

Our philosophical science correspondent

Massimo Pigliucci asks

Is Science Going To End?

“Before my meeting with [physicist Roger] Penrose, I had taken it for granted that science was open-ended, even infinite... The earnestness, and ambivalence, with which Penrose contemplated the prospect of a final theory forced me to reassess my own views of science’s future.”

This comment is by former *Scientific American* columnist John Horgan, who in 1996 provoked a storm among scientists, philosophers and the general public with his book *The End of Science: Facing the Limits of Knowledge in the Twilight of the Scientific Age*. This is not a review of Horgan’s book, and I certainly do not think we are even close to the twilight of the scientific age. Still, the issue is worth pondering: will there ever be an end to science as a fruitful human enterprise, a time when all the major questions we can think of will have been asked and properly answered?

When I posed this question to several of my science colleagues over the last few years, I got almost unanimously negative answers – accompanied by a spectrum of reactions that went from the mildly amused to the positively scandalized. The typical response, however, was indicative of the fact that most scientists simply don’t have a penchant for philosophical thinking. For instance, many colleagues said something along the lines of “every new answer generates a large number of new questions.” Perhaps; but is this an empirical statement, or an expression of a belief rooted in the inconceivability that what one does may one day come to an end? It is certainly possible to look at the history of science and show that the answer to one question did in fact lead to the posing of new, hitherto unimagined questions. But surely there is no *guarantee* of that happening. Sometimes we settle a question and that’s that – the process cannot continue *ad infinitum*.

Could it be that it is simply depressing for a scientist to entertain the possibility of the end of his discipline? Again from Horgan’s book: “I don’t think we’re close [Penrose said]... but it doesn’t mean things couldn’t move fast at some stage... I guess this is rather suggesting that there is an answer, although perhaps that’s too pes-

simistic.” Why pessimistic? Is it not the goal of science to answer questions about nature? Would not science answering all such questions be a triumph of human ingenuity? (Let us set aside for now obvious issues of epistemic limits and so forth.) Apparently not for the scientists involved.

And yet, it stands to reason that the number of interesting and meaningful questions about nature must be finite, indeed even fairly limited in number. Even if the universe itself is ‘infinite’ in some sense or another of that slippery term, what we wish to know about it cannot be of the same order, unless we have a pathological curiosity to, say, establish a complete catalog of every physical object in the universe (in alphabetical order, perhaps?). But that would be a far less exciting intellectual pursuit even than stamp collecting, and certainly would not look at all like what we think of as science.

Let us consider one currently unanswered question in biology: how did life originate? This is one of the big ones, probably on the top-5 list of any biologist (my list also includes the biological bases of consciousness, the origin of novel biological structures, the import of non-genetic inheritance, and the detailed evolutionary history of the human lineage). I do not know whether we will ever get a satisfactory answer. After all, it is a difficult problem: the pivotal events happened more than 3.5 billion years ago, there are no fossil records, and we don’t even know for sure what the physical and chemical conditions were at the time on planet Earth. Heck, biologists and philosophers don’t even agree on what ‘life’ is – a question that obviously becomes appropriate if one is trying to figure out how it started. Nonetheless, let us entertain a hypothetical scenario in which biologists, biophysicists and even philosophers work together and find the answer to life’s origin. They will subsequently be able to replicate the event at will under laboratory conditions; and they perhaps have even found life in other places in the solar system, which discovery helped figure out how the transition from non-living to living matter took place



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on our planet. Well then, question settled, and the journal *Origin of Life* (there is such a publication) can happily publish its last issue and send everyone home, happy or not.

Of course, something like this has already happened in subfields of science, several times. There was a time when the structure of the atom was a hot research topic in chemistry; but particle physics has pretty much settled the big question, by identifying the fundamental particles that make up the atomic nucleus – the quarks. True, there is now a (new) question, whether quarks themselves are made of something even more fundamental, like strings. But scientists are attempting to find that out as well, and no physicist believes that this game of Russian dolls can or will be played in perpetuity. There will be an end, and many physicists actually think that ‘the final theory’ is just around the corner (and even if it isn’t, the general point stands).

So, yes, there will be an end to science, and the end we have discussed so far is actually the most optimistic possibility. The much more realistic scenario – and even more of an anathema to practicing scientists – is that the quest will stop well short of the final answer(s), just because human minds are a product of an evolutionary process which delivers organisms capable of survival and reproduction. Minds are not designed to solve the deep mysteries of the universe in which they happen to live.

I think Horgan’s book is still a bit ahead of its time, and we will see many centuries of intriguing and successful science. But if one of those discoveries on the horizon is about significantly prolonging human life, I better start looking for something else to do in the distant future.

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