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## First artificial life 'within months'

By Roger Highfield, Science Editor

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- From reading DNA to writing it
- Audio: Roger Highfield on the significance of the breakthrough

Scientists could create the first new form of artificial life within months after a landmark breakthrough in which they turned one bacterium into another.

In a development that has triggered unease and excitement in equal measure, scientists in the US took the whole genetic makeup - or genome - of a bacterial cell and transplanted it into a closely related species.

This then began to grow and multiply in the lab, turning into the first species in the process.

The team that carried out the first "species transplant" says it plans within months to do the same thing with a synthetic genome made from scratch in the laboratory.



Craig Venter likened the process to 'changing a Macintosh computer into a PC by inserting a new piece of software'

If that experiment worked, it would mark the creation of a synthetic lifeform.

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The scientists want to create new kinds of bacterium to make new types of bugs which can be used as green fuels to replace oil and coal, digest toxic waste or absorb carbon dioxide and other greenhouse gases from the atmosphere.

But this pioneering research also triggers unease about the limits of science and the inevitable fears about "playing god," as well as raising the spectre that this technology could one day be abused to create a new generation of bioweapons.

Producing living cells from synthetic genomes of lab-made DNA would require the ability to move and manipulate whole genomes.

To that end, a milestone was passed today by a team led by Craig Venter, the first person to have his entire genetic makeup read, and which included the Nobel prizewinner Ham Smith.

Dr Venter said that, in the light of this success, the culmination of a decade's work, he will be attempting the first transplant of a lab-made genome to create the first artificial life "within months."

Dr Venter said: "We would hope to have the first fuel from synthetic organisms certainly within the decade, possibly within half that time."

The breakthrough occurred at the J Craig Venter Institute in Rockville, Maryland, the team reports today in the journal Science.

One of its editors called it "a landmark in biological engineering."

Since the 1970s, scientists have moved genes - instructions to make proteins - between different organisms.

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But this marks the first time that the entire instruction set, consisting of more than a million "letters" of DNA, has been transplanted, transforming one species of bacterium into another.

They are attempting to build a microbe with the minimal set of genes needed for life, with the goal of then adding other useful genes, such as ones for making biofuels.

It recently submitted broad patents for methods to create a synthetic genome from such lab-made DNA.

In anticipation, the team wanted to develop a way to move a complete genome into a living cell, choosing the simplest and smallest kind, a bacterium.

In all, of the millions of bacteria that they tried the transplant on, it only worked one time in every 150,000.

Dr Venter likened it to "changing a Macintosh computer into a PC by inserting a new piece of software" and stressed it would be more difficult in other kinds of cells, which have enzymes to snip the DNA of invaders.

But he said to achieve the feat, without adding anything more than naked DNA, "is a huge enabling step."

"This is a significant and unexpected advance," commented Robert Holt of the Michael Smith Genome Sciences Centre, Vancouver, Canada.

"It's a necessary step toward creating artificial life," added microbiologist Fred Blattner of the University of Wisconsin, Madison.

Antoine Danchin of the Pasteur Institute, Paris, calls the experiment "an exceptional technical feat."

But he told Science "many controls are missing." And that has prevented Glass's team, as acknowledged by Ham Smith, from truly understanding how the introduced DNA reprograms the host cell.

"We are one step closer to synthetic organisms," said Markus Schmidt of the Organisation for International Dialogue, Vienna.

He said the experiment will drive discussions about the safety issues related to synthetic biology and the implications for society.

Dr Venter stressed that the work had been halted for some time for a review to ensure it is ethical, though acknowledged concerns that synthetic biology could pave the way to new kinds of biowarfare.

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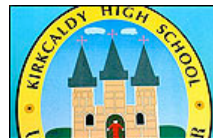
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