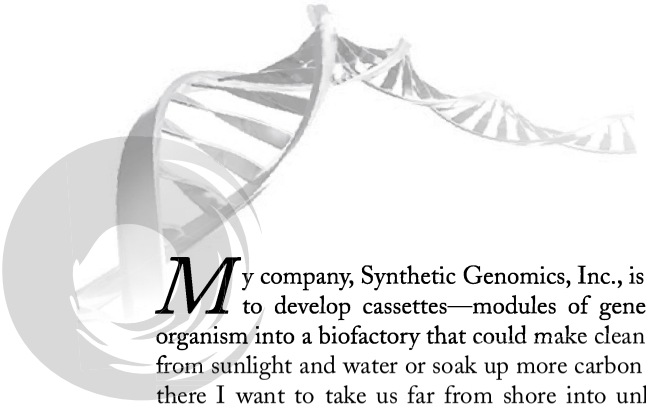
SYNTHETIC LIFE



> My company, Synthetic Genomics, Inc., is already trying to develop cassettes—modules of genes—to turn an organism into a biofactory that could make clean hydrogen fuel from sunlight and water or soak up more carbon dioxide. From there I want to take us far from shore into unknown waters, to a new phase of evolution, to the day when one DNA-based species can sit down at a computer to design another. I plan to show that we understand the software of life by creating true artificial life.
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> —J. Craig Venter, "A Life Decoded: My Genome: My Life" (Viking Adult; First Edition, October 18, 2007)

On May 20, 2010, *Science Express* published the research article "Creation of a Bacterial Cell Controlled by a Chemically Synthesized Genome" by research scientists of the J. Craig Venter Institute. The next day, Elizabeth Pennisi explained its significance in *Science Magazine* with her article "Synthetic Genome Brings New Life to Bacterium." This kindled a worldwide media firestorm and people's imagination ran wild. If the results could be confirmed, the possibilities were endless.

The *Financial Times* headline read, "Scientists Create Synthetic Life Form with a Computer and Four Bottles of Chemicals." The *New York Times* released, "Synthetic Bacterial Genome Takes Over a Cell, Researchers Report." The *Wall Street Journal* stated, "Scientists Create Synthetic Organism." *The Economist* in London read, "And Man Made Life: The First Artificial Organism and its Con-

sequences." A headline in the German newspaper *DIE ZEIT* read, "Humans can now Play Creators."

Instead of jumping to conclusions, I chose to read the facts for myself. After sifting through a host of sensational commentaries, I located the original research paper in *Science Express* and the May 20, 2010 press release, "First Self-Replicating Synthetic Bacterial Cell" from J. Craig Venter Institute's Web site. The White House wasted no time when the story broke. That same day, President Barack Obama issued the following statement in a letter to Dr. Amy Gutmann, President, and Christopher H. Browne, Distinguished Professor of Political Science at the University of Pennsylvania:

> As you know, scientists have announced a milestone in the emerging field of cellular and genetic research known as synthetic biology. While scientists have used DNA to develop genetically modified cells for many years, for the first time, all of the natural genetic material in a bacterial cell has been replaced with a synthetic set of genes. This development raises the prospect of important benefits, such as the ability to accelerate vaccine development. At the same time, it raises genuine concerns, and so we must consider carefully the implications of this research.
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> I therefore request that the Presidential Commission for the Study of Bioethical Issues undertake, as its first order of business, a study of the implications of this scientific milestone, as well as other advances that may lie ahead in this field of research. In its study, the Commission should consider the potential medical, environmental, security, and other benefits of this field of research, as well as any potential health, security or other risks. Further, the Commission should develop recommendations about any actions the Federal government should take to ensure that America reaps the benefits of this developing field of science while identifying appropriate ethical boundaries and minimizing identified risks. My Science and Technology Advisor, Dr. John P. Holdren, will be in communication with you about the scope and progress of your study.
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> —President Barack Obama, White House, Washington, DC, May 20, 2010

The Human Genome Project defines a genome on their website as "all the DNA in an organism, including its genes." They continue to say, "Genes carry information for making all the proteins required by all organisms. These proteins determine, among other things, how the organism looks, how well its body metabolizes food or fights infection, and sometimes even how it behaves." DNA is a combination of four chemicals called bases abbreviated A, T, C, and G, which form the building blocks of all life. The order of how these bases are paired determines life's diversity. The human genome has three billion base pairs, so identifying a complete genome is no easy task.

In simple terms, the scientists at J. Craig Venter Institute designed a complete synthetic genome on a computer and assembled it in a yeast cell. They then isolated it from the yeast cell and transplanted it into a bacterial cell which had its own genome destroyed. After surmounting several hurdles in the process, the cell responded to the instructions from the synthetic genome. It then began replicating to make a new set of proteins. This process was different to cloning because the genome did not come from another organism. It was the creation of synthetic life because it was designed on a computer.

To the untrained eye, this furor seems unwarranted. What's the big deal? What they did was on such a small scale that it doesn't change anything in our day-to-day lives. That might be true if all we lived for was today. This scientific breakthrough will change our lives in the future. According to the May 21, 2010, article in *Science Magazine*, the project lasted fifteen years and cost an estimated forty million dollars. Obviously, it's significant, because the money is coming from somewhere. All life, including human life, comes from a self-replicating cell that responds to instructions from its genome. If they can create fully functional genomes on a computer already, it's a very big deal.

What Does the Bible Say about Synthetic Life?

> Then I saw another beast come up out of the earth. He had two horns like those of a lamb, but he spoke with the voice of a dragon. He exercised all the authority of the first beast.

> And he required all the earth and its people to worship the first beast, whose fatal wound had been healed. He did astounding miracles, even making fire flash down to earth from the sky while everyone was watching. And with all the miracles he was allowed to perform on behalf of the first beast, he deceived all the people who belong to this world. He ordered the people to make a great statue of the first beast, who was fatally wounded and then came back to life. *He was then permitted to give life to this statue so that it could speak.* Then the statue of the beast commanded that anyone refusing to worship it must die. He required everyone—small and great, rich and poor, free and slave—to be given a mark on the right hand or on the forehead. And no one could buy or sell anything without that mark, which was either the name of the beast or the number representing his name. Wisdom is needed here. Let the one with understanding solve the meaning of the number of the beast, for it is the number of a man. His number is 666.
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> Revelation 13:11–18 NLT *(emphasis mine)*

The Bible says, "And he had power to give life unto the image of the beast, that the image of the beast should both speak, and cause that as many as would not worship the image of the beast should be killed" (Revelation 13:15 KJV). One day, mankind will have the power to give life to something inanimate. Synthetic life was prophesied by the Apostle John thousands of years before the technology was developed to make it happen. The Christian viewpoint on synthetic life really is not hard to locate. If the Bible is the book upon which we base our position, then it gives us the answer. Synthetic biology is an inevitability. Revelation 13:15 is a symbolic representation of this.

If scientists at J. Craig Venter Institute can assemble a synthetic genome in a yeast cell after fifteen years of research in 2010, what will be possible fifteen years later, in 2025? Living in denial doesn't change the future. In the quote to start this chapter, J. Craig Venter undoubtedly stated his true intentions in his book "A Life Decoded: My Genome: My Life" and is well on his way to seeing it happen. On the molecular level, they can already give life to a bacterial cell and absolutely nothing can stop them from extending their research

to human cells. In fact, I believe it's probably already been done and we just don't know about it.

> Our synthetic genomic approach stands in sharp contrast to a variety of other approaches to genome engineering that modify natural genomes by introducing multiple insertions, substitutions, or deletions (18–22). This work provides a proof of principle for producing cells based upon genome sequences designed in a computer. DNA sequencing of a cellular genome allows storage of the genetic instructions for life as a digital file. If the methods described here can be generalized, design, synthesis, assembly, and transplantation of synthetic chromosomes will no longer be a barrier to the progress of synthetic biology.
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> —*Creation of a Bacterial Cell Controlled by a Chemically Synthesized Genome* by Daniel Gibson et al of The J. Craig Venter Institute published on May 20, 2010 in Science Express

I released the book *Revelation Unplugged: Decoding the Book of Revelation* in 2009. I studied the book of Revelation in detail and connected it with other parts of the Bible that covered the same areas of Bible prophecy. At the time, I looked at everything with a very religious eye. I had no idea that within my lifetime, science would actually catch up to what has only lived in the imagination of Christians for thousands of years. I interpreted Revelation 13:15 from a religious perspective. Now I see that many scriptures like these contain underlying themes that are unfolding before our very eyes. They have already given life to a bacterial cell and may do the same with a human cell within our lifetime.

Is Synthetic Life Morally Acceptable?

After President Obama issued his statement in response to the big announcement from J. Craig Venter Institute, Craig Venter was asked to testify before the US House Committee on Energy and Research. Of course, he provided all the right answers about the benefits of synthetic life, but it does take a high level of naïveté to not see where this is going. For every lofty intention that's portrayed before the public,

there's some ulterior motive brewing beneath the surface. Guest columnist for Christian Post, R. Albert Mohler Jr gave a stirring analysis of this issue in the article "Has Man Created Life?"

> Venter, never one to underplay his achievements, described the transformed cell as "the first self-replicating species we've had on the planet whose parent is a computer." He added, "This is a philosophical advance as much as a technical advance." But what kind of philosophical advance? Writing at The Guardian [London], Andrew Brown described "this moment of complete victory for materialism," noting that atheists would point to the announcement as evidence that there is no need for a divine Creator. David Baltimore, another influential scientist, described Venter's achievement as "a technological tour de force," but rejected the claim that Venter had created life. "He has not created life, only mimicked it," he told The New York Times. On the other hand, University of Pennsylvania bioethicist Arthur Caplan described the achievement of Venter's team as "one of the most important scientific achievements in the history of mankind." He told The Financial Times: "Venter's achievement would seem to extinguish the argument that life requires a special force or power to exist."
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> —"Has Man Created Life?" by R. Albert Mohler Jr, president of the Southern Baptist Theological Seminary and guest columnist for Christian Post, Friday, May 28, 2010

When a man makes a genome and puts it in a cell, does that disprove God's existence? Who made the man and who made the cell? So why would anyone claim this as a victory for atheists? That's the vitriol that fills the atmosphere with each announcement like this. People with an agenda that opposes God use anything they can to fuel their disgust for all things godly. Mohler was able to capture in his article the attitude that accompanies synthetic biology. Some of the fiercest critics of the Christian faith are not research scientists, yet they conveniently use scientific research to make a case for what they believe.

> Everything is pure to those whose hearts are pure. But nothing is pure to those who are corrupt and unbelieving, because their minds and consciences are corrupted.
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> Titus 1:15–16 NLT

Based on the Bible, morality is judged solely by intentions. For instance, the same nuclear technology that was developed to produce sustainable, clean energy was also used to create nuclear weapons. Technology is neither good nor bad. The people who use it are the standard bearers of morality. Yes, there are tremendous potential benefits to humanity, but when DNA can be written on a computer to control life, who is going to determine the content?

At some point, this process will be replicated worldwide, just like DNA cloning, and there will be no way to control what direction it takes. The purpose of scientific publication is to share the stepwise approach to research findings so they could be replicated and proven to work. Once the process is out there, other scientists can follow the steps and get comparable results. Instead of repeating the same research, other scientists build on what's been published and take it to another level. Synthetic life in a bacterial cell has already been announced, so it won't be big news anymore. They have no choice now but to take this a step further.

> The new "synthetic biology" epitomized by the Venter Institute's work—in essence the ability to design new genetic code on computers and then "download" it into living organisms—heralds a new era of potentially transformative technology innovation. As if to underline this, the US House of Representatives Committee on Energy and Commerce heard testimony from Craig Venter and others on the technology's potential yesterday—just days after last week's announcement. But the technology also raises serious ethical and safety concerns: Is it right and proper to meddle with the fundamental basis of life? What happens if the technology gets into the wrong hands? And what might occur when synthetic life meets the natural world?
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> —"The Future Safety of Synthetic Biology" by Andrew Maynard, Director of the Risk Science Center at the University of Michigan School of Public Health published by the Institute for Ethics and Emerging Technologies on May 28, 2010.

Do you want to know what will happen when the technology gets into the wrong hands and synthetic life meets the natural world? Read the book of Revelation. In Revelation 13:11–18, a man will have the power to give life and will use it to wreak global havoc. We can pray, fast, fill out petitions, write letters to Congress, march in Washington, and do whatever we can, but it will not be stopped. The federal government won't stop it, scientists won't stop it, and God won't stop it either. We just have to deal with it. Until then, let's remain sober concerning the future while we consider the potential benefits of synthetic biology.

The German Academy of Science and Engineering published the following list of applications for synthetic biology in 2009:

1. The chemical enzymatic synthesis of nucleic acid and complete genomes. The specific modification and optimization of gene sequences has the potential to lead to gene-therapy products and DNA vaccines.
2. The construction of cells with a minimal genome. This genetic platform, which is reduced to the essential life functions, can be used as a "chassis" for establishing new functions.
3. The synthesis of protocells, i.e. artificial systems constructed according to biological and physical principles, which can serve as models for living cells.
4. The production of biomolecules using genetic engineering approaches to bring together complete metabolic reaction pathways according to modular design principle.
5. The design of regulatory circuits with sensitive sensory functions to control cellular and industrial process chains or networks.
6. The use of modified cellular machines in orthogonal systems. This might enable the production of polymer compounds from chemical constituents according to the drawing-board principle. Orthogonality refers to the possibility of combining independent components and is an important construction principle in the technological and computer sciences.

"Engineers of Life:" Nanowerk Nanotechnology News Email Digest, June 15, 2010

Sometimes, the position of the church on many of these issues is so far to the right that we are completely left out of the discussion. Everybody else gets to state their case while we remain outside the loop, clueless to what's going on. Anybody who is completely one sided tends to become irrelevant. Synthetic life does not disprove God, so the atheist position is irrelevant and all synthetic biologists are not guaranteed a place in hell, so that religious, fanatic position is also irrelevant.

The fact is that the science behind this is real, and the truth is that the scriptures which point toward it are also real. This is why I believe it's time to take this discussion to a more balanced position. In synthetic biology, faith and the scientific method collide to form "faith science." Gather the facts from the research and the truth from the Scriptures; then develop an informed position.

> He who answers a matter before he hears the facts—it is folly and shame to him.
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> Proverbs 18:13 AMP