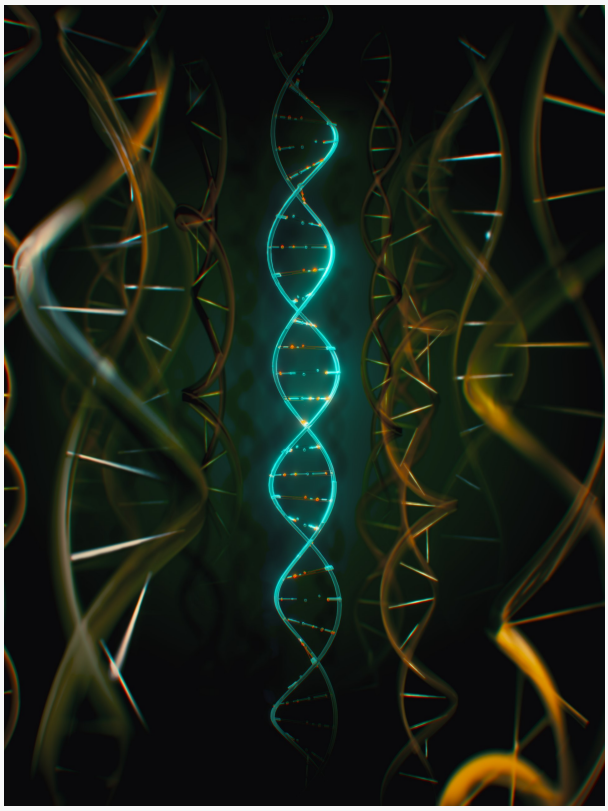
Synthetic chromosome pushes the scientific boundaries

Step closer to producing the first completely engineered yeast strain for bioindustrial solutions



Artist impression of SynXIV

SYDNEY, NSW, AUSTRALIA, November 8, 2023 /EINPresswire.com/ -- Australian researchers have moved us a step closer to having the world's first yeast strain with an entirely synthetic and versatile genome – an advance seen as a future-defining moment in science.

Dr Tom Williams, from the Australian Centre of Excellence in Synthetic Biology, based at Macquarie University, has spent the last seven years designing and building a single yeast chromosome, known as SynXIV.

It is one of 16 human-designed chromosomes that form the Yeast 2.0 project, a global bid to create the first completely engineered Saccharomyces cerevisiae strain.

The results of his research are published today in Cell Genomics.

“The global Yeast 2.0 project attempts something humanity has never done before,” says Dr Williams. “Bacterial genomes have been synthetised chemically and brought to life before but never a eukaryotic genome – which codes for life in the same kinds of cells that humans share.”

The Yeast 2.0 project is delivering genome-engineering tools and technologies that will help connect the dots between our improved understanding of a complex cell and the application of bioengineered cells designed for advanced biomanufacturing of beneficial products.

Yeast is considered the workhorse of synthetic biology for its versatility and capacity through bioengineering to address some of the world’s biggest challenges relating to food, water, energy and the economy.

“The ultimate goal is for the synthetic yeast to have the same fitness as wild type yeast,” says Dr

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>
> *Professor Sakkie Pretorious*

Williams. "That's been a real challenge that the whole consortia has struggled with and why it's taken most of my life for the past seven years to build this."

Dr Williams says built into every one of these chromosomes is a new-to-nature gene shuffling mechanism called SCRaMbLE add link

What that means is we can switch on the shuffling of the chromosomes by expressing a particular enzyme that rearranges the DNA.

This will deliver the capacity to produce an infinite number of unique genomes at the flick of a switch.

Co-author Professor Ian Paulsen, who leads the Australian Centre of Excellence in Synthetic Biology, says this means scientists are not "just limited to tinkering with a few genes at a time but can engineer hundreds and thousands of genes in parallel."

"The synthesis of a functional yeast chromosome is a major breakthrough in science that has only been achieved in a handful of laboratories in the world," says co-author Professor Sakkie Pretorious, Deputy Vice-Chancellor, Research at Macquarie University.

"Our findings and learnings from the Yeast 2.0 project, and the concurrent advancements in bio-design tools and smart data-intensive technologies, make a future world powered by a thriving bioeconomy seem realistic.

"Explorations such as this have a rich history of resulting in unexpected discoveries and unanticipated applications for the benefit of people and planet."

The work is described in Cell Genomics – 10.1016/j.xgen.2023.100379.

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