

## **Human, robot, alien: the universal succession and transformation of terrestrial life**

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Drawing from examples in science, art, technology, architecture and space exploration this paper proposes that the successors of humans may not be post humans or robots, but will instead be more akin to bacteria or synthetic forms of biology. Our role in the larger scheme of things may be simply to act in the capacity of midwives to facilitate the evolution of our more robust and sophisticated successors. Cross-disciplinary collaborations are now taking place that fundamentally challenge our anthropocentric evolutionary aspirations.

Hans Moravec proposed that our successors would be silicon biology, or robots, that would colonize the universe in our stead, rendering humans a transitional stage in evolution rather than as a definitive tertiary species [1].

Developments within the field of chembiogenesis suggest that the creation of artificial life forms within the laboratory is not only feasible within the next ten years according to Mark Bedau of Proto Life, based in Venice Italy, but marks the beginning of an age of synthetic organisms whose existence will be at first fragile [2] but gradually, with human nurturing, will become self sustaining and independent from us.

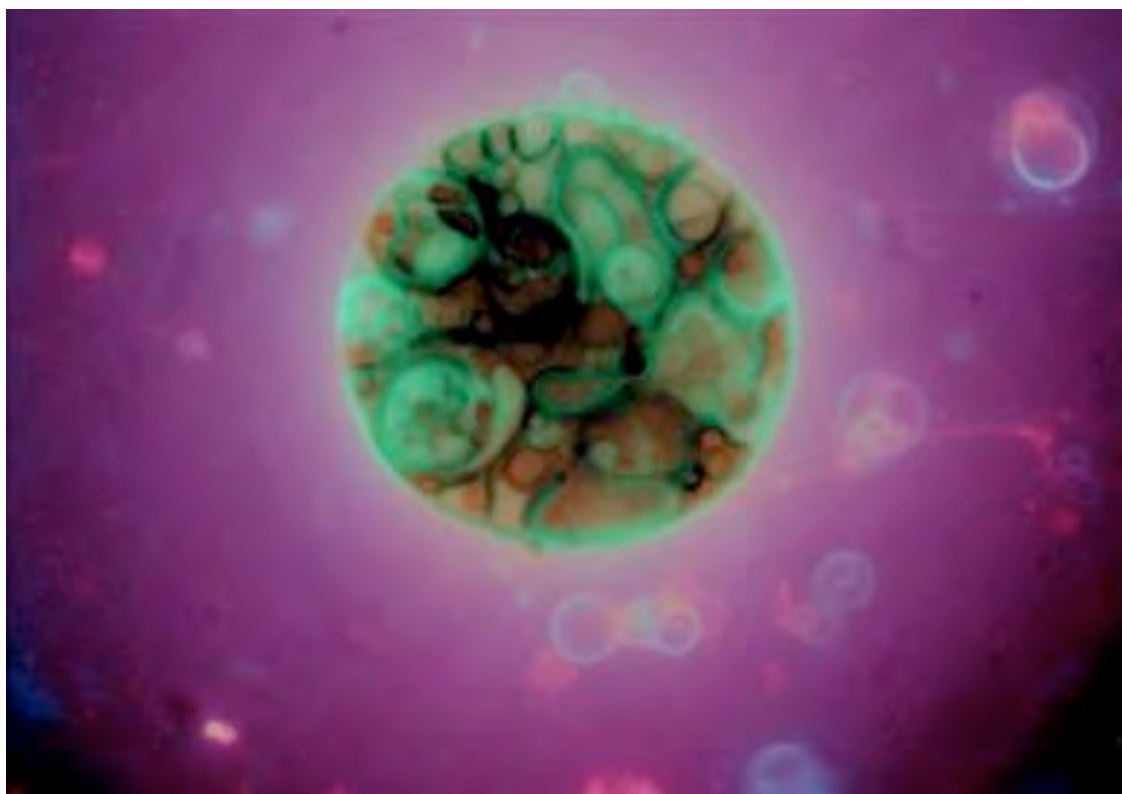


Figure 1. A Protocell – the first cell of synthetic life, with the potential to shed new light on our role in the universe. (Courtesy of Martin Hanczyc and Proto Life, © Martin Hanczyc).

According to Dimitar Sasselov, Director of the Harvard Origins of Life Initiative, new forms of self sustaining chemistry may actually be our legacy in the universe [3] and the notion that ‘wet’ alien biology that is already present here on earth is well established [4]. That bacteria might succeed where humans fail is not unthinkable since bacterial *Extremophiles* thrive in the most inhospitable conditions [5] where ‘advanced’ eukaryotes cannot survive. Perhaps anthropocentrism has made us blind to the sophistication of ‘primitive’ bacteria that continue to be the most successful phylum in Earth’s biotic history. After all, they have already indulged in a few billions years more of evolutionary refinement than our own, relatively immature, species *Homo Sapiens* [6].

Contrary to conventional wisdom which treats bacteria as individual cells, James Shapiro argues that bacteria are sentient, interactive organisms with an unexpectedly broad repertoire of chemical and physical mechanisms for signalling each other and for organizing themselves into multicellular aggregates with novel properties [7].

J. Craig Venter, the scientist who has recently created the first synthetic bacterial organism [8] has discovered a huge number of new bacterial species in the Sargasso Sea [9] whose characteristics are still being studied. Venter has witnessed first hand the extraordinary abilities of these micro organisms and asserts that bacteria will be found on Mars since we have been seeding it with micro organisms that have travelled with the robotic explorers [10] sent by humans over the last decade [11].

It seems that wherever robots go, bacterial life goes with them.

Perhaps Moravec is almost right in his prophecy in that robots perform a function that humans are incapable of. However, they have not been designed to replace us. Robots exist to disseminate bacterial and chemical systems into alien environments creating a form of artificial panspermia by which terrestrial life will dominate the universe and potentially solve the Fermi Paradox! <sup>1</sup> [12]

#### References:

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[2] Reed Website, (p5)  
[http://web.reed.edu/reed\\_magazine/spring2006/features/life\\_in\\_venice/index.html](http://web.reed.edu/reed_magazine/spring2006/features/life_in_venice/index.html)

[3] Sasselov, Dimitar. *Life What A Concept! An Edge Special Event at Eastover Farm*. John Brockman, editor, Published by EDGE Foundation, Inc., NY, 2008: 56.

[4] Paul Davies, "Are Aliens Among Us?" *Scientific American*, (p1)  
<http://www.sciam.com/article.cfm?id=are-aliens-among-us>.

[5] Meet Conan the Bacterium, Humble microbe could become "The Accidental (Space) Tourist" [http://science.nasa.gov/newhome/headlines/ast14dec99\\_1.htm](http://science.nasa.gov/newhome/headlines/ast14dec99_1.htm)

[6] Richard Dawkins, "Science, Delusion and the Appetite for Wonder." *Richard Dimbleby Lecture*, BBC1 Television, November 12th, 1996,

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<sup>1</sup> The *Fermi Paradox* is the apparent contradiction between the high probability extraterrestrial civilizations' existence and the lack of contact with such civilizations.

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<http://arjournals.annualreviews.org/doi/abs/10.1146/annurev.micro.52.1.81>

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[10] Venter, J. Craig. *Life What A Concept! An Edge Special Event at Eastover Farm*, John Brockman, ed, EDGE Foundation, Inc., NY, 2008: 43

[11] Galloway, David, "Mars, Robots Lead the Way, Autonomous machines first to explore Mars", [HoustonChronicle.com](http://www.chron.com/content/interactive/space/exploration/mars/robotics/)  
<http://www.chron.com/content/interactive/space/exploration/mars/robotics/>

[12] Larry Yaeger, Personal Correspondence, 'My Abstract for ISEA' Tuesday, 26 August, 2008 3:45 pm.

## Citations

[1] '...what happens when robots are superior to their creators? Will they still be subservient to us, or will the popular "robot takeover" of sci-fi movies become reality? I love robots as much as the next geek, but maybe we need some sort of plan for when they stop loving us...' (Hans Moravec Interview)

[2] '...Bedau suggests that the first generation of artificial cells will be extremely feeble and utterly dependent on human intervention to survive.' (Proto Life for Reed Magazine)

[3] '...Freeman was saying about the Darwinian era. To me his ideas are not so much about the end of a process but the beginning ... synthetic life, even if it's not creating life from scratch, basically starts a new phenomenology in the universe that hasn't been observed before, because you have a complex chemistry that reached the stage at which it actually changes and produces viable complex chemistry that can continue even without its own existence. In other words, if we do not continue as a species and

our technological civilization comes to an end, those species will actually continue to exist on this planet potentially and could go to other places.' (Dimitar Sasselov)

[4] '...scientists have begun searching deserts, lakes and caverns for evidence of "alien" life-forms—organisms that would differ fundamentally from all known living creatures because they arose independently. Most likely, such organisms would be microscopic, so researchers are devising tests to identify exotic microbes that could be living among us.' (Paul Davies)

[5] 'D. radiodurans can withstand without loss of viability a dosage that is 3,000 times greater than what would kill a human. "The fact that you can genetically engineer these things is the key to the utility of this bug.' (Dr. Michael J. Daly)

[6] 'For the first half of geological time our ancestors were bacteria. Most creatures still are bacteria, and each one of our trillions of cells is a colony of bacteria.' (Richard Dawkins)

[7] 'Bacteria benefit from multicellular cooperation by using cellular division of labor, accessing resources that cannot effectively be utilized by single cells, collectively defending against antagonists, and optimizing population survival by differentiating into distinct cell types.' (James Shapiro)

[8] 'Craig Venter, the controversial DNA researcher involved in the race to decipher the human genetic code, has built a synthetic chromosome out of laboratory chemicals and is poised to announce the creation of the first new artificial life form on Earth.' (Ed Pilkington, The Guardian)

[9] '... there were some 1.2 million previously unknown genes, roughly 10 times more genes than were represented in the SwissProt database at the time. Those genes came, in aggregate, from about 1,800 species.' (Dr Jeremy Cherfas, Science Watch)

[10] 'We exchange roughly a hundred kilograms of material annually with Mars. So we're exchanging biological material and biological information. To me it's just a matter of time until life is found on Mars. It's inevitable. It won't tell us whether it originated on Mars, or originated on Earth, but there'll be common overlap. We won't know if we don't know our own planet's genetic repertoire, which we're in the earliest stages of discovering. There are the evolutionary aspects, the origin of life aspects to this, which make it very intriguing.' (J. Craig Venter)

[11] 'Our first foray into robotics on Mars was, of course, the Sojourner rover (in 1997)...' (David Galloway, HoustonChronicle.com)

[12] '... the most fit thing in the universe might be bacteria, natural or artificial. Maybe the Fermi Paradox is resolved by every evolved intelligence creating a bacterial disease that wipes it out.' (Larry Yaeger).