But it may well please the growing number of consumers who do not want to consume genetically modified grain.

Indeed, use of the teosinte genes would address many of the concerns that environ-

mental and consumer protection groups raise. Rebecca Goldberg, senior scientist at the Environmental Defense Fund in New York City, commented cautiously that if it works it could be a good thing, but it must be proven. Moreover, she said, there must be some guarantee that the technology will only be used 'to do the right thing'—meaning, not employed as a 'terminator' gene to prevent farmers in developing nations from saving seeds.

WARF has patented the new technology and is licensing it on a non-exclusive basis to agricultural and biotechnology companies for use in the USA and inter-

feed and human food, for instance, the US Department of Agriculture reached an agreement with Japan to screen USA corn exports to that country. Indeed, the timing of WARF's public announcement of the technology soon after the recalling of genetically modified corn 'may not be all that coincidental,' said Kermicle, who added that WARF has been conducting field tests for some time now.

Gerrish expects a lot of interest in the gene transfer-resistant corn particularly in those countries that have strong consumer and environmental concerns about GM crops. 'Instead of the millions of acres of

The teosinte genes may well please the growing number of consumers who do not want to consume genetically modified grain

nationally. Over the past year, WARF has been conducting quiet negotiations with a seed company regarding licensing the technology, and has also been extensively testing it. 'We expect the technology to become commercially available in hybrid corn seed by 2002, or the year after at the latest,' stated Steven Gerrish, agronomist and WARF official.

'With 50% of corn grown in the USA used for animal feed, 22.6% of corn grown here currently exported, 8% used for sweeteners, 2.6% used for starch, and 1.2% used for human consumption, we believe there is a huge market here and abroad for this technology,' said Gerrish. He added that by patenting the technology, it would also protect it from any use that is contrary to Kermicle's and WARF's intentions, thus addressing Goldberg's concerns about potential abuse.

Gerrish notes that overseas customers such as the European Union, Australia, New Zealand and Japan, who oppose genetic engineering, should be particularly interested in corn grown using these genes. After genetically modified corn from the USA was found in Japan's animal

farmland planted with genetically modified organisms, or GMOs, this technology will give those who desire it an unmodified alternative,' he said. In addition, modified corn will be able to grow alongside unmodified corn using the new type as a pollen barrier to ensure genetic integrity. Moreover, the technology may obviate the need for legislation to protect the public from GM food, Gerrish added.

'We are not opposed to GMOs,' noted Gerrish. 'Genetic engineering holds promise for improving nutritional quality of foods, such as adding beta-carotene to rice, and we believe it's only a matter of time until the public sees this and gains confidence in them,' he said. But until that occurs, this technology can ensure that those who are not comfortable with genetic engineering in corn can avoid it, he added.

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