

# Sustainable vaccines and fuels research boosted by computer breakthrough

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Synthetic biology uses living cells to create and enhance molecules that can be used in biofuels or as precursors to medical drugs. Credit: University of Aberdeen

Sustainable sources of fuels and new medicines and vaccines for a growing global population could be a step closer after the University of Aberdeen made an important breakthrough that will optimise a new and rapidly evolving biotechnology.

Synthetic biology, a new increasingly used biotechnology, uses living

cells to create and enhance molecules that can be used in biofuels or as precursors to medical drugs.

However, when scientists use biotechnology processes to make the proteins used in many medicines, the process can work inefficiently. Sometimes not enough key medicinal proteins are made, or the proteins don't work properly.

Now researchers at the University of Aberdeen have, for the first time, used computers to find out what goes wrong during the process, and correct it.

In addition, along with the University of Maryland and biotechnology firm Fujifilm Diosynth Biotechnologies, Aberdeen has been awarded £700,000 in funding by the Biotechnology and Biological Sciences Research Council (BBSRC) to advance the research further.

Biotechnology is already used to create a wide range of antibodies - the body's natural response to disease or infection. For example, the Hepatitis B vaccine is made by combining the gene from the virus with baker's yeast. This creates the hepatitis protein which, when injected into humans as a vaccine, stimulates the body to create antibodies against it. Similarly, a human gene can be combined with *E. coli* to make insulin for treatment of diabetes.

This extremely complicated process, called recombinant protein expression, is not always reliable however. Sometimes an insufficient quantity of proteins is made, or the proteins are made inaccurately.

Now mathematicians, physicists and microbiologists from the University of Aberdeen have shown for the first time that mathematical models can replicate this process to understand the reasons why it goes wrong. This allowed them to show that small changes in the cell biochemistry could

improve the manufacture of the proteins. The findings have been published in *Nucleic Acids Research*.

By understanding why the proteins aren't being created correctly during biotechnology, microbiologists can use a process called [synthetic biology](#) to correct this process, and optimise the biotechnological production of medicines and vaccines.

Once corrected, the cell is able to 'sense' when the creation of these valuable proteins is becoming inaccurate, and will actively slow down their own production to improve the quality.

"Synthetic biology is going to become essential in the future for producing everything from new, sustainable medicines and treatments, to sustainable chemicals made from plant-derived raw materials," explains Professor Ian Stansfield from the University of Aberdeen's Institute of Medical Sciences.

"We are developing ways of optimising this process by simulating the 'protein manufacturing process' in a computer, which means we can tailor the genes to ensure the process is more efficient and more reliable." commented Dr Mamen Romano, co-project lead from the University of Aberdeen's Institute of Complex Systems and Mathematical Biology.

Professor Stansfield explained: "Our latest paper shows for the first time that we can accurately simulate this process in a computer and our next project in conjunction with the University of Maryland and our industrial partners Fujifilm Diosynth Biotechnologies will advance this research even further.

"There is also an important public awareness and acceptance element that we, as scientists, along with other relevant authorities need to

encourage. There are clearly misgivings in some people's minds concerning the production of genetically modified consumables and medicines – much of which, we believe, stems from a lack of accessible and reliable information on the subject. We hope to work to inform and reassure people of the benefits and potential of this exciting new area of science."

Provided by University of Aberdeen

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