

The Implications of Synthetic Life

Parsa Shahbodahi

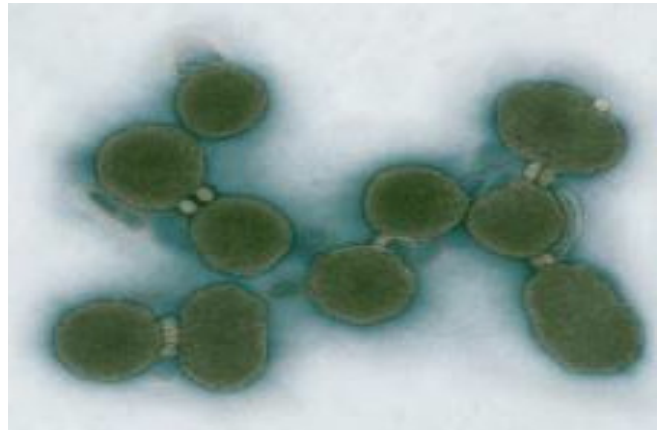
Craig Venter and his lab have created an organism with entirely synthetic DNA. The lab, in 2010, created a cell with a synthetic genome. As exciting as this breakthrough is, it has many concerned about the implications of this experiment.¹ How will this scientific breakthrough affect the way we live tomorrow?

Venter suggests that this technology will usher in a new industrial revolution where man-made organisms can produce flu vaccines or become effective tools in treating disease.² He is hopeful that he and his fellow scientists can modify the genetic code of algae to "...vary the 50 to 60 different parameters for algae growth to make superproductive organisms [in the production of biofuels]."² However, critics of this approach are concerned that new bio-weapons could be created from synthetic organisms and that they could be particularly devastating in the hands of terrorists.

That said, it's important for people not to overreact to the either the potential benefits or dangers of this research. For one thing, reaping the benefits of synthetic life is going to be difficult. For example, scientists would like to create an organism that can absorb carbon dioxide. They are going to have to overcome immense challenges to perform this task. First, they would have to find a gene or a series of genes that absorbs carbon dioxide in plants, algae, or some other organism. They would then have to understand many of the biochemical aspects of carbon-fixation in order to produce an organism that could perform the given function (CO₂ absorption) more efficiently than its natural counterpart. Needless to say, it's an extremely complicated and costly process.

That's actually why it is highly unlikely that you will see synthetic organisms being used in a potential terrorist attack. It takes a tremendous amount of resources to create an organism that might or might not kill people as effectively as something that isn't already out there (it cost the J. Craig Venter Institute \$40 million to finance the creation of the first synthetic cell)¹. It is much easier to fill a few envelopes with anthrax than to hire a bunch of mad scientists to create a deadly synthetic organism.

There is another concern with this line of research, however. The ecological impact of unknowingly introducing synthetic organisms into the environment could be potentially devastating. Humans have introduced the Asian carp in the United States and it became highly detrimental to the environment and later became known as an invasive species.³ People also bred two different sub-species of bee in an effort to create a bee that could produce more honey, an effort that gave rise to the killer bee⁵, an organism that is far more aggressive than its bee cousins⁶. We don't know the ecological impact of creating organisms through artificial selection, so how on earth would we know the impact of introducing man-made organisms into the environment? How will we simulate the conditions organisms will live under in order to understand



Above: Negatively stained electron micrographs of aggregated *M. Mycoides*, provided by the J. Craig Venter Institute

the impact they will have once they have been released into a natural habitat? It's a question that currently seems beyond the scope of science, and therefore all possible preventative measures must be taken to ensure synthetic organisms do not escape from a controlled environment.

With quandaries like this, it's unlikely that humanity will see the benefits (or dangers) of synthetic life for some time. However, we shouldn't focus on the fact that we might not see any potential benefits. The marvel of this experiment is that it provides essentially indisputable evidence for the underlying principle of all biology: that an organism's DNA determines its form and function. Dr. Venter and his fellow scientists removed all the DNA from the cell of one bacterial species and inserted synthetically made DNA of a different bacterial species.⁷ After the synthetic DNA was inserted, the cell began to proliferate and exhibited none of the qualities of the host cell. In fact, it behaved like any other organism with natural DNA.⁷ All of these experimental observations allow us to understand that the only thing that truly determines what every living thing will become is its genes and the manner in which its genes are expressed.

References

1. Katsnelson, Alia. "Researchers Start up Cell with Synthetic Genome." *www.nature.com*. Nature, 20 May 2010. Web. 7 Oct. 2010. <<http://www.nature.com/news/2010/100519/full/news.2010.253.html>>.
2. Wade, Nicholas. "Researchers Say They Have Created A 'Synthetic Cell'" *The New York Times*. The New York Times, 21 May 2010. Web. 9 Oct. 2010. <http://www.nytimes.com/2010/05/21/science/21cell.html?_r=1&ref=j_craig_venter>.
3. Gill, Victoria. "'Artificial Life' Breakthrough Announced by Scientists." *BBC - Homepage*. British Broadcasting Corporation, 20 May 2010. Web. 11 Oct. 2010. <<http://www.bbc.co.uk/news/10132762>>.
4. USGS. "Carassius Carassius (Linnaeus 1758)." *Nas.er.usgs.gov*. United States Geological Survey, 8 Apr. 2005. Web. 10 Oct. 2010. <<http://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=509>>.

Parsa Shahbodahi is a staff writer for TuftScope