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Life is transformed

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Genetic engineering is beginning to live up to its name. Over the past 30 years it has meant transferring existing genes, one at a time, between organisms. Now – under the banner of "synthetic biology" – scientists are using the principles of systems engineering to transform whole organisms and potentially even to create novel forms of life.

Synthetic biology is sufficiently different from old-style genetic engineering to need a new system of regulation and governance, plus a fresh effort by its practitioners to tell the public what they are up to. Enormous benefits could flow from their work – practical pay-offs, such as new medicines and biofuels, as well as scientific insights into the nature of life.

But there are serious concerns too. First is bio-safety. Synthetic biology involves the production of novel living organisms that are self-replicating and potentially uncontrollable if something goes wrong.

Such fears were voiced in the mid-1970s when scientists first discovered how to snip a piece of DNA out of one organism and splice it into another. Indeed everyone in the field agreed to a voluntary moratorium on genetic engineering while they considered the safety consequences. Soon work resumed and, to this day, no serious accident can be blamed on the genetic manipulation of microbes.

The good safety record of conventional genetic engineering does not mean that far more radical reshaping of life through synthetic biology will be equally trouble-free. However, the very fact that synthetic organisms are so unnatural will make it hard for them to survive, let alone thrive, if they escape from a special bioreactor into the natural environment.

A bigger concern is the deliberate construction and release of a pathogen more virulent and transmissible than anything in nature. The perpetrator might be a malevolent individual with a knowledge of synthetic biology or a terrorist group seeking the ultimate bioweapon. Fuelling such fears is the rapidly growing availability of BioBricks and other "standard biological parts", which enable even undergraduates to engineer their own microbes.

We probably have at least five years grace before synthetic biology has reached the point where new regulations become really urgent. But that is no reason to procrastinate. On both national and global levels, regulators such as the US Environmental Protection Agency should be preparing now. And if synthetic biology is to win public approval while avoiding unnecessarily stifling regulations, scientists must lead an open debate about its risks and rewards. Europe's debacle over genetically modified crops remains a cautionary tale.