EvoS Journal:
The Journal of the Evolutionary Studies Consortium

# Creating Life

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A review of: *Life at the Speed of Light: From the Double Helix to the Dawn of Digital Life.* By J. Craig Venter, Penguin Group, 2013. ISBN: 978-0670025404

What is life? How did it come to be? What is the difference between natural life and synthetic life? Is there a difference? Should we create life? These are the questions that are now having to be answered by biologists like J. Craig Venter in his book *Life at the Speed of Light*. In the book, Venter describes both the reason why he pursues his research and how his team of scientists created the first synthetic organism. By telling the personal story behind his team's research, Venter outlines the coming biotechnological revolution and how his research along with many others' will pave the road to a future where humans will have the capability to design new life and control the forces of evolution.

Venter begins the book by describing the research in biology and genetics that came before. He recounts such milestones in biology like the discovery of DNA and evolution as well as the philosophical beliefs that have affected biological thinking in each era. Throughout the book, Venter gives a vivid account of how he and his team converted the genetic code into a digital format and created the first synthetic organisms. These two accomplishments are what form the core of his book as they are linked to two great advances in biotechnology: the Human Genome Project and life by design. After describing the arduous process his team underwent to create the first synthetic organism, Venter uses the rest of the book to discuss the implications, technological and ethical, of his research. Central to Venter's argument are two facts that have been demonstrated by him and his team: DNA can be recorded digitally and stored in a computer, and synthetic organisms can be created by "downloading" this code into a suitable cell thereby transforming that cell into an entirely new organism.

"Digitizing Life" is the phrase Venter uses to describe the process of converting the genetic code into a digital medium. Throughout the book, he employs computer metaphors to serve as shorthand in describing this process by using words like "upload" to describe the process of digitizing life and storage of it on a hard drive and "download" to describe the transfer of a digitized genetic code into another organism. It is through this process that the biotechnological and digital

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revolutions will merge and, according to Venter, will open the door to designer-made organisms.

While Venter's and his team's synthetic organism (*M. mycoides*) was not "made from scratch" (the organism was originally the bacterium *M. capricolum* and the synthetic genome was transplanted into the cell after the native genome was removed), it still possessed a functioning sythetic genome that was not the original the bacterial cell. This cell multiplied regularly, built colonies, and continued to live with a wholly synthetic genome. This experiment demonstrated that not only can life by synthesized, it is also bound by the same rules of evolution as it creates yet another tributary on the river of life. Though its genetic code began as a digital file on a computer hard drive, *M. mycoides*' became a fully-functional and living organism that will continue to reproduce and evolve like "natural" life. Even though not everything about it is synthetic (its cell membrane, organelles, etc.), its "software" (DNA) is synthetic and, as according to Venter, DNA is the basis of all life.

After describing the process he and his team performed to create the first synthetic organism, Venter begins to discuss the technological and ethical implications of their work. He describes two major technological advances synthetic life might allow: a pragmatic advance and an academic advance. Pragmatically, Venter envisions new tailored-made organisms that will address major world problems like food insecurity, pollution, and climate change that will save both human and non-human lives on earth. Academically, Venter discusses how the ability to create life frees "the design of life from the shackles of evolution and opens up new vistas of life." Thus, researchers will be given an amazing tool to explore both the evolution and origins of life. Furthermore, Venter is aware of the ethical and security concerns of such research and acknowledges that investment in "underpinning technologies, science, education, and policy" is necessary to provide for a safe and efficient development of this new science. While Venter is aware that technology is often (and rightly) viewed as a "double-edged sword," he believes that the benefits of his research greatly outweigh its risks and that the ability to create new forms of life is a worthy endeavor for humankind.

The life that Venter and his team created had a purely synthetic genome that had been copied digitally to a hard drive and downloaded into the new cell. It is the opinion of this review's author that the evolutionary implications of such a life form, one born in a lab and not in nature, are too numerous to account for properly. What does the future hold for this single synthetic species? Will the technology advance to the point that multicellular life forms could be created synthetically? How will this life evolve over time? What might it evolve into? Only time will answer these questions. What can be shown for evolutionarily is that Venter and his team created a synthetic organism and that organism lived, developed, and reproduced building a population of similarly synthetic organisms. Evolution at work even within an artificial genome.

While there are still a multitude of questions left unanswered regarding the future of synthetic organisms, Venter is confident that the science will develop further, and one day it might be possible for researchers to arrange assemblies of

synthetic cells to cooperate and form larger multicellular complexes though he refrains from outright stating that these assemblages will be true multicellular entities. Ultimately, *Life at the Speed of Light* presents both a vibrant account of the creation of the first synthetic organism and the implications of such a development. While there are still many questions remaining after the book ends, there is little doubt that synthetic biology will prove to be a powerful tool for humanity in the coming years as it shapes our understanding of what life is and how it originated.

**Received May 04, 2015; Accepted June 29, 2015**