Researchers develop tools to make more complex biological machines from yeast

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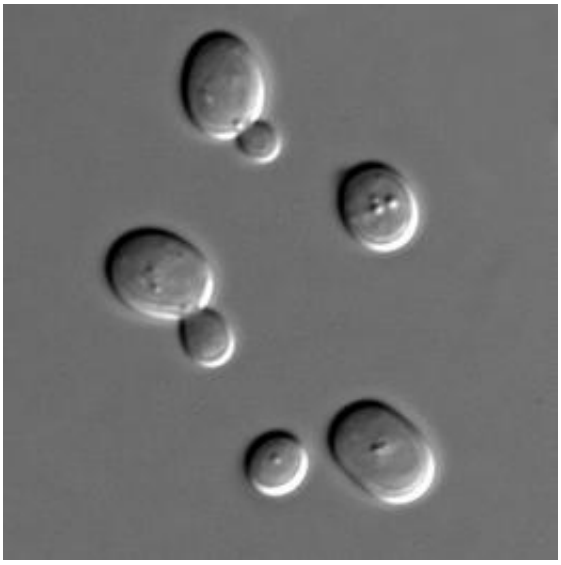

Sacharomyces cerevisiae cells in DIC microscopy. Credit: Wikipedia.

Scientists are one step closer to making more complex microscopic biological machines, following improvements in the way that they can "re-wire" DNA in yeast, according to research published today in the journal *PLoS ONE*.

The researchers, from Imperial College London, have demonstrated a way of creating a new type of biological "wire", using proteins that interact with DNA and behave like wires in electronic circuitry. The scientists say the advantage of their new biological wire is that it can be

re-engineered over and over again to create potentially billions of connections between DNA components. Previously, scientists have had a limited number of "wires" available with which to link DNA components in biological machines, restricting the complexity that could be achieved.

The team has also developed more of the fundamental DNA components, called "promoters", which are needed for re-programming yeast to perform different tasks. Scientists currently have a very limited catalogue of components from which to engineer biological machines. By enlarging the components pool and making it freely available to the scientific community via rapid Open Access publication, the team in today's study aims to spur on development in the field of synthetic biology.

Future applications of this work could include tiny yeast-based machines that can be dropped into water supplies to detect contaminants, and yeast that records environmental conditions during the manufacture of biofuels to determine if improvements can be made to the production process.

Dr Tom Ellis, senior author of the paper from the Centre for Synthetic Biology and Innovation and the Department of Bioengineering at Imperial College London, says: "From viticulture to making bread, humans have been working with yeast for thousands of years to enhance society. Excitingly, our work is taking us closer to developing more complex biological machines with yeast. These tiny biological machines could help to improve things such as pollution monitoring and cleaner fuels, which could make a difference in all our lives."

Dr Benjamin Blount, first author of the paper from the Centre for Synthetic Biology and Innovation and the Department of Bioengineering at Imperial College London, says: "Our new approach to re-wiring yeast

opens the door to an exciting array of more complex biological devices, including cells engineered to carry out tasks similar to computers."

In the study, the Imperial researchers modified a protein-based technology called TAL Effectors, which produce TALOR proteins, with similar qualities to wires in electronic devices. These TALORS can be easily re-engineered, which means that they can connect with many DNA-based components without causing a short circuit in the device.

The team says their research now provides biological engineers working in yeast with a valuable new toolbox.

Professor Richard Kitney, Co-Director of the Centre for Synthetic Biology and Innovation at the College, adds: "The work by Dr Ellis and the team at the Centre really takes us closer to developing much more complex biological machines with yeast, which may help to usher in a new age where biological machines could help to improve our health, the way we work, play and live."

Professor Paul Freemont, Co-Director of the Centre for Synthetic Biology and Innovation at the College, concludes: "One of the core aims of the Centre is to provide tools and resources to the wider scientific community by sharing our research. Dr Ellis's team has now begun to assemble characterised biological parts for yeast that will be available to researchers both in academia and industry."

More information: "Rational Diversification of a Promoter Providing Fine-Tuned Expression and Orthogonal Regulation for Synthetic Biology", 12 March 2012, *PLoS ONE* journal.

Provided by Imperial College London