Minimalist BIOLOGY

BIOCHEMICAL SOCIETY

What is Synthetic Biology?

Living organisms are made up of many types of molecules, from lipids and sugars to the long chains of deoxyribonucleic acid (or DNA) that forms our genomes. Those molecules in turn interact to carry out every chemical function unique to any given cell, be it a bacterium or a human nerve cell (neuron).

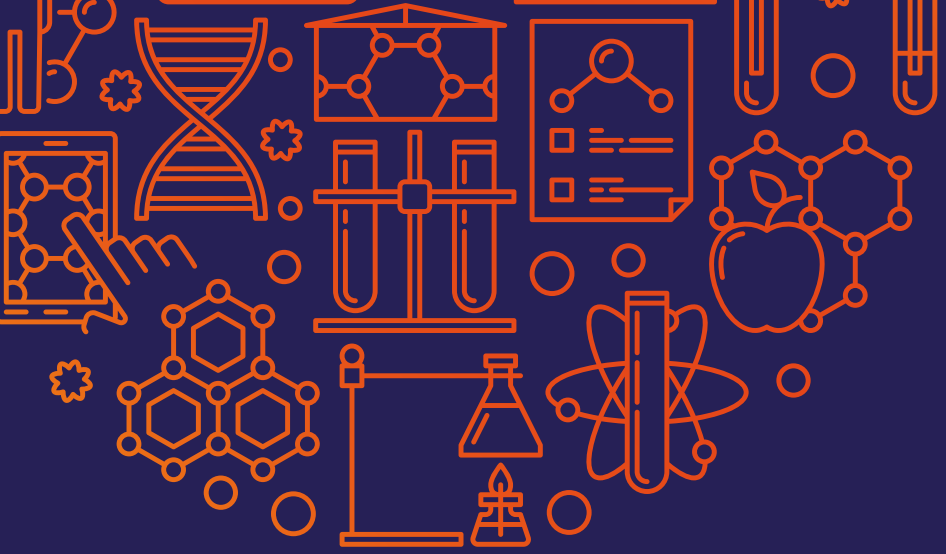
Synthetic biology is an emerging field created at the crossroads of biology, chemistry, physics and engineering that brings all these disciplines together to modify biological systems or to create completely new ones.

How do scientists "do" Synthetic Biology?

Mycoplasma are among the smallest bacteria. Their genomes contain the fewest number of genes known in nature, yet these can be stripped down even further to make a biological chassis – a carrier or factory in which to put the tools for whatever job scientists want these bacteria to carry out.

In a top-down approach, a sequence of DNA instructions made in a laboratory can be given to cells containing a scaffold genome - one that has been dismantled to the bare minimum of instructions required for cellular function.

In bottom-up approaches, an entire genome is built from scratch in the laboratory and transferred to a cellular chassis, which will in turn implement the instructions that are contained in that new genome.



What are the applications of Synthetic Biology?

Biological systems can be engineered to detect chemicals in the environment, such as pollutants, or to produce novel proteins that recognise a variety of molecules, functioning as **biosensors** and generating a signal that researchers can measure and quantify.

Bacterial cells can be artificially engineered and rewired to produce foreign compounds that may be used as environmentally friendly energy sources called **biofuels**.

Bacterial and human cells can be modified to produce molecules with therapeutic potential, such as new antibacterial agents, or function as targeted drug delivery systems to fight diseases such as cancer, both examples of synthetic **therapeutic systems**.

Cells can be engineered to produce novel biological polymers, or reprogrammed to function themselves as components of these new **biomaterials**.

Using synthetic biology approaches, researchers can also transform living cells into **biological computers** capable of complex computational tasks, from calculations to information storage.