Commentary

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In the 1970s, efforts were made to deal with the questions raised about the possible harmful effects of recombinant DNA experiments. These activities were initiated soon after the experiments were invented. Together, they are often referred to as "Asilomar" because that was the site of the 1975 international conference that was a key event for the entire discussion. In February 2000, some of those who attended the 1975 meeting met to ask whether the Asilomar approach was a useful model now, and in the future, for dealing with new scientific issues that are of concern to the public. We concluded that the model was not broadly applicable. This was a disappointment because we thought, and still think, that we had done a good job in 1975.

One reason for thinking that the Asilomar model is not relevant to the current situation has to do with timing. When recombinant DNA experiments were first announced in 1973, they were not a public issue. The word "gene" rarely appeared in newspapers in the United States or anywhere else. The community of scientists who realized that they would adopt this technique raised questions as to the safety of the experiments immediately after the first successes were announced. What was essentially an early warning system within the scientific community gave us the ability to pose serious scientific questions about the potential benefits and risks of those experiments without a tremendous amount of public talk and publicity.

Why was that important? It was important because it allowed us to take a scientific approach to the issues. One of the first things that was done (in 1974) was to declare a moratorium on several kinds of recombinant DNA experiments. A lot of scientists thought that was foolish, but a significant number thought there might be a serious problem with those experiments. As far as anyone knows, the moratorium was adhered to without exception all over the world.

From the start, we began to distinguish among experiments and classify them according to the level of imagined or speculative risks. At the Asilomar conference, we talked about specific levels of containment appropriate for carrying out the experiments within each class. We were able to do this because of the scientific communityís resolve to deal responsibly with the issue. We also benefited from the fact that the scientific situation could be thoughtfully evaluated in the absence

of major public concern and pressure. Indeed, before the Asilomar conference discussions, it was difficult to know what to say to the public. The journalists who attended the conference cooperated by refraining from submitting stories until the meeting was over.

The Asilomar approach became the framework for official guidelines and/or regulations in the United States and in many other countries. It led, for example, to the National Institutes of Health (NIH) forming the Recombinant DNA Advisory Committee (RAC), which was and is composed of both scientists and public representatives. Many people, independent observers and scientists alike, have said that the RAC engendered public confidence in the control of recombinant DNA experiments. Public confidence was also fostered by the position successfully urged by the involved scientists: The initial guidelines should be extremely strict but they should contain provisions for selective easing and even eventual elimination as the accumulating scientific data indicated that the experiments were in fact harmless. Unfortunately, the history of the concerns about genetically modified agricultural organisms (GMOs) has not enabled a similarly broad and careful scientific consideration as a background to public debate.

After the Asilomar conference and the development of the NIH Guidelines for Recombinant DNA Research, the scientific community spent a tremendous amount of time talking to groups all over the country, including Congress, trying to describe the experiments. For a variety of reasons, some understandable and others not, the plant biology research community, including the plant breeders, has not fostered an analogous public discussion. They are now beginning to do so.

A comparative evaluation of risks and benefits was inherent in the classification of experiments according to speculative hazard that was the basis of the Asilomar approach. Nevertheless, more attention was paid to the risks than to the possible benefits. The precautionary principle discussed by Julia Moore in chapter 14 would put aside evaluation of possible benefits and focus only on the risks. For many scientists that approach seems unscientific, in part because the risks, like the benefits, will embody probabilities, not certainties. Scientific conclusions are always tentative. It is part of normal science to recognize the errors or inadequacies in previous interpretations and to change conclusions when new data dictate modification or correction. Scientists also accept the importance of random events in nature. These two aspects of science present serious challenges to the application of the precautionary principle in the making of public policy for scientific issues.

We can put these problems in perspective by thinking back to the beginning of the 20th century. What would have happened if the precautionary principle had been in play when automobiles were invented? Anyone smart enough to realize that automobiles could kill a lot of people and pollute our atmosphere might have argued to ban them at the start. While we all agree now that we should ameliorate those bad outcomes, how many people really regret the invention and production of automobiles?

Many scientists who are concerned about GMOs are puzzled as to why the lines are drawn so sharply by some of those who oppose their use. For example, why is it that many outspoken people who are part of the movement against GMOs take such absolute, negative positions? Why are they so dogmatic and insistent against these plants even when there are plants in use and under development that offer positive opportunities for environmental improvements? One example I find interesting is the potential to engineer trees so that the normal ratio of lignin to cellulose is lowered; this could markedly decrease the quantity of noxious chemicals that are used and then dumped into streams in the process of making paper.

A similar question is why people who appear to be honestly fervent about social justice take to the streets to oppose methods that can, if responsibly applied, help feed starving people all over the world. We know that 30 to 40 percent of vegetable crops are lost every year due to rotting or pests. Can we not get together and talk in reasonable ways about how these technologies might be brought to bear to alleviate that problem? Why not take a more constructive stance regarding these plants? Why not recognize that while the regulations we have in the United States may not be perfect, they are taken seriously and appear to be protecting American consumers? Why not work together to improve them? Why instead the violent destruction of fields? Many scientists are environmentalists and we are puzzled by the anger and the exaggerations.

One example concerns monarch butterflies. A recent National Research Council report discusses the current knowledge with respect to the effect of pollen from Bt *(Bacillus thuringiensis)* corn on monarch butterfly larvae. While some conflicting data exist, it seems that if the pollen is harmful to monarchs, it is a rather modest harm considering, for example, how much pollen actually spreads from fields to surrounding milkweed plants and the relative timing of pollen release and larval feeding. In evaluating the situation, it is also necessary to compare the effects of Bt corn pollen on monarchs with the effects of spraying fields with chemical insecticides. These chemicals kill all sorts of insect as well as monarchs and

are not very healthy for the surrounding human populations. And yet, a colleague told me that he received a fund-raising mailing from an organization called Environmental Defense (previously the Environmental Defense Fund) that had an automobile sticker displaying a big monarch butterfly. The sticker was accompanied by written material implying that the use of Bt corn was a serious threat to monarchs. Yet an individual from the staff of Environmental Defense was a member of the committee that produced the cautious and reasoned National Research Council report.

The press also fosters this controversy, probably because the press likes controversy. A recent example occurred in the March 9, 2000, *Wall Street Journal*. The story described the problems that restaurants face if they want to serve only food that is organically grown and not genetically modified. The headline was "Chefs at the biotech barricades" and the subhead was "Restaurants try to eliminate genetically modified food and find it's no easy feat." The story tells us that Alice Waters, the famous owner of the equally famous Chez Panisse restaurant in Berkeley, California, instructed her staff to use only products free of genetically modified foods. Later in the story we read that the pastry chef is having a terrible time redoing the recipe for one of their most popular desserts. It "had to be completely recalibrated after genetically modified chocolate was replaced." Checking around I learned that modified cacao plants are not yet available. So I called the restaurant to find out what was going on. They were very helpful. They too had not heard about genetically modified cacao or chocolate made from it. Their problem was only that the cacao had not been organically grown. Why then had the *Wall Street Journal* reported mistaken information? Was the reporter confused? Didn't she do her homework? Don't we expect more from the *Wall Street Journal?*

We can build confidence in genetically modified plants only by providing accurate and up-to-date information. But it is very difficult to make scientifically sound information credible when faced with inaccurate reporting and emotional, imprecise statements from people who oppose the use of genetically modified plants. The public would be better served if all views on this issue were presented in a straightforward and accurate manner.

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