

BOX 2: Man, Beast and Scientist

Seeing animals through the eyes of those who study them

The knowledge that humans share the bulk of our DNA sequence with chimpanzees has implications not only for how we see ourselves, but also for how we view animals. Modern biology illuminates our relations with animals in many other ways. Genetically modified animals are a common feature of biomedical laboratories. We can clone sheep, cats, dogs and cattle, and we fashion human-animal chimeric embryos for stem cell research. Animal tissues are used to replace faulty human parts such as heart valves, and there is the possibility of doing similar with entire organs. Some of these developments serve to close the gap between humans and animals, while others can reinforce notions of animals as resources fit for human exploitation. All of them, however, bestow humans with new manipulative powers over animals.

At Cesagen, Richard Twine's work shows that the way in which we understand animals in the context of genomics and biotechnology has implications for our understanding of animal welfare. His research explores how the use of animals in various fields of agricultural research feeds back into the scientists' conceptions of them. His interviews reveal striking contrasts between sub-disciplines. While scientists working in the field of animal welfare or selective breeding programmes using the techniques of population genetics regard animals as sentient, conscious beings, researchers using modern molecular techniques such as GM or cloning speak of animals as experimental objects, molecular systems or as computerised genetic sequences.

"One of the ways in which genomics has been sold to policy makers, funding bodies and the public is that it can be used to improve animal welfare, by improving resistance to disease, for example," says Twine. But his research suggests that this emphasis on physical wellbeing belies a lack of attention paid to the psychological health of study animals.

The findings highlight challenges faced by policy-makers seeking to balance animal welfare against scientific productivity. Twine says that bioethical debates surrounding new technologies need reinvigorating with expertise on animal ethics. This is important even if you do not hold a view of animals as sentient, conscious beings, says Twine, because the ethical regime we use to guide our use of animals in science and agriculture also impacts human and environmental health via, for example, ecological impacts of farming and diseases that cross the animal-human divide.

The ESRC Genomics Network (EGN) is dedicated to examining the social and economic consequences surrounding the development and use of the science and technologies of genomics.

The EGN includes 3 ESRC funded Genomics Centres - Cesagen, Egenis and Innogen - and the Genomics Policy and Research Forum. These investments range across 5 universities, and involve over a hundred researchers, from professors to PhD students, as well as administrative and support staff and a rotating cast of visiting research fellows. The Network is one of the largest social science investments in the ESRC's current portfolio, and is growing into the largest concentration of social scientific research on genomics in the world.

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Understanding of Nature, Humanity and Society

Genetically, we might be 97% chimpanzee - and 35% daffodil, for that matter - but if there's one thing that distinguishes humanity from the rest of life on Earth, it's our ability to absorb new information and use it to recast ourselves and society in an image of our own making.

The people we meet, the conversations we have and the books we read all provide grist to the mill. Broad social developments such as globalisation expose us to new ways of seeing the world and ourselves. Scientific and technological innovations and insights throw up new material and raise novel questions for us all to mull over and incorporate into our communal redefinition of society. And biological discoveries are particularly easy to take personally. Some of us are still getting over the idea that we evolved from apes, let alone from unicellular micro-organisms. And the scientists behind the Human Genome Project were as surprised as the rest of us to discover that human DNA carries not many more genes than that needed to build a lowly roundworm or fruitfly.

Biological knowledge does not necessarily determine how we think about ourselves. But it certainly informs our conceptions of who we are as individuals, as social groups and as a species. All three categories of identity get renegotiated with reference to genetic knowledge and information; all three are morally highly significant; and all are debated vigorously by different people, in different settings, in relation to such weighty issues as animal rights, abortion, designer babies, paternity tests, the politics of race and ancestry, genetic databanks and animal-human chimeras.

But that is only part of the story. Just as scientific and technological developments feed into our construction of society, so society informs the science that gets done, and how that science is applied. And the whole dynamic, ongoing interaction between science and society is facilitated not only by the media, but also by social scientists who study it, such as those of the ESRC Genomics Network.

Them and Us

An illustration of how people incorporate biological information into their constructions of society and their place within it is provided by Thomas Morton's research at Egenis. Morton looks at how people draw on biology to explain their membership of social groups - particularly, stigmatised groups such as those based on gender, sexuality, race or ethnicity.

Biological explanations of group membership can suit the purposes of both the stigmatised and those who stigmatise them. For the former, the idea that group membership is biologically determined - "it's natural" - can imply that prejudice is unjustified. For the latter, it can legitimise group differences - "it's an affliction" - and promote discrimination.

But when, for example, are homosexuals inclined to explain their sexuality as a matter of personal preference and when do they prefer to see it as a biological inclination determined by genes or neurobiology? Conversely, under what circumstances might men draw on biology instead of politics to explain the relative low status of women in society?

To tackle these questions, Morton conducted controlled experiments in which he manipulated individual perceptions of the social structure. These revealed that people who identify with stigmatised groups tend to embrace biological explanations when they are reminded of marginalisation, and avoid them when they are reminded of discrimination.

Stigmatised social groups can face both forms of treatment, so different groups, under different social circumstances, might vary in their willingness to use biology to explain group membership depending on whether they are trying to avoid negative treatment or promote an identity as something that is real and meaningful. "If the very existence of homosexuality is denied by the heterosexual majority - if it is seen as an aberration in individuals rather than as a group characteristic - the greater the inclination for homosexuals to draw on biology," says Morton.

Morton has carried out similar experiments on members of dominant social groups. Men who score highly on measures of sexism, for instance, tend to use biological arguments to explain social and behavioural differences between the sexes when they are primed with information suggesting that women are becoming more equal to men in the workplace – when they perceive their social status to be under threat. If, on the other hand, it is suggested to them that women are as disadvantaged as they always have been, those same men are more inclined to offer social or political explanations for the differences.

“These biological concepts have enormous rhetorical power,” says Morton, “because biology is seen to be immutable. If it’s biology, then that’s just the way it is.”

According to Morton’s Egenis colleague Christine Hauskeller, who is preparing a monograph on genomics and the politics of human identity, the attraction of rhetoric based on genomes and genes is that it provides explanations that escape the need for political and personal responsibility. “If biology defines the borders between species and between kinds of humans, what we are as humans is no longer a matter of self- or alien-determination,” she says. “It is so much easier and stylistically in accordance with our cultural religious traditions – which also provided us with absolutes – to talk about complex social issues such as ethnic or gender divides in bioscientific terms than to acknowledge the relativity of that knowledge and human action.”

Those biological absolutes can be drawn on in different ways in different circumstances, and lead to very different societal outcomes. Hauskeller points to the strategic importance of biology in discussions about abortion and medical research on embryos. Various social groups and legislators in different European countries assign status to the embryo on the basis of different criteria. But whether it is the fusion of sperm and egg, the formation of a unique genome, implantation in the womb, or the development of the primitive streak, biology is granted the authority to arbitrate in difficult legal, ethical and political reflections on the start of human life. But science is plainly not an unequivocal arbiter. It would seem that we use biology as a way of obscuring as much as illuminating political choices.

Naturalising Inheritance

The way in which changes in wider society feed back into scientific developments is explored in Staffan Mueller-Wille’s research at Egenis into the cultural history of heredity. The concept of heredity is of fundamental importance right across the biological sciences, and it is hard to imagine how genetics and genomics could exist without it.

And yet prior to the late 18th century, the notion of heredity did not feature in scientific thought at all. Before then, reproduction

was described using more active metaphors: Aristotle wrote of parents “fashioning” embryos; Descartes compared it to brewing beer. Others talked of “cooking” or “crafting” offspring. “Heredity” was only ever used in a legal sense, to mean the inheritance of money or property.

Mueller-Wille and his collaborators at the Max Planck Institute for the History of Science in Berlin have traced heredity’s entry into the scientific lexicon to an entrepreneurial Leicestershire livestock farmer named Robert Bakewell who started selling rams around the country as breeding stock. The selective breeding of livestock or crops was nothing new, but because it had always taken place in a local environmental context, there had been no need to distinguish between the respective roles of nature and nurture. Bakewell changed that by that by moving breeding stock between environments

Once heredity had taken off as a business, it also took off as a metaphor in biology, which found purchase in discussions of human races and family diseases, paving the way for the work of Galton, Darwin, Mendel and, ultimately, genomics.

But it’s a history that is still ongoing. The notions of crafting, cooking or fashioning embryos and children live on in the public consciousness, and these both influence and are reinforced by modern reproductive technologies such as genetic screening. Visions of designer babies foster the desire to have the kind of child one wants rather than that which nature provides, while new reproductive technologies are promoted in ways that feed such desires. From a legal category to a biological one, “inheritance” is again being transformed, this time into an index of parental purchasing power.

Ultimately, the history of heredity, like that of alternative biological definitions of the beginning of human life, provides a lesson for anyone drawing on biological absolutes to justify politics or policies. The story of heredity is one of change, revealing a dynamic interchange of ideas with wider society. At a time when biology is drawn on as if it were immutable, it is a call for caution over the authority we grant it.

BOX 1: Managing the Message

Science and cinema can sometimes appear to be reading from the same script when it comes to their treatment of fact and fiction

Following the media storm in 2004 that accompanied reproductive biologist Dr Panos Zavos’s claims that a female patient at his clinic had been implanted with a cloned human embryo, the UK’s Science Media Centre wrote an open letter of complaint to news editors, signed by eminent scientists. The disproportionate coverage given to unsubstantiated efforts to clone humans plays on the desperate hopes of infertile couples, it said, and brings into disrepute the good work of scientists using cloning techniques to develop disease therapies.

In a similar vein, Ian Wilmut, the leader of the lab that created Dolly the sheep, has publicly criticised films such as the 2006 blockbuster *The Island*, in which human clones are grown to provide spare organs for elite clients, for generating unwarranted fear over biotechnologies. But according to research at Cesagen, the notion of a public being hoodwinked by irresponsible media should itself be taken with a pinch of salt.

“There’s a lot of scapegoating of the media,” says Cesagen’s Kate O’Riordan. “But if you look at what’s being broadcast, how people consume it, and the way that scientists use it, a much more complex picture emerges.”

The Cesagen team’s analysis of media portrayals of science shows how mainstream scientists, too, use the media to get their messages across to policy-makers and the public, a process that can blur the boundaries between science fact and science fiction.

Professor Wilmut’s book *After Dolly*, for example, which he wrote with journalist Roger Highfield, is dedicated “To the tens of millions of people who will one day benefit from research on cloning, embryos and stem cells.”

“When scientists make claims about the future, they are also in the realm of the imaginary,” says O’Riordan’s colleague Joan Haran. No doubt the motives behind the promises of the future offered by scientists are admirable, she says. “But they are still speculating: they can’t predict the future.”

Surveys conducted by the Cesagen team reveal that, contrary to the claims that science fiction can promote unwarranted concerns about technology, people attach more weight to the imagined futures offered by scientists than, say, Steven Spielberg. And most are broadly supportive of therapeutic cloning.

“The narrative that stem cell research and therapeutic cloning will lead to cures in the future is one that the public find highly persuasive,” says Haran. And it’s a narrative that is also finding purchase in the media. Over the past decade, horror films about cloning have given way to thrillers whose storylines take a more optimistic view of new biotechnologies. “It’s almost impossible to make an intelligible horror story about cloning anymore,” says O’Riordan.

Unlike *Clonus Horror*, for example, a 1970s flick about humans being cloned for spare parts, *The Island*’s villains are not mad, bad scientists, but greedy capitalists exploiting a worthy technology for their own ends. And in *The Eleventh Hour*, a UK television drama series made in the wake of the furore over Zavos’s claims, the hero is a government scientist on the trail of maverick reproductive cloner who must be stopped if public confidence in stem cell research is not to be damaged.

“Being a scientist carries much more public authority than being a film-maker,” says Haran. “But it’s important to be aware that scientists don’t provide purely objective accounts of the science. Perhaps we should start treating scientists’ claims about the future with some of the scepticism we apply to a Hollywood film.”