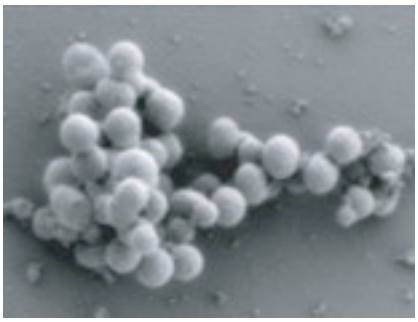
Scientists report first cell made with artificial genes

May 20, 2010
Courtesy of the American Association
for the Advancement of Science
and World Science staff

Scientists say they have developed the first cell controlled by an artificial genome.

Although it's a near-copy of a natural genome, the researchers say their method can be used to better understand the basic machinery driving life, and to engineer bacteria for tasks such as fuel production or environmental cleanup.



The synthetic cells, dubbed JCVI-syn 1.0. (Courtesy AAAS)

The research group, at the J. Craig Venter Institute in Rockville, Md., was already credited with chemically producing a bacterial genome, and with transplanting the genome of one bacterium to another. In the latest work, reported in the May 21 issue of the research journal *Science*, the team combined both methods. The result is what they call a "synthetic cell," though only its genome is synthetic, or artificial.

"This is the first synthetic cell... we call it synthetic because the cell is totally derived from a synthetic chromosome, made with four bottles of chemicals on a chemical synthesizer, starting with information in a computer," said J. Craig Venter, president of the institute and leader of the research. The artificial genome consisted of a sequence of DNA code on a single chromosome; bacteria need only one, circular chromosome. The new genome's code was copied from that of a bacterium known as *Mycoplasma mycoides*. However, the scientists added DNA sequences that "watermarked" the genome to distinguish it from the original.

Because current machines can only assemble relatively short strings of DNA letters at a time, the researchers used the DNA repair machinery of yeast and *E. coli* bacteria to link these strings together and form full chromosomes. After three rounds of assembly involving transplanting between yeast and *E. coli*, the researchers had produced a genome over a million base pairs, or genetic "letters," long.

The scientists then transplanted the synthetic *M. mycoides* genome into another, related type of bacteria, *Mycoplasma capricolum*. The new genome "booted up" the recipient cells. These began to function almost like the original *M. mycoides* as judged by the chemical products of their genes, proteins, and by the cells' colonizing properties, said Venter and colleagues. Fourteen genes failed to function in the transplant bacteria, the researchers said, but this didn't disrupt the overall activity of the new cells, which also could reproduce.

"This is an important step, we think, both scientifically and philosophically," Venter said.

Acknowledging that research into the creation of artificial life forms is subject to ethical debates, Venter said his team asked for a bioethical review in the late 1990s and has participated in various discussions on the topic. "I think this is the first incidence in science where the extensive bioethical review took place before the experiments were done. It's part of an ongoing process that we've been driving, trying to make sure that the science proceeds in an ethical fashion," he said.