

Where Do We Come From? What Are We? Where Are We Going? An Interview with George Church

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George Church is an American geneticist and molecular engineer. He is a Professor of Genetics at Harvard Medical School and his is widely regarded as a pioneer in cutting-edge genetics and synthetic biology. Dr. Church participated in the "Life: What a Concept!" seminar with thinkers such as Freeman Dyson and Craig Venter.¹

David Klinghoffer is a member of the Discovery Institute, a think-tank that claims to provide a center for "scientists and scholars challenging Darwin's theory of evolution on the basis of science." Dr. Steve Meyer, the author of Darwin's Doubt is the Director of the Discovery Institute's Center for Science and Culture. Is there anything in particular that draws you to his work? Are you familiar with his earlier book Signature in the Cell?

Yes, I had read *Signature in the Cell* before David and Steve sent *Darwin's Doubt*. The latter restates large parts of the former and then extends it with more detail, especially in the direction of multicellular evolution. I'm drawn to efforts to define gaps in otherwise compelling theories and thereby provoke applications of new technologies to try to fill those gaps.

You have said that Darwin's Doubt presents an opportunity for bridge-building. Can you say a little bit more about this?

One approach to controversy is to "balance" an extreme point of view by an equal and opposite POV, even if the second author would otherwise aim for something more central or more pluralistic. Alternatively, "balance" can be achieved by exploring the middle ground for ideas. In this case, there are genuine gaps in the story of evolution, which are, suddenly and increasingly fillable using synthetic biology. Indeed, many gaps might be fillable via "spontaneous" evolution in the lab and it is valuable to discuss the barriers to doing this.

What is your view on the concept of Intelligent Design as interpreted by people like Dr. Steve Meyer?

The book is full of interesting challenges suitable for molecular, cellular and multicellular synthetic biology tests and gap-filling.

Can you say a bit more about the idea that we can define intelligence (to embrace all sorts of non-human varieties) as "preparing for the future"? What would these long-term "intelligent" forces in our past and future be?

¹ Editor's Note: Ryan Cochrane conducted this interview with George Church via email during a period from 1 June to 11 June 2013. Ryan's questions are in italics.

We need a definition of intelligence which is mechanical and less anthropocentric, which can encompass artificial intelligence and potential radically different extraterrestrial intelligence. What these may have in common is the ability to develop adaptations which anticipate the future based on experiences in the past.

If human beings are able to make sense of the cosmos and potentially capable of remaking nature through genetic engineering, what does that say about the role humans play in nature? After all, you don't see other animals sequencing genomes or landing on the moon or sending probes to distant stars.

Clearly, humans seem special (so far) in our abilities and these include learning from our mistakes, occasionally learning without making mistakes (via imagination and models), and even radically changing our abilities.

Do you think evolution could be purposeful and that humans were somehow intended?

If we interpret the terms "purposeful" and "intended" mechanistically, we say that a set of atoms in a being respond to their environment by some motions which are "intentional". This can include "evolutionary" trial-and-error components (e.g. in the immune and nervous systems). In this same sense, many other natural systems can "compute" on their internal states plus environments in microseconds or in aeons.

Most Intelligent Design theorists believe that "intelligence" in nature is due to the activity of an intelligent designer. One statement to this effect comes from the Discovery Institute, which claims "Mind, not matter, is the source and crown of creation." This statement suggests that there is a form of intelligence in the universe (perhaps God) that, in some sense (temporally or conceptually), 'precedes' evolution. Do you believe that there is such an intelligence — or is intelligence entirely an outgrowth of natural evolutionary processes?

It seems valuable to consider that minds (defined broadly as in my previous answers) are composed of matter (defined broadly to include all matter/energy and dark matter/energy and anything that interacts with those). Such mind-matter could define physical-chemical evolution (= computation) which preceded (and indeed lead to) biological evolution. If "natural" is defined as everything that affects or is affected by our known world (even if not currently fully understood), then whatever lead to our current processes should be considered "natural".

How does your view that mind and intelligence are embedded into the very fabric of the cosmos relate to your work in very cutting-edge genetics and synthetic biology? Does one motivate the other?

As we are rapidly getting better at "accelerated evolution" in the laboratory at the molecular to ecosystem levels, we get a deeper appreciation for how this could happen in the past or far away in the cosmos — and how we might use it to distribute evolution "intelligently" to other planets.

Can you say a bit more about the ID-synthetic biology connection? Is there one?

Yes. The recent ID discussion is increasingly focused on tests that I feel synthetic biology can handle.²

What are your views on the nature of God? If I understand you correctly your views seem to be closer to pantheism or panpsychism than to traditional theism.

The sort of natural forces of change that we have discussed thus far are probably consistent with all of the above. It is truly appropriate that humanity is in awe of this enormous process.

What do you think human society will be like a hundred years from now? What will humanity be like in the far future?

No guarantees, but if our technologies continue their exponential improvement, we may have eliminated most diseases (and what is currently defined as poverty), and may stay youthful far longer on average than we do currently. We may also be much more successful at space exploration and spreading biological evolution to previously sterile planets. This could be crucial for survival of our species if our planet faces a large enough existential event. We may find that to get to the most distant sites swiftly (close to the speed of light), we need to send very small packages (sub-micron) that contain some information that could aid evolution toward intelligence.

² In an email to Ryan Cochrane on 11 June 2013, Professor Church added: "A key aspect of experimental tests of a hypothesis is that you don't know in advance whether they will confirm or deny the hypothesis — in this case, will they explain a gap easily or show that a gap is indeed very hard to fill. The book [*Darwin's Doubt*] describes the gaps a bit better than the experiments, but the latter should be evident enough to researchers at the cutting edge of rapidly moving fields including synthetic biology, de-extinction research, origins of life, and 'accelerated evolution' in the lab."