

The ties that bind or benefit

As industrial corporations become more involved in developing new biological techniques, where does this leave the scientist? How will university biology departments maintain their integrity and autonomy? How will individual scientists react to growing corporate demands? These and other questions were explored when *Nature* brought together **Sheldon Krimsky**, Acting Director of the Program in Urban, Social and Environmental Policy at Tufts University, and **David Baltimore**, Professor of Biology at MIT.

Krimsky: I am very concerned about the growing influence of industry on academic science. This has existed for many years in the chemical and the nuclear industries. And now it is beginning to occur in the biological sciences, especially with the advent of advances in recombinant DNA.

The direction of research influenced by industry may not be the direction that is in the public interest. Corporate requirements for scientific research may be at odds with pressing societal needs. There are many examples one could cite, especially in environmental research, nutrition and biomedical science.

Our academic institutions and academic scientists need to be free from corporate influence. And such influence can emerge in various ways: through direct funding by corporations to departments and investigators, by scientists serving as consultants to or on advisory boards of industrial firms, or by academic scientists playing a double role by setting up their own small venture-capital firms.

These are dangerous moves if they become widespread because in the end university-based science will lose its sense of detachment. When confronted with policy decisions on the applications of technologies to society we need objective academic involvement. How can the public have confidence in the expert opinion of scientists on the potential risks and benefits of a technology when those same individuals have financial interests in commercial development?

Baltimore: It seems to me that there is nothing wrong with universities serving as a source of technical expertise for newly developing industries or even for mature industries. And that kind of symbiosis between industry and academic departments has been very good for both over history — take the chemical industry.

This seems to be a healthy development for a number of reasons. One is that if there is an industrial use for modern biological techniques, it means that those who are trained in university biological laboratories will have an increased range of employment opportunities. With the recent plateau of hiring into academic positions, it is necessary, if we are going to maintain graduate student activity, to find other opportunities for our graduate students.

What's more, we find that after the large investment in basic biological research we are now beginning to get practical spin-offs. While society may value the advancement of abstract knowledge, that is not society's major interest. Consequently, I find it heartening that we can now say to the public, "You've been investing all this money for so long and now things are emerging that are of practical value."

I, too, worry about the academic enterprise being undermined by corporate interests. We can have both an academic focus and industrial involvement but we must maintain a separation between the two. To make certain that university biology departments maintain their autonomy we must be vigilant about a number of things:

- We must be entirely open about industrial affiliations.

- We must maintain a separation between university and industry. When academics consult for industry to help find solutions to industry's problems, they ought to remain consultants and not turn their laboratories into factories for the solution of corporate problems. To be independent, university laboratories must be allowed to follow the internal logic of science.

- We should not use our students for our own ends. Students should continue to have freedom to work out problems that emerge in the laboratory, without being tied to predefined industrial needs.

If we can handle this mixed economy with honesty and integrity, we will have done a service to the university by bringing in new sources of funding and by increasing the importance of the university to industry.

Krimsky: In the 1960s, many scientists (including yourself) expressed moral outrage in learning of the war-related

research carried on secretly at many universities. Now we must ask ourselves what the consequences will be if industries ostensibly fund entire departments (as they have done in chemistry, computer sciences, engineering and, more recently, certain areas of policy analysis). Notwithstanding the fact that corporations claim they give money with no strings attached, we can expect first that they will establish the broad boundaries of research. And second, there will exist a "chilling effect," particularly when industry-funded faculties are inclined to work on projects or express views that can be interpreted as disadvantageous to the goals of their corporate benefactor. Just as war-related academic research compromised a generation of scientists, we must anticipate a similar demise in scientific integrity when corporate funds have an undue influence over academic research.

Crucially, during periods when we worry about the risks of technology, we need independent scientists willing to speak out. Risks may crop up in research itself or in the ultimate marketing of biological products. As you know, in the petrochemical industry we have had very few scientists willing to speak out against the potential hazards of petrochemical agents to workers, consumers or military personnel. And now we are faced with the results of their timidity. With so many scientists working directly from the chemical industry, can we expect them to speak freely about the toxic effects of chemicals? How extensive is the influence of industry on biology going to be?

Baltimore: I couldn't agree more. I think it is extremely important that the academic enterprise maintain its freedom to do what it wants, to say what it wants, to be counter to conventional wisdom and to discover things that are counter to the desires of industry.

Nevertheless, the positive side of industrial involvement in the academic world should not be discarded out of fear that university-based scientists will lose their autonomy owing to industrial pressure. We need to maintain a balance between industrial influences and influences from outside the corporate world.

Krimsky: Are there any mechanisms



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available to universities guaranteeing that balance? And as for spin-offs: what role does society play in determining what the research priorities or the practical applications of biological research ought to be? We can have many different kinds of potential spin-offs. Shall we simply allow corporate management to decide autonomously what path to take? Scientists may feel free to choose the fine-structured problems in a research programme at the same time that the shape of the outer boundaries of that programme are exogenously determined. It is in this important respect that science does not develop from some internal logic. I want to see more public and less corporate influence in establishing the outer boundaries.

Baltimore: In the United States the answer to your question is that the desire of people to seek profits determines what research gets turned into useful products for the general economy. If they are not even seen as potentially profitable, they are not pursued or produced. One can argue persuasively that that is not a sufficient reason and that government ought to play a larger development role.

Behind these kinds of disputes stands a naive model: at one side there is a scientific sector with people doing basic research. On the other, independent of basic research scientists, we have the industrial sector, selecting those areas for practical exploitation and deciding how they are to be applied. There is a much more important, neglected relationship. The shape of the outer boundaries of basic research is not merely influenced by the corporate sector alone, either directly or through government, but emerges from research itself. I see the world-wide research effort as a continuum — from the problems determined by the inner logic of science to the problems determined by outside influence.

Many scientists work totally out of the logic of their research as it evolves in front of them. For them it doesn't matter what the rest of society thinks about the utility of what they are doing. These are the projects that in the end often turn out to produce the real surprises. No corporation can control them because no-one can see where they are heading.

At the other end of the continuum there are people doing contract research who have been asked to solve specific problems that industry or government wants solved.

Some research is a mixture: scientists get a little money to do something, trying perhaps to cure a disease and at the same time they discover new phenomena. They then have the freedom to explore these new areas.

Krimsky: How are we going to maintain a sufficient number of biologists not tied to the industrial sector, willing to stand up and say: "Wait a minute I am not very confident"? Remember it didn't happen in the petrochemical industry.

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Baltimore: Yes, there ought to have been much more questioning of what was going on. Universities should have opened up the debate. The rush of industrial development following World War II undercut the critical function of universities.

We now should look at the strengths of what has happened in the last five to ten years. The environmental movement has been a significant success in its own terms, even though it has not accomplished everything it wanted to. It never will. Nonetheless, it has moved from nowhere to become a major force in our society. That has happened because it has been supported by large groups of people.

Krimsky: But what about the scientific community?

Baltimore: In fact, many of the leaders in these movements have been scientists. Matthew Meselson, for example, is one of the best-recognised scientists in the academic world and yet he is the person who became most identified with opposing defoliation in Vietnam. The movement to stop biological warfare research (which even I had something to do with) came from inside the scientific community, again led by Dr Meselson. The movement to inhibit the development of recombinant DNA research (which, to my mind, got out of hand) came from within the scientific community.

Or consider Bruce Ames, the one person who has really brought a new dimension to our thinking about environmental dangers associated with cancer. He is one of the most eminent scientists in the United States. The Ames test revolutionises our understanding of the dangers inherent in everyday life. This seems to me to be most responsible action, coming directly from the scientific community. Now in fact industry uses the Ames test widely.

Krimsky: But industry has systematically opposed the Ames test as an instrument for establishing policies regarding potential human chemical carcinogens.

What's more, industry has set up its own cadre of scientists and experts to legitimate its opposition to effective testing. The American Industrial Health Council, the American Tobacco Institute and the Chemical Manufacturing Association have all set up private institutes designed to defend their positions and I'm worried that the influence of these institutes will spread into the biological departments of universities.

We do not have sufficient checks and balances. We cannot continue to allow university departments and individual scientists to exercise their own judgements because large amounts of money are likely to be derived from consultancies and from profits from these new biological technologies.

What we need is an independent source of funding, encouraging research on the dangers which might emerge from the new biological technologies. We need to secure the university against undue influence by industry in this new field. There must be a balance between research on developing new technologies and research on the potentially adverse effects of these developments.

Baltimore: I agree that we need to strongly counter attempts by industry to undercut legitimate, validated testing.

Krimsky: One way to accomplish this would be to give incentives to industry to fund universities indirectly through government agencies. Let the government funding agency distribute support to universities rather than allowing corporations to provide direct funding to departments of biology.

But why should industry do this? Clearly, corporations want to be able to direct research at universities and control the purse-strings.

If such funding went through agencies like the National Science Foundation or the National Institutes of Health, peer review committees could distribute the funding to appropriate university-based laboratories. The public would then have some way of overseeing the way the money was spent. We would then not end up with a closed, insulated system.

Baltimore: Where industry directly supports research in a given laboratory, that fact should be on record. One can then see in context the views of a scientist funded by industry when that research worker participates in discussions of work funded by the supporting corporation.

Krimsky: Given that scientists play multiple roles — for example there are those who are faculty members at universities, who also consult for industry and, in addition, sit on government advisory panels — shouldn't these multiple roles be on the public record?

Baltimore: To the extent that it does not unreasonably interfere with a person's private life, I think it ought to be available information. □