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Challenges of our own making

The successful transplantation of a synthesized genome highlights unresolved ethical and security issues posed by synthetic biology.

Who gets to imagine the future where science and technology are concerned? If we are creating new objects, who is responsible for the proliferation of good consequences and the prevention of bad ones? These perennial conundrums were aptly posed last July by the social scientist Sheila Jasanoff of Harvard University at a high-level conference on synthetic biology (see go.nature.com/HTQ7JS).

Events last week illustrated their continuing relevance. Scientists led by Craig Venter published the first successful transplantation of a synthesized genome into a recipient cell (D. G. Gibson *et al. Science* doi:10.1126/science.1190719; 2010). The feat was a technical tour de force, requiring the accurate synthesis of a slightly modified genome of the bacterium *Mycoplasma mycoides* — all 1.08 million base pairs of it — followed by its successful insertion into a related species, *Mycoplasma capricolum*, and then the demonstration of replication of descendant cells exhibiting the characteristics of *M. mycoides* (see pages 406 and 422).

As many biologists were quick to point out, this was not the synthesis of life, nor indeed of a cell. But it was the first time that an organism had been put together with DNA constructed from specifications in a computer database, albeit derived from an existing organism rather than conceived from scratch. The long-anticipated development is a landmark in synthetic biology — a field that is burgeoning not only in its science and engineering but also in the discussions that surround it.

Credit is due both to the pioneers of the field for fostering open deliberations about the research-community, societal and ethical issues surrounding synthetic biology, and to the Alfred P. Sloan Foundation of New York for its long-standing support of these efforts. Unfortunately, such discussions repeatedly point to key concerns without resolving them. The achievements reported last week underline the need to do better.

A prime example is the lack of international governance for synthetic biology, not least in relation to security issues. The European Union, the Organisation for Economic Co-operation and Development as well as national governments such as those of the United States and, to a lesser extent, China are engaged. But none seems willing to take the lead in establishing an international framework of governance and standards.

Another chronic security issue is the growth of do-it-yourself synthetic biology. The construction and transplantation of whole genomes remains beyond the capacity of most labs, although both may be routine within five years. But the ability to undertake hazardous biology in the garage is already with us. With trust being so important in science, universities and individual investigators are almost certainly not attentive enough to security risks. Nor are governments: the very possibility of malign synthetic biology, whether by states or eventually by 'biohackers', only reinforces the need for a much more extensive worldwide network of centres able to detect emerging infections.

"Concerns need to be developed beyond the knee-jerk soundbite."

Meanwhile, the anticipated power of synthetic biology leads back to the larger, as-yet-unresolved questions that Jasanoff posed. US President Barack Obama took a belated step in the right direction last week when he asked his bioethics council to consider the wider significance of synthetic biology and to report back in six months. But other organizations — ethical, environmental, medical and commercial — also need to join the discussion.

If its visions can be fulfilled, the power of synthetic biology is profound. The extensive discussions that have already taken place have revealed no significant new moral or societal constraints on its full realization. Accordingly, where there are concerns, they now need to be developed beyond the knee-jerk soundbite. Those inclined to worry about synthetic biology should take only small comfort from the fact that the complexity of organisms makes it so difficult to deliver. ■

All at sea

US agencies have moved too slowly in gathering key data on the oil spill in the Gulf of Mexico.

When disaster strikes, the priority for governments and individuals alike is to limit the damage and help the people affected. But also critical is the rapid, coordinated collection of data to document the disaster. Getting a full picture of exactly what happened can be a huge help in planning recovery efforts, minimizing losses in future disasters and, if need be, in holding guilty parties accountable.

In the case of the ongoing oil spill in the Gulf of Mexico, researchers have been hampered in their desire to collect more data and have been left feeling ill-informed about what has been done so far.

In theory, the necessary mechanisms for arranging data collection exist. The US Incident Command System, which coordinates federal agencies and first responders during a crisis, has a mandate to collect 'ephemeral' or 'perishable' data. That is also part of the job of the Office of Response and Restoration, run by the National Oceanic and Atmospheric Administration (NOAA), and of the Environmental Protection Agency (EPA).

In addition, academic scientists can apply for up to US$200,000 in quick funding from the National Science Foundation (NSF) to study a disaster's aftermath, through its aptly named RAPID programme.

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