An active life in science

An interview with Jonathan Beckwith, Professor of Microbiology at Harvard University (Boston, Massachusetts, USA) and author of *Making Genes, Making Waves: A Social Activist in Science*

EMBO reports (ER): In 1969 you were the first person to isolate a gene, and also the first to warn about the potential misuse of molecular biology. Now, 34 years later, do you think your warnings are still valid?

Jonathan Beckwith (JB): I began to wonder at some points whether my warnings really were valid, but I still think so, absolutely. Also at that time, other scientists who were upset by us challenging biology said that the consequences we were worried about were pretty far off and it was silly to be worrying about them. But things obviously moved very fast in biology and genetics.

ER: Are you worried about the same things today?

JB: Not necessarily. At that time, the context was the Vietnam War and concerns about our government using science and technology in very destructive ways. We were thinking also about World War II and what had happened in Germany, and what the government had done there and what other governments had done in terms of eugenics policies. When we voiced our concerns, I had not studied or thought much about the consequences of science, so we worried about things like creating 'super races', which today to me don't seem a problem at all. I think we were pretty naive when we started but our instincts were good; we just didn't have a complete picture. But as a result of calling that press conference, I had to think what it was exactly that I was worried about, and very quickly it became clear that the issues were more subtle. I think it's turned out to be not so simple and the worries are broader. I suppose this has happened because of changes in society and the emergence of the biotech industry.

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ER: So what do you think are the biggest problems with genetic research today?

JB: I'm not particularly worried about things like genetic engineering or genetic enhancement, but I can see it as a potential problem much further off in the future. I'd say that one of the major concerns is the rapid expansion of genetic information that can be obtained about individuals and about groups of people, including ethnic groups and racial groups. That information can be used in ways that are harmful to individuals or to groups. The accumulation of that information is moving so fast that mechanisms for making sure that it doesn't harm people are not in place. One area is the huge health insurance problem in our country, where more people are going to have difficulties getting health insurance because some predictive genetic test suggests that they have a certain probability of coming down with some disease or condition. Another area is discrimination against groups of people. This was hinted at recently in this whole fuss over race, genetics and medicine. The apparent increasing ability to distinguish groups of people on the basis of chromosomal markers raises questions over whether that information should be gathered, whether it is useful in medicine, and, from my perspective, whether establishing these

genetic differences will reinforce old arguments about racial superiority and inferiority. There are all sorts of issues in genetics, but that's the one that certainly concerns me the most.

ER: The USA hasn't passed federal legislation yet to prohibit genetic discrimination. Do you support such laws?

JB: In 1989, I joined the ELSI (Ethical, Legal, and Social Issues) working group of the Human Genome Project and one of the three issues we looked at seriously was health insurance. Our committee came up with a report that said you can't really separate genetic information from other kinds of health information and that it seemed unfair to give genetic information privilege over other kinds of health information. We concluded that as genetic information increases and the ability to predict susceptibility to disease improves, eventually the insurance system will become rather absurd. If everyone is rated based on probabilities then there's no longer any value in getting insurance because people who don't have predictable risks will pay practically nothing for insurance and others will pay more. For all those reasons, we stated that the solution was national health insurance, which seemed reasonable at the time because it was in the early days of the Clinton administration and there was a feeling that national health insurance was going to happen. For various reasons, including the opposition of certain institutions in society and because the government botched it, it never happened. So in the absence of a national health insurance plan, it seemed to me that at least we needed to protect some people who might lose out in this system. So, with some qualms, I basically support anti-genetic discrimination

legislation. Many states in the US have passed such legislation. It's not federal legislation yet but I believe it's going to pass. The problem is, I'm not sure how effective the legislation is, because it's often very hard to prove that the insurance company discriminated against people. So, the principle is there but I'm not sure about the actual effect.

ER: Controversial claims are often made, such as in Herrnstein and Murray's 1994 book *The Bell Curve*, that genes can influence such traits as criminal behaviour, addiction, alcoholism and intelligence. Do you see this as the old eugenics debate lingering in a more subtle form?

JB: Well, I would say *The Bell Curve* is hardly subtle. I was stunned when it came out. So the problem is still there, but I think what's happening in human genetics is that geneticists are becoming much more aware of the

complexity of humans or of living organisms in general, and that you can't have such a deterministic view of the effects of genes. So it's not an issue of whether there are genes involved, because everyone admits, at least on the surface, that human traits are a combination of both nature and nurture. But Herrnstein and Murray said in *The Bell Curve* that we've got close to the perfect society; that we can't do much more to improve people's intelligence and social status. Therefore they argue for social policies that effectively are eugenics—they would reduce the number of children coming from

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the lower classes and increase the number of children coming from the upper social classes.

ER: So how is it, after the experiences of Nazi Germany and eugenics in the 1920s and 1930s, that this topic is still not dead? Not just that genes are claimed to have an influence on behaviour, but also that political recommendations are based on these beliefs?

JB: There are two levels, and the arguments of Herrnstein and Murray were the most popular and most extreme version of that. At that level, which mostly concerns intelligence and social success, you don't see those arguments coming out so much any more, at least overtly. In fact, when *The Bell Curve* came out it was reviewed pretty critically, at least in the United States. Yet we have to worry about how new information

on genetic differences between groups of different geographical origins will be misused. Where you mainly see the arguments now is over the question of whether people have the right to bear children with any kind of significant genetic problem, whether muscular dystrophy or cystic fibrosis or whatever. I think that's going to become more of a prominent issue because a lot of well-known scientists like Jim Watson, Robert Edwards in England and others agree that parents may have the right to choose, but they will be decried if they choose to bear a child with a significant genetic condition. Although they don't come out for social policies that would directly mandate that parents make such choices, they certainly imply that these people should be disdained or almost made social outcasts. I guess, in terms of eugenics-type arguments, it becomes easier to use a genetic explanation for social inequalities and social problems than to come up with social solutions for social problems. And since we all agree that nature and nurture work together, it seems to me there are still people who think, "well, if we take the social road, that has economic consequences and we don't want to face those economic consequences." I'm not saying that's an overt argument but it certainly is in some cases.

ER: You've always been quite active in speaking out against such claims, for instance against the notion that the XYY chromosome causes criminal behaviour. Do you think scientists in general should be

much more proactive in countering such claims as were made in *The Bell Curve*?

JB: I was thinking of another incarnation of the XYY story, and that is the monoamine oxidase story. It started in the early 1990s, when Hans Brunner and his group discovered a family in the Netherlands where a number of male family members had some incidence or history of aggressive or antisocial behaviour. When they did the genetic analysis, all of the men who showed this behaviour had a knock-out mutation for the gene for monoamine oxidase A, MAOA, and the men who hadn't shown any of the behaviour did not have that mutation. It looked like fairly solid work. It got enormous play in the United States, with media coverage showing film footage of gang wars, and a picture in *Newsweek* showing Arab-Israeli conflict, and saying, "now we know the explanation: MAOA." But about two years ago, a group in New Zealand, following children from a very early age doing genetic analysis and looking at antisocial behaviour, found that children who were abused were much more likely to be incarcerated later in life. Another group in London was doing the genetics and was looking at MAOA levels, and they found that if you compared children who carried a wild-type copy of this gene and children who had this mutated version—it's a common polymorphism; I think maybe 20% of people have it—there's basically no difference in antisocial behaviour between children who did not suffer child abuse. Among the children who had suffered severe child abuse, those with this MAOA allele had a significantly higher probability of antisocial behaviour as measured by tests and incarceration. The interesting thing to me about the study, aside from all the technical details, was that the authors argued, in the article and publicly, that we now know how to deal with this problem of antisocial behaviour—find a drug that will improve the MAOA activity—when it was obvious that child abuse was such an incredibly strong factor. So there's a case where there

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were obviously two factors involved and the authors focused only on the genetic one as the solution. So yes, I think scientists should think about their own work and should have a broader sense of social responsibility and take responsibility for their area of expertise. I feel tremendously strongly about this and it's something I've been arguing for years, because as a geneticist I don't want to feel that my field is being misused. I suppose I was influenced by what happened with the atomic bomb and people like Robert Oppenheimer, a physicist who took responsibility, and after that a good proportion of the physics community in the 1950s and 1960s in the United States campaigned for control over nuclear weapons and nuclear testing.

ER: The XYY chromosome or the MAOA gene are part of a current theme—a publication that gets picked up by the press, but is later disproved in a paper that receives scant publicity. Shouldn't there be a responsibility, given the impact that biological research has on society, to correct such errors publicly?

JB: I have the feeling that biologists are pretty much unaware of the impact that these things have. I don't know if they just don't bother to look at the media. If I give a talk and I show some slides of newspaper headlines and stories that come out and the consequences of these studies, people are very surprised; they don't know about it. So if they're not looking for it, then they're not going to react to it. And if they're not looking for it, in part that's because they're generally not thinking much about the social consequences of science. It's interesting today, because as a result of the Human Genome Project there's been a fair amount of publicity and I think biologists are much more aware that there are social consequences of science, but still that hasn't changed things very much in terms of scientists being active.

ER: Do you think the curriculum of biologists should change, to take these social, economic, health and security consequences into account?

JB: I have argued for a long time for the incorporation of social issues into science classes. I taught a microbial genetics course for many years and I found places where I could bring in social issues and

students seemed to appreciate it. But I absolutely feel that it should not be set aside in a separate ethics course—there should be ways to encourage the integration of this information into any scientific activity. One way is through education. The second is proposing that when scientists do contribute to these discussions and are activists, those contributions should be considered when appointments are made, when promotions are made, and when tenure is granted. I've published 70 or 80 articles on science and society, and I know a lot of my friends have. Of course those articles would not help them in any way in their scientific career and in some places could even hurt them. The third way is that these activities should be part of a closer interaction between scientists and people in humanities and social sciences.

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ER: There's an ongoing debate about this gap between natural sciences and social sciences and the humanities. How can this be overcome?

JB: I can only speak of my own experiences. Some people are effective activists, like Stephen Jay Gould or Richard Lewontin, who work on their own and publish wonderful books and articles. My inclination has always been to work in groups and interact with other people. I just think that's a very effective way to be an activist, to work with people in other domains. The Genetic Screening Study Group, which I've been involved in for many years, is a heterogeneous mixture of people from sociology, philosophy, science, law and ethics. I'm not saying such interactions are easy, because there's a lot of misunderstanding and lack of knowledge on both sides when people like that

get together. And you certainly could find it easy to disdain ethicists, philosophers and sociologists who deal with science for not getting everything right, but in some senses that reflects the separation anyway.

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ER: Do you think the ELSI group of the Human Genome Project could be a model for getting these people together to talk, on the basis of a given project or problem?

JB: I wouldn't say ELSI is an ideal model because what it did was to segregate off people—including scientists—who dealt with these issues from the geneticists of the Human Genome Project, who did not appreciate the effort at all. I argued very early on that we shouldn't have this complete separation of the two efforts. If it were to be done over again, there would have to be ways that the two groups could get together. The problem was that you've got a project whose main purpose was to map and sequence the human genome and ELSI was an add-on at the last minute; many of the geneticists felt that this was a bit of a drag on the genome project.

ER: Another problem with biological research is security, as we have seen with the anthrax letters in New York City. Do you see the potential abuse with regard to bioweapons and bioterrorism as a new challenge to the freedom of science? We can already see that scientists from certain countries are not allowed to do certain research in the United States.

JB: Absolutely yes. I preface this by saying that this is by far the worst government I've lived under in the United States. I see aspects of the “war on terror” as part of a much larger picture, an attempt at building

a much more restrictive society in terms of freedom of speech, freedom of science or whatever freedom you can think of. To me, many of the efforts in the United States around bioterrorism have some validity, and we know the anthrax attacks almost certainly came from within the United States and not from foreign terrorists. But it seems to me that the publicity about it, the constant warnings, and the establishment of programmes to deal with it are part of a larger picture in which the government is trying to keep people at a level of fear that will allow them to impose more restrictive controls. I think scientists who are getting government funding for research have an important role in saying that this is a problem even if it may end up hurting them and restricting that funding.

ER: Do you see the restrictions being imposed by the US government as a threat to scientific freedom?

JB: There's nothing wrong with biodefence research and with trying to ensure that such weapons aren't developed. But in this case I trust the scientific community more than the government because I think it has other agendas than ensuring we don't get attacked by these weapons.

ER: How do you encourage your own students to think about these things and become more involved in social activism?

JB: I talk about these issues often or I post articles on our bulletin board that I think are relevant, but I don't like to push it on people. Roberto Kolter and I teach a course every other year called ‘Social issues in biology’ to graduate students, to raise these issues and talk about social activism and social responsibility. I just hope that by following my example, people choose to do it.

ER: Professor Beckwith, thank you for the interview.

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