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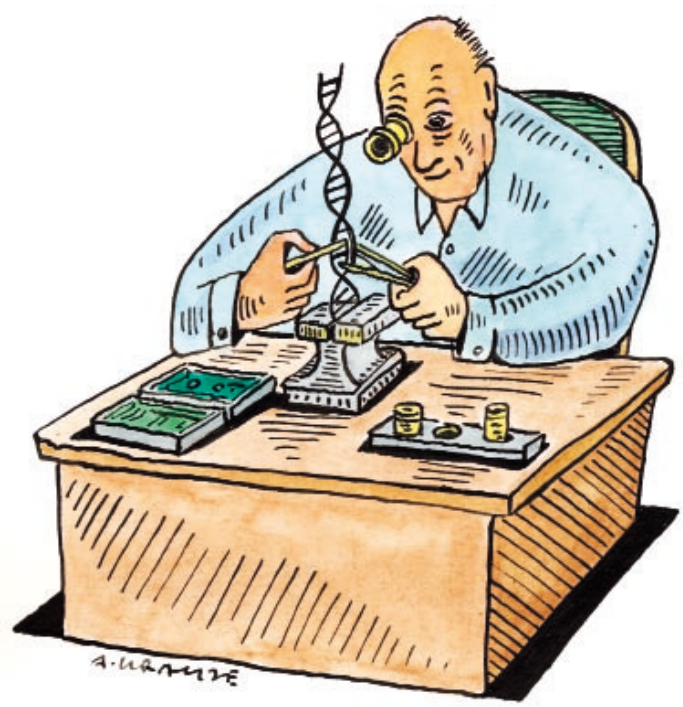
The seeing watchmaker

The race to build life from scratch inspires hyperbole on both sides. That may be warranted one day, say **Claire Marris** and **Nikolas Rose**, but not yet

EXCITING but terrifying. Powerful but scary. This is what some say about the emerging field of synthetic biology. Not surprising, perhaps, for an initiative that aims to "create life from scratch", to "make life better" and to "make biology easier to engineer".

The goals of synthetic biology are certainly ambitious: to produce a toolbox of standard biological parts with well-characterised functions that can be put together in combinations that may not exist in nature in order to perform human-designed functions outside the laboratory. Some hope to make the parts and the knowledge of how to assemble them accessible to all. The overall aim is to make the engineering of biology a routine process that can be put to use in many industries, with no need for highly specialised skills.



Most ethical, policy and media discussions about synthetic biology start from the assumption that these aims have already been achieved: that biology has become easy to engineer for whatever ends we choose, that the toolbox is available to any student or potential terrorist, that dangerous organisms and powerful bioweapons are easy to make, and that no effective regulation is possible. The ability of synthetic biologists to overcome serious scientific and technological challenges is taken for granted, and the economic, legal, social and political conditions for the uptake of these technologies are ignored.

Commentators instead focus on potential reckless use or misuse, overestimate the pathogenic possibilities, and worry about deep questions such as: "Do we have the right to play God?". These worries are the flip side of grand claims about synthetic biology's imminent ability to solve challenges in health, environment and energy. Utopias and dystopias seem to be the only scenarios possible.

This way of framing discussions is unhelpful. It is an example of "speculative ethics" that distracts us from less exciting but more pressing questions. What are synthetic biologists actually doing? How easy, or difficult, is it proving? What applications are they realistically going to develop in the short to medium term? What is their intended purpose, and to what extent could these contribute to the public good?

How, then, to proceed? Synthetic biologists have been impressively open to collaborations with the social sciences, law, arts and humanities, and open to debates with critical groups. In the UK, for example, social scientists have been participating in synthetic biology research programmes from the outset.

"In discussions of synthetic biology, utopias and dystopias seem to be the only possible scenarios"

We are engaged in such partnerships and work closely with synthetic biologists so that together we can better understand the promises and challenges. We aim to help them reflect on why they are doing what they are doing, and to encourage them to open up such reflections to people outside their labs. In so doing, we try to avoid the pitfalls of speculative ethics and – perhaps idealistically – influence the kind of synthetic biology that is developed.

Science is creative, exciting and future-oriented and most synthetic biologists, like most people, do want to "make life better". But this means different things to different people, and even among synthetic biologists there are different views about what research is most valuable and which directions should be pursued.

As "embedded" social scientists, we routinely witness fascinating, nuanced discussions among synthetic biologists that acknowledge the complexities and uncertainties involved in their research. Sadly, these often disappear when synthetic biologists present their work in official public dialogues – or to journalists.

It is often left up to the most vocal critics of new technologies to articulate the complexities in public, and this is also the case for synthetic biology. When a number of NGOs led by opponents of genetic technology issued a declaration entitled *The Principles for the Oversight of Synthetic Biology* this year, most of the

discussion focused on their call for a limited moratorium. Yet much of the document in fact focused on the debatable desirability of the goals of synthetic biology, and on the need to acknowledge the complexities and uncertainties involved in designing novel living organisms – issues which concern many of those working in synthetic biology and which can and should be the subject of open debate.

Discussions about the inherent complexities and uncertainties, and about desirable futures, should be opened up to a whole range of social groups, not least those who have anxieties and criticisms. This might take us beyond the limits of most previous public-engagement exercises, and it could help ensure a more democratic process in which different visions of what is desirable are debated before particular ones become entrenched and hard to modify.

Such conversations should also help move the discussion beyond speculation about utopias and dystopias, by recognising that the prospects for synthetic biology are likely to be both less sensational and less forbidding than is generally acknowledged.

A meeting run by the science and engineering academies of the UK, US and China that will take place in Washington DC next week aims to assess the prospects for synthetic biology, and the concerns about its potential, by bringing together natural scientists, social scientists, artists, regulators, science funders and critical NGOs. Let's hope that this is a key moment in developing the kind of dialogue that is essential if the potential of synthetic biology is to be realised. ■

Claire Marris and Nikolas Rose are sociologists at King's College, London. They work with synthetic biologists within the Centre for Synthetic Biology and Innovation, a partnership between King's and Imperial College London

One minute with...

David Nutt

Outlawing drugs like ecstasy is hampering the hunt for new medical treatments, says the ex-government adviser

How do the drug laws in most countries affect scientific research?
One of the things I find very disturbing about the current approach to drugs, which is simply prohibition without necessarily any full understanding of harms, is that we lose sight of the fact that these drugs may well give us insights into areas of science that need to be explored and may give us new opportunities for treatment.

In what way?
Almost all the drugs of interest in terms of understanding brain phenomena such as consciousness, perception, mood and psychosis are illegal. And so there is almost no work done in this field.

How bad is the impact?
The effects these laws have had on research is greater than those caused by the US government stopping stem cell research. No one has done an imaging neuroscience study of smoking cannabis. I can show you 150 papers telling you how the brain reacts to an angry face, but I can't show you a single paper that tells you what cannabis does.

Any examples of missed opportunities?
There were six trials of LSD as a treatment for alcoholism, the last one in 1965. The evidence is it's as good as anything we've got, maybe better. But no one is using it for this. I wonder how many other opportunities have been lost in the past 40 years with important drugs like MDMA (ecstasy) and its empathetic qualities or cannabis for all its possible uses and insights into conditions like schizophrenia. All those opportunities have been wasted because it is virtually impossible to work with a drug when it is illegal.

How do you see change coming about?
The scientific bodies in the UK are the ones that should really be challenging the government. I will try to get the Royal Society and the Academy of Medical Sciences to support this campaign for a more rational approach to the regulation of drugs for research.

TONY BUCKINGHAM

PROFILE
David Nutt is neuropsychopharmacology professor at Imperial College London. He headed the UK Advisory Council on the Misuse of Drugs' Technical Committee for seven years

You were sacked as a UK government adviser for comparing the risks of horse riding with taking MDMA. Do you still take this line?
It is still a very important discussion. It raises the question of what the appropriate comparisons are. Where do you draw the line on harm? Should it be drawn equally across all sorts of endeavours and activities that humans engage in?

Should recreational-drug laws be relaxed?
If you are using a drug less dangerous than alcohol, that is a rational choice. If you are using drugs that are more harmful than alcohol, essentially heroin or other forms of opiates and crystal meth and cocaine, then that's different.

As head of the UK Independent Scientific Committee on Drugs you've written a book, *Drugs: Without the hot air*. Who is it for?
Parents and those with no scientific background can read it, children can read it and hopefully the media and politicians will read it. I hope we can start having more of a discussion about drugs.
Interview by Jon White