

This copy is for your personal, noncommercial use only. You can order presentation-ready copies for distribution to your colleagues, clients or customers [here](#) or use the "Reprints" tool that appears next to any article. Visit [www.nytreprints.com](http://www.nytreprints.com) for samples and additional information. [Order a reprint of this article now.](#)

PAUL DANO  
PAUL GIAMATTI  
LUPITA NYONG'O

May 20, 2010

# Researchers Say They Created a 'Synthetic Cell'

By **NICHOLAS WADE**

The genome pioneer **J. Craig Venter** has taken another step in his quest to create synthetic life, by synthesizing an entire bacterial genome and using it to take over a cell.

Dr. Venter calls the result a "synthetic cell" and is presenting the research as a landmark achievement that will open the way to creating useful microbes from scratch to make products like vaccines and [biofuels](#). At a press conference Thursday, Dr. Venter described the converted cell as "the first self-replicating species we've had on the planet whose parent is a computer."

"This is a philosophical advance as much as a technical advance," he said, suggesting that the "synthetic cell" raised new questions about the nature of life.

Other scientists agree that he has achieved a technical feat in synthesizing the largest piece of DNA so far — a million units in length — and in making it accurate enough to substitute for the cell's own DNA.

But some regard this approach as unpromising because it will take years to design new organisms, and meanwhile progress toward making biofuels is already being achieved with conventional genetic engineering approaches in which existing organisms are modified a few genes at a time.

Dr. Venter's aim is to achieve total control over a bacterium's genome, first by synthesizing its DNA in a laboratory and then by designing a new genome stripped of many natural functions and equipped with new genes that govern production of useful chemicals.

"It's very powerful to be able to reconstruct and own every letter in a genome because that means you can put in different genes," said Gerald Joyce, a biologist at the Scripps Research Institute in La Jolla, Calif.

In response to the scientific report, **President Obama** asked the White House to commission on Thursday to complete a study of the issues raised by synthetic biology in six months and report back to him on its findings. He said the new development



OPEN

MORE IN  
**Withc  
Nobel**  
Read Mo

“genuine concerns,” though he did not specify them further.

---

Dr. Venter took a first step toward this goal three years ago, showing that the natural DNA from one bacterium could be inserted into another and that it would take over the host cell's operation. Last year, his team synthesized a piece of DNA with 1,080,000 bases, the chemical units of which DNA is composed.

In a final step, a team led by Daniel G. Gibson, Hamilton O. Smith and Dr. Venter [report in Thursday's issue of the journal Science](#) that the synthetic DNA takes over a bacterial cell just as the natural DNA did, making the cell generate the proteins specified by the new DNA's genetic information in preference to those of its own genome.

The team ordered pieces of DNA 1,000 units in length from Blue Heron, a company that specializes in synthesizing DNA, and developed a technique for assembling the shorter lengths into a complete genome. The cost of the project was \$40 million, most of it paid for by Synthetic Genomics, a company Dr. Venter founded.

But the bacterium used by the Venter group is unsuitable for biofuel production, and Dr. Venter said he would move to different organisms. Synthetic Genomics has a contract from Exxon to generate biofuels from algae. Exxon is prepared to spend up to \$600 million if all its milestones are met. Dr. Venter said he would try to build “an entire algae genome so we can vary the 50 to 60 different parameters for algae growth to make superproductive organisms.”

On his yacht trips round the world, Dr. Venter has analyzed the DNA of the many microbes in seawater and now has a library of about 40 million genes, mostly from algae. These genes will be a resource to make captive algae produce useful chemicals, he said.

Some other scientists said that aside from assembling a large piece of DNA, Dr. Venter has not broken new ground. “To my mind Craig has somewhat overplayed the importance of this,” said [David Baltimore](#), a geneticist at Caltech. He described the result as “a technical tour de force,” a matter of scale rather than a scientific breakthrough.

“He has not created life, only mimicked it,” Dr. Baltimore said.

Dr. Venter's approach “is not necessarily on the path” to produce useful microorganisms, said George Church, a genome researcher at Harvard Medical School. Leroy Hood, of the Institute for Systems Biology in Seattle, described Dr. Venter's report as “glitzy” but said lower-level genes and networks had to be understood first before it would be worth trying to design whole organisms from scratch.

In 2002 Eckard Wimmer, of the [State University of New York at Stony Brook](#), synthesized the

genome of the [polio](#) virus. The genome constructed a live polio virus that infected and killed mice. Dr. Venter's work on the bacterium is similar in principle, except that the polio virus genome is only 7,500 units in length, and the bacteria's genome is more than 100 times longer.

Friends of the Earth, an environmental group, denounced the synthetic genome as "dangerous new technology," saying that "Mr. Venter should stop all further research until sufficient regulations are in place."

The genome Dr. Venter synthesized is copied from a natural bacterium that infects goats. He said that before copying the DNA, he excised 14 genes likely to be pathogenic, so the new bacterium, even if it escaped, would be unlikely to cause goats harm.

Dr. Venter's assertion that he has created a "synthetic cell" has alarmed people who think that means he has created a new life form or an artificial cell. "Of course that's not right — its ancestor is a biological life form," said Dr. Joyce of Scripps.

Dr. Venter copied the DNA from one species of bacteria and inserted it into another. The second bacteria made all the proteins and organelles in the so-called "synthetic cell," by following the specifications implicit in the structure of the inserted DNA.

"My worry is that some people are going to draw the conclusion that they have created a new life form," said Jim Collins, a bioengineer at [Boston University](#). "What they have created is an organism with a synthesized natural genome. But it doesn't represent the creation of life from scratch or the creation of a new life form," he said.