CHRISTIAN FLEMMING/LINDAU NOBEL LAUREATE MEETINGS

Q&A Richard Roberts

Microbe cheerleader

Richard Roberts shared the 1993 Nobel Prize in Physiology or Medicine with Phillip Sharp for their discoveries of split genes, which contain parts that encode protein, called exons, and gaps between them, called introns. Now chief scientific officer at New England Biolabs based in Ipswich, Massachusetts, Roberts talks to Gijsbert Werner about microbes, genetically modified food and the problem with Nobel prizes.

In your Lindau lecture this year you talked about genetically modified organisms (GMOs). Are people right to worry about them?

Frankly, they are not. We have been genetically modifying everything we eat for more than 5,000 years. We have been improving plants by 'natural' breeding since the origin of agriculture. When we breed plants, we make hybrids — and typically move hundreds of genes from one plant to another. You don't know what those genes are. You don't know where they go. And you don't know how these genes are influenced by moving them. Genetic engineering is just a better way of doing what we have been doing for the past 5,000 years. The argument that inserting bacterial genes into plants is a break with the past is invalid because, to pick an example, there is very good evidence that the sweet potato genome contains bacterial genes. It doesn't make sense to think that new methods of altering plant genomes will be inherently dangerous. Genes are genes; it is what they do that matters. We need to test whether the products are safe, not worry about the process of creating them. This argument extends to the potential ecosystem effects of GMOs. I do worry about ecosystems, but there is no special risk to them from plants created using these new methods.

One of your main interests is microbes — indeed you gave a lecture about why we should love them at Lindau last year. Why did you feel this was necessary?

The vast majority of the microbes that live with us are good. But bacteria have a bad reputation because science has focused on the ones that cause disease. Biologists are finally starting to realize that by manipulating and controlling microorganisms, we can probably do more for human health than by any other means. The nice thing about this kind of medicine is that it would be cheap. We should explore all sorts of ways to make bacteria more beneficial, including genetic engineering. If you can cure disease by manipulating the microbiome, that is going to save a lot of money and will probably also teach us how to live better. I love bacteria.

Has biotechnology focused too much on the health of the human host without considering its microbial colonizers?

I absolutely think we have gone overboard in studying humans as humans. We need to study good bacteria in the context of their human ecosystems. Until recently, microbiologists did almost no work on good bacteria, which means that these organisms are under-appreciated even though they are an incredibly important part of us. That is a big mistake. The average human contains two to five pounds of bacteria! They provide protection against pathogens and prime our immune systems. If I were to kill all the bacteria that live in or on you, you would probably die. It is as simple as that. We know this because bacteria-free individuals of other species die young.

Why are you so passionate in your support of GM food?

I feel that scientists need to provide more legitimacy to GMOs. A lot of people cannot grasp the nuances of the relevant science, but respect and listen when prominent scientists — particularly Nobel laureates — speak up. I want to make sure the general public receives the benefits of GM food, but also understands its limitations. The fabrications that the anti-GMO people have used to scare the population worry me very much. I would really like to convince green parties of the benefits of GMO. In general, I support green parties. I think they just made a mistake in opposing GM foods — and they did it not because they were against genetic modification per se, but because they were afraid that multinationals were going to take over the food supply.

New techniques are making gene technology available to much smaller organizations than ever before. If what the anti-GMO lobby really cares about is multinationals taking over, might these techniques increase acceptance of GMOs?

The way to think about this is to consider evolution as a very slow process. Plants might eventually adapt to global warming, but if they don't adapt fast enough we won't have enough to eat. Genetic modification is a fast way of doing things. If we do not interfere and 'help' evolution where we can, an awful lot of people are going to die unnecessarily, particularly in the developing world. There are opportunities to really get something done here, and there are strong moral arguments. And there is no reason

ROLF SCHULTES/LINDAU NOBEL LAUREATE MEETINGS

why small companies or non-governmental organizations cannot make a big impact and significantly help the developing world.

As well as the new GMO initiative, you also signed the Mainau Declaration on climate change and campaigned in China for the release of Nobel peace laureate Liu Xiaobo. Do you consider it a responsibility to use your Nobel laureate status for the public good?

A Nobel prize is something rather special. Almost all of the laureates here in Lindau were awarded a Nobel prize because we were lucky. It is not that we are super smart or better than anybody else, but because we made a serendipitous discovery along the way. For whatever reason, when you win a Nobel prize people listen to you who never listened before. That means two things. The first is that you should use the opportunity to do good in the world, if you can. The second is that you should also be careful about what you say because you might not always be right. There are plenty of issues in which Nobel laureates could have been helpful, but they were rarely politically organized in the past. We tried to get Aung San Suu Kyi released from house arrest in Myanmar. Even though that was not successful, it showed that we laureates can come together — 225 of us signed letters that were sent to the Chinese and Burmese governments.

"Genetic engineering is just a better way of doing what we have been doing for 5,000 years."

What is the future of the Nobel prizes in the era of big collaborative science, in the light of projects such as ENCODE, the Encyclopedia of DNA Elements?

Many of the major steps forward in biology have been made by individuals or small groups of individuals. Our knowledge of biology is so limited, we are still at the starting point of understanding how organisms work and there are still terrific roles for individuals. But, in general, I am not sure science prizes are a particularly good thing. They are wonderful for the people who win them, and can be terrible for those who don't. I think they end up causing rather a lot of heartbreak. ■

This interview has been edited for length and clarity.

Gijsbert Werner is a PhD student at Vrije University Amsterdam, the Netherlands, where he studies the evolution of plant-microbe mutualisms.

Q&A Bruce Beutler

Chance encounters

Bruce Beutler is director of the Center for the Genetics of Host Defense at UT Southwestern in Dallas, Texas. He shared one half of the 2011 Nobel Prize in Physiology or Medicine with Jules Hoffmann for their work on the activation of innate immunity; the other half of the prize was awarded to Ralph Steinman. Here, Beutler talks to Christoph Thaiss about biological puzzles and intuition.

The discoveries that have resulted from your work are often referred to as the second revolution in immunology — the elucidation of how innate immunity operates — with the first revolution being adaptive immunity. Will there be a third revolution?

I hope there will be third, fourth and fifth revolutions. People always seem to overestimate what they already know, and we certainly know very little about how the immune system functions. If we think of the immune system as a machine, then we are far from even knowing all of its parts. We cannot predict the outcome of an immune response. We cannot say with confidence who will and who will not get an

NATURE.COM
To listen to the interview with Bruce Beutler in full visit:
go.nature.com/noxjgi