



OTTO

Watching science at work

A network of social scientists in the United Kingdom is seeking better ways to study the work of biologists. But, asks **Colin Macilwain**, can it earn its subjects' trust?

There was something of a chill in the air at Cardiff's City Hall in October, and not just because autumn was arriving. Social scientists, and some life scientists, were gathering there for the annual meeting of the Genomics Network, a programme run by Britain's Economic and Social Research Council (ESRC) to stimulate dialogue between the disciplines. The plenary talks got under way, led by Christine Hauskeller, a philosopher with the network from the University of Exeter, and Martin Evans, winner of the 2007 Nobel Prize in Physiology or Medicine for his development of gene knockout technology. But when the initial call for questions sparked little real discussion, it was clear that dialogue was going to take some stimulating. Then Evans was asked what he thought of his hosts. "They like to say, why are we doing things?" he growled. "We should be asking, why are they doing things?"

The Genomics Network started its work back in 2002. The previous year, when the British government had said it would earmark

an additional £200 million (US\$290 million in 2001) to genomics research, the ESRC successfully argued that about £9 million of it should go to the investigation, by social scientists, of genomics issues and the scientists who study them. Seven years after its creation, the network, which supports about 100 researchers at five universities, is one of the largest projects of its kind in the world, and has broadened its

interests beyond genomics to embrace synthetic biology and other areas. Two years ago, the ESRC announced a further £18 million in funding for three of its centres after peer review. The money was for a second, and final, five-year term: the ESRC doesn't support permanent centres of

excellence, on the grounds that societal challenges are always changing.

The centres have a very broad scope. Cesagen, the Centre for Economic and Social Aspects of Genomics, is the largest of the groups, and is co-hosted by Cardiff University and Lancaster University. The University of Exeter is home to Egenis, which uses philosophy-based approaches to study genomics

questions. Innogen, which studies innovation in genomics and the life sciences, is co-located at the University of Edinburgh and the Open University in Milton Keynes. And the Genomics Forum, also at Edinburgh, was set up in 2004 to help coordinate the Genomics Network and push its findings into wider political and public arenas.

Embedded in the community

Unlike some previous attempts by sociologists to 'study' scientists at work, in these centres the social scientists are organized into multidisciplinary teams — often including lapsed natural scientists, as well as sociologists and philosophers — with funding to do empirical research. And the researchers embed themselves deeply in the community of natural scientists that they are seeking to study.

Three-quarters of the way through the centres' ten-year lives, their track record is mixed. They have provided a stable and conducive environment for social-sciences research, much of their work is undoubtedly original and some of it has made its impact felt in policy circles, influencing debates on the legislation of animal-human hybrid embryos, for example, and on innovation at the Organisation for Economic Co-operation

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and Development (OECD) in Paris. “I think that we’ve really added value by having these centres,” says Ruth Chadwick, the director of Cesagen and chair of the ethics committee at the international Human Genome Organisation. “The ESRC made it clear from the outset that it wanted to see interactions with hard scientists. And we’ve seen increasing openness to such collaboration: in part because the funding agencies demand it.”

Well-trained social scientists can play a much bigger part in helping scientists to build bridges with the outside world, says Grahame Bulfield, former head of science and engineering at the University of Edinburgh and an early champion of the two centres there. “We need organizations that will study the interactions between science and society in a scholarly way, and interpret their findings for the public,” he says.

But some critics fault the ESRC for failing to provide sufficient direction for the network since its foundation. Its staff case officer, Liz Grassby, is the fourth or fifth official to hold that position since the network was conceived. “The quality of the research output has not been as good as you might have expected,” said one senior social scientist from outside the network. “Much of the problem can be laid at the door of the ESRC; for whatever reason, it has high staff turnover and no collective memory. The initiative could have been better managed.”

Chinks in the wall

The relationship between natural and social scientists has, historically, been more fraught than fruitful. Scientists are often prickly about being studied by outsiders such as sociologists or historians of science.

Lately, however, some chinks have appeared in the wall that separates the two realms. Brian Wynne, a sociologist, former physicist and associate director of Cesagen, based at

Lancaster, says that he has noticed profound changes over the past decade in the natural sciences’ receptiveness to social science. “Social scientists have become welcome, and indeed essential, partners with the natural sciences,” he says. “We’ve become embedded — like the media folks in the Iraq war,” he says.

Wynne, for example, has been involved in planning a citizens’ science programme at the Natural History Museum in London, which seeks, among other things, to integrate huge banks of data collected by amateur naturalist groups into the museum’s study of biodiversity. Scientists such as Johannes Vogel, keeper of botany at the museum, have built on Cesagen’s work on public engagement to help draw on this amateur expertise. For example, the detailed observation of river conditions by fly fishermen led UK regulators to revise their criteria for measuring water quality.

In a separate but related project, Vogel, Wynne and two Cesagen researchers, sociologist Claire Waterton and anthropologist Rebecca Ellis, have been contributing to the Barcode of Life initiative, which seeks to build tools that will enable biologists to identify species from short stretches of DNA. Here, the social scientists have been mediating between people who have their own genetic methods for species identification (such as public-health officials checking different strains of mosquito) and the larger international project, which needs global standards for genetic bar-coding. As a result, Wynne says, the whole project is embracing standards, such as on what gene segments to use, that better incorporate existing approaches.

It was James Watson who pioneered the large-scale, systemic involvement of non-scientists in the life sciences when, as associate director for

human genome research at the US National Institutes of Health in 1988, he casually suggested that about 3% (later 5%) of all Human Genome Project funds — about \$10 million per year since then — should go to the investigation of the Ethical, Legal, and Social Issues (ELSI) involved in the Human Genome Project.

The ELSI programme now serves as the dominant global model for this sort of social-science effort. But it also became synonymous with poor relations between the observers and the observed. From the scientists’ point of view “there were two main frustrations with ELSI”, says Robert Cook-Deegan, director of the

Center for Genome Ethics, Law and Policy at Duke University in Durham, North Carolina. “One was its association with what I call ‘finger-wagging ethics’” — telling researchers how they ought to conduct their business. “The other was the way that it created a constituency that wanted grant money

more than it wanted to go out and help solve real problems.”

Ros Rouse, the ESRC programme officer who built the Genomics Network and is now head of policy at Research Councils UK, the umbrella group for the seven UK research councils, says the ESRC wanted the Genomics Network centres to address “a totally different terrain”, from the ELSI programme, including original research into the sociology of biology and medicine, and the nurturing of better links between science, the public and policy-makers.

“This is more of a serious attempt to engage with the life sciences than the original ELSI, which was seen as an ‘add-on’ to the genome project,” says John Dupré, a philosopher of biology who runs Egenis. Dupré is particularly interested in the way that scientists continue to work with a ‘tree of life’, the representation of species’ relationships to each other in a branching tree, even though genomic data challenge it. Genome sequencing has shown that bacteria and other prokaryotes have swapped genes so extensively that their evolutionary histories cannot be represented on a conventional phylogenetic tree¹.

Dupré and his colleagues are now working with philosophers, evolutionary biologists and others to develop other means, such as webs or grids, to represent organisms’ genetic relationships. Ford Doolittle of Dalhousie University in Halifax, Canada, is one of the biologists most closely involved. “I think that it’s been very useful because biologists don’t think very much about philosophy,” he says. “We impose patterns on nature for philosophical reasons, and then deny that philosophy is important.

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John Dupré (front row, centre) and his team at Egenis study the social and philosophical issues of genomics.

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Researchers at Innogen have been examining what Joyce Tait, a former chemist and the first director of Innogen, calls the “innovation triangle” of the pharmaceutical industry, the regulators and the consumer. Tait and her colleagues say that the speed and nature of innovation in some sectors, such as pharmaceuticals and agricultural biotechnology, are determined largely by the regulatory apparatus. They argue, in particular, that it is not the severity of a regulatory system, but rather its ability to discriminate in how it treats large and small companies, that has the greatest bearing on rates of innovation.

These findings are being absorbed in high places. The OECD, for example, used an Innogen study² about the future of the pharmaceutical industry as the basis for the health component of a report³, *The Bioeconomy to 2030*, that it published in June. Given the OECD's considerable prestige, the report is likely to exert a strong influence on government approaches to drug regulation around the world.

Broad reach

The ESRC always wanted the Genomics Network to reach out beyond academia to public and policy circles, and the Genomics Forum was added with this in mind. “If you have a social-science centre, its prime emphasis is going to be on getting its best work published,” says Steven Yearley, a sociologist and director of the forum. “What the forum does is to accept this and make sure that we take that work to a broader audience.”

Research teams at the network centres, including Jane Calvert at Innogen and Emma Frow at the Genomics Forum, are involved in helping to

shape UK participation in the field of synthetic biology — the search for approaches to build novel biological systems and even entire organisms. The concept of artificial life is expected to stir strong public passions, and those studying it have turned to social scientists from the outset. Some argue that if synthetic biology is to get off the ground, the working dynamic between biologists and engineers needs to be examined and improved. Calvert and Frow have been studying some of these questions, and helping scientists and organizations such as the Royal Academy of Engineering in early public consultations on synthetic biology.

Alistair Elfick, a medical engineer at the University of Edinburgh, is joint leader of a UK-wide synthetic-biology network that is looking at the technical standards that may be needed if approaches to synthetic biology — such as the design of DNA ‘biobricks’ that can be pieced together like Lego — are to be successfully pursued. He says he appreciates the social scientists’ perspective. “Having their insight will be hugely valuable to us,” he says, adding that the nascent discipline is serious about working with social scientists on public engagement. “It’s a matter of entering into a dialogue with the public about what it wants us to do. We need to have the authority of society, in order to proceed.”

But does the social study of science need to have this kind of practical utility? Some social scientists caution that producing work that is useful to policy-makers, scientists or the public — as the Genomics Network has set out to do — is not always consistent with their core scholarly activity, of seeking to better understand how science works. Paul Martin, a medical sociologist

at the University of Nottingham who is not part of the network, warns that the desire to make work fit the needs of policy-makers can create conflicts of interest, in which those who are trying to objectively study science and innovation end up being part of the scientific and innovative process. “We want to be engaged, but not

reduced to a handmaiden’s role for new technologies,” he says.

Nik Brown, a sociologist at the University of York who is also outside the network, worries that policy-makers and scientists can expect the wrong things from social scientists.

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— Ford Doolittle

“There’s a misperception that our main role is to ease the interaction between scientists and the public,” he says. “What we want to do is understand the science, and how it is constructed — which is not a public-understanding-of-science question.”

The biggest practical challenge for the network, though, is the interactions between the scientists and social scientists themselves. One senior researcher, who knows the Genomics Network well, said privately that social scientists still have difficulty speaking a language that scientists can relate to. “There’s still a huge credibility gap,” according to this observer. “Their methodologies just don’t align well.”

The issues that interest social scientists most are not always the top concern of many research scientists, who are busy with funding, publications and the science itself. “Scientists don’t especially want to know whether their work produces an ethical dilemma,” says Tony Woods, head of medicine, society and history grants at the London-based Wellcome Trust, the medical-research charity. “Questions about societies’ concerns don’t always weigh heavily on their minds.”

Asked whether the network has succeeded as whole, Jim Stevenson of the University of Southampton, a psychologist and member of the ESRC’s strategic research board, equivocates somewhat: “I think now it is working well, but it has taken a while.” He says that the centres need to persevere. “We’ve got to get to a situation where science, and industry, takes this work seriously,” he says. “But it’s a slow process.” ■

Colin Macilwain is a writer based in Edinburgh, UK.



Social scientists are tackling concerns raised by research to build systems from ‘biobricks’.

1. Baptiste, E. *et al. Biol. Direct* 4, 34 (2009).
2. Tait, J., Wield, D., Chataway, J. & Bruce, A. (eds) *Health Biotechnology to 2030* (OECD, 2008); available at go.nature.com/YzFDJE
3. *The Bioeconomy to 2030: Designing a Policy Agenda* (OECD, 2009); available at go.nature.com/aQZWF1

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