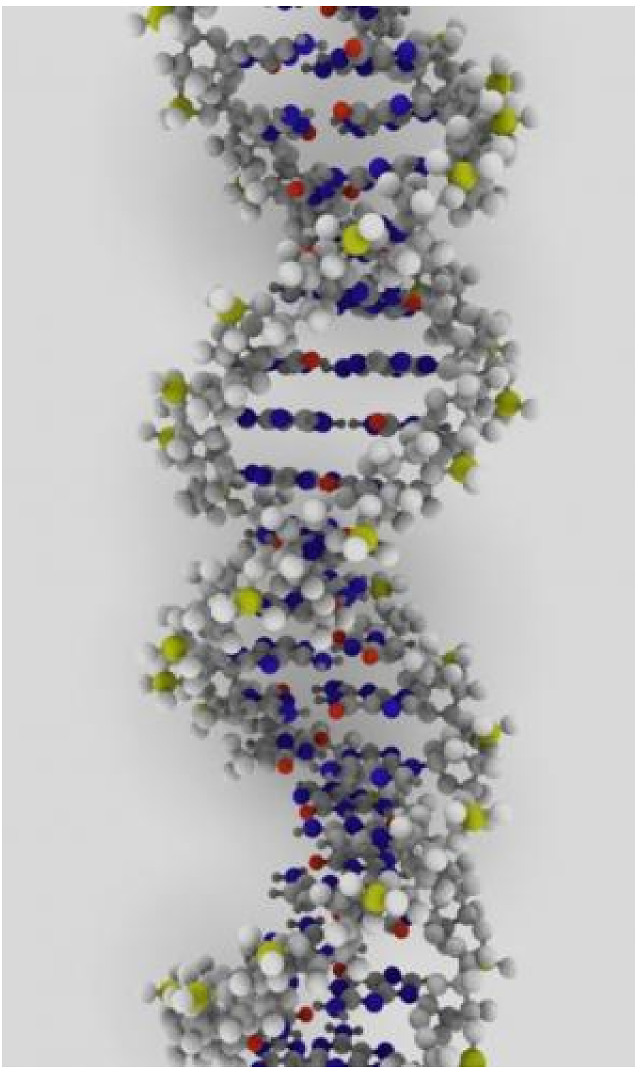
Making 'designer genes' from scratch begins with yeast

May 27 2014, by Sakkie Pretorius



Credit: ynse/Flickr, CC BY-SA

Australia is to play a significant role in the quest for artificial life as it joins an international project to create the world's first synthetic yeast, we can announce today.

Under the leadership of Jef Boeke from New York University, the Yeast 2.0 project is a consortium of yeast laboratories in the US, UK, China, Singapore, India and now Australia aims to produce the first synthetic yeast by 2017.

It marks a major breakthrough for Australian research in the field of synthetic biology which takes science and technology into a new dimension. From the treatment of malaria to the production of environmentally friendly biofuels, synthetic biologists are shifting the boundaries of science and technology to pioneer new life.

In 2010, the world witnessed a future-shaping breakthrough in re-programming the natural "software" of bacteria. Researchers at the Craig Venter Institute in the US successfully transplanted an artificially constructed genome of *Mycoplasma mycoides* – all 1.1 million base pairs of its DNA – into a closely related bacterial cell, *Mycoplasma capricolum*.

This marked a world-first: a "synthetic" genome, designed by computer, giving life to another living being with no ancestor.

The potential for future advances in synthetic genomics seems endless and the possibilities are revolutionary.

Synthetic biology aims to build novel and artificial biological parts (such as genes and chromosomes) devices and systems that can then be used to "fuel us, heal us and feed us" – as the UK Science Minster David Willetts said last year.

New organisms can be custom built to perform specific tasks for a range of purposes, ranging from medical diagnostic tests to the detection of bugs in water supplies.

There are plans for biological computers, where electronic circuits are replaced by synthetic biological systems and artificial photosynthesis, where fuel is produced from artificial leaves.

The humble yeast – a single-cell fungus – is vital to many of Australia's key industries and are ideal for research because they are the most simple eukaryotic cells that are easily propagated and only survive in man-made environments such as laboratories.

The ability to design and create synthetic yeast "to order" so that it can perform specific tasks, stands to benefit a range of sectors from primary production to medical research.

The Yeast 2.0 program is an ambitious project. Earlier this year, Professor Boeke's laboratory announced it had synthesised the first functional chromosome in yeast, marking an important first step.

The next step requires an international mission to create the other 15 chromosomes that are needed to generate the first fully synthetic yeast by 2017.

I will be leading the Australian team at Macquarie University responsible for the synthesis of yeast's chromosome 14. The other 15 chromosomes will be synthesised by the Yeast 2.0 partners and, as this synthetic genomics project continues, further universities will also become involved in synthetic biology beyond this yeast-focused project.

Synthetic biology: different to genetic modification

At this point, some clarification is needed.

While synthetic biology may involve "genes" and "engineering" it is very different from "genetic modification". Synthetic biology does not change existing genes: it invents entirely new genomes.

These new genomes can be used to change the blueprint of a yeast cell enabling that cell to perform specialised tasks such producing new, life-saving antibiotics.

So under Macquarie's leadership, Australia's contribution to synthetic yeast genomics will also cross traditional disciplinary boundaries and seek meaningful, collaborative engagement between science and society.

In the UK, public understanding of this emerging field is sophisticated, engaged and collaborative. From the start, those working at the coalface of synthetic biology research have engaged closely with those who care about the impact of their work on wider society.

So from the outset, as in the UK, our panel of experts engaged on the project will not be limited to scientists, engineers and technologists. We will engage social scientists and ethicists, we will work closely with experts in philosophy, law and religious studies.

But our objective – without reservation – is to conduct research that puts systems biology at the service of society.

Source: The Conversation