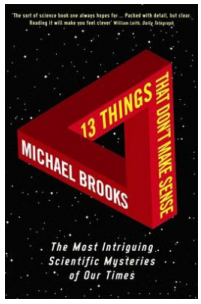
13 Things That Don't Make Sense. The most intriguing scientific mysteries of our times by *Michael Brooks*. Doubleday, 2008 (256 p.) isbn 978-1-861978-17-2





Michael Brooks

Reading *The quantum astrologer's handbook* (2017) by Michael Brooks, made me look at some of his previous books, and although already 10 years old, and not directly involving a lot of mathematics, I believe this one is still interesting to read.

It discusses scientific facts for which we do not have a proper explanation. It makes you as a scientist humble and it makes you realize that we still understand only very little about the ourselves and the world we live in. But on the other hand, the Big Bang is assumed to have happened 13.8 billion years ago and the Earth came about 4.500 million years ago. It took then a period of 4.000 to 540 million years to have elementary forms of life evolve to a more complex form, and the Homo Sapiens dates back about 300.000 years. So we have come a long way in a relatively short time, while progress seems to be growing exponentially. Thus there is good hope that we shall soon find answers to all the questions raised here. In fact some progress was made already in the last decade.

The subjects can be subdivided into physics and life sciences. To give a flavour of what is being discussed, I will quickly scan some of the 13 chapters.

• *The missing universe.* This is about the fact that only 4 percent of the mass in our universe is visible. It was the reason that Einstein introduced his cosmological constant, which he later called his biggest mistake. The current generally accepted explanation is that the rest consists of dark matter. There are several theories but as yet nobody properly understands what it actually is.

• *The pioneer anomaly.* The Pioneer 10 & 11 spacecrafts launched in the 1970's deviated from their acceleration predicted on the basis of gravitation theory. This was still a mystery and the source of many speculations in 2008 which are described by Brooks, but since 2012 it has been explained by an anisotropic radiation pressure caused by the spacecraft's heat loss. There are however still some issues that are not completely explained by this thermal solution.

• *Varying constants.* This is about the fine-structure constant in physics usually indicated by α and which is approximately 1/137. It is fundamental in quantum electrodynamics, as are some other constants, and thus defines everything that is derived from this, including our understanding of the whole cosmos as it has evolved in the past, and what its future will be. But what if these constants are actually slowly varying? Then cosmology would need to be rewritten.



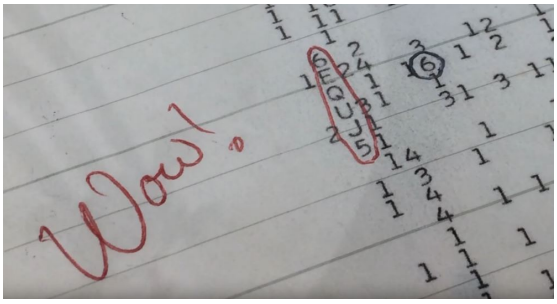
$$\alpha = \frac{1}{4\pi\epsilon_0}\frac{e^2}{\hbar c}$$

• *Cold fusion.* This was a highly researched subject since Fleischmann and Pons announced this in 1989, but since their experiment could not be reproduced, it ruined their career. Although of primal interest in view of our increasing need for alternative sources of energy, no successes have been booked since and the exploration of the possibilities has faded away.

• *Life.* Several of the remaining chapters are more related to life sciences and biology, like this one about the origin of life on Earth. Many books appeared recently because of our improved understanding of DNA and cell biology. One of the more recent books with some interesting insightful views is *The vital question* by Nick Lane (1915). It has much more details than is in this chapter, but it is harder to read since it requires some deeper understanding of cell biology. If you are not familiar with the subject, then this chapter may be a place to start before starting the Lane book.

• *Viking.* Is about the search for life on Mars. It was only in March 2018 that it was announced

that a substantial lake of liquid water was detected below the ice cap of the south pole by ESA's Mars Express orbiter.



The Wow! signal

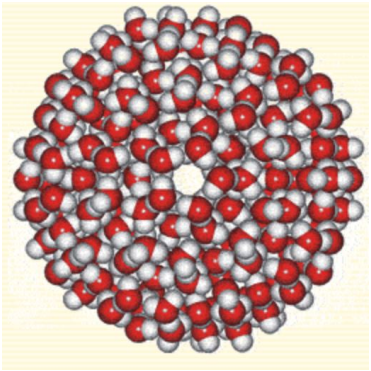
• *The wow! signal.* When in 1977 the radiotelescope Big Ear was probing the universe for 'messages from extraterrestrials', its hard disk was printed out and erased, but when Jerry Ehman checked the listing several days later, he detected some high energy signal indicated by the string 6EQUJ5, and he wrote Wow! in the margin. That was an unusual signal sticking out of the noise. But even tough many planets in the goldenlocks zone of stars have been detected since, no other such signal or other contact has ever been observed. Whether there is any life form 'out-there' is still a subject of speculation.

• *A giant virus.* The mimivirus (a mimicking microbe) was detected in 1992, and originally mistaken to be a bacterium. It was the largest one detected until 2011 when an even larger one was described. Is it to be placed on the boundary between living and non-living, which required to redraw the tree of life. It may be related to DNA that existed before cellular organisms, or it may be the remainder of a different type of DNA (besides eukaryotes and prokaryotes like archaea and bacteria).

• *Death.* This is about gerontology or rather bio(medical)gerontology. So far our life span has been extended by mitigating the diseases of aging. But there are many theories that explain why we age and catch these diseases. Telomeres at the end of chromosomes diminish after reproduction. When there are no more, the cell will die. Cancer cells reproduce telomeres. Can we re-engineer our cells to prevent them from dying or is there a natural limit? Life evolved so quickly because it used oxygen to burn sugars in eukaryote cells. But oxygen is toxic, which evolution counteracted by introducing sex which entailed more lethal threats. Green plants live on photosynthetic prokaryotes that produce oxygen as waste and therefore live longer.

• *Sex.* Why did sex arise in the reproduction process, while it is so much more efficient to just reroduce by cloning? Several hypotheses exist. Selection of a partner on the basis of producing the fittest offspring may be one of them, but it could also be a selection for the benefit of the group. About the origin of sexual reproduction you might also want to read Lane's book.

• *Free will.* How much of a free will do we have if everything has to follow physical, biological and chemical laws? Neurological experiments showed that a decision is made in our brains before the moment that we think that we actually decide. Curiously enough, since Brooks has a background in quantum physics, he does not refer to the fact that there is something like quantum physical uncertainty contradicting determinism.


An $(H_2O)_{280}$ icosahedral cluster

• *The placebo effect.* A placebo is never completely a placebo. The sight of a needle or just taking a pill, may already have an effect on our expectations, or have a nocebo effect. It could be a matter of conditioning, but anyway our reaction to a placebo is not fully understood, since it has a measurable effect that cannot be explained.

• *Homeopathy.* Every right hearted scientific mind will claim with certainty that homeopathy cannot work, but can it have a placebo effect, and if so how does it work? Further research shows that we do not know everything about liquid water. Water is essential for life and DNA, and according to Martin Chaplin the organization of water in larger icosahedral clusters may be of importance and this could be modified by just one molecule.

Adhemar Bultheel