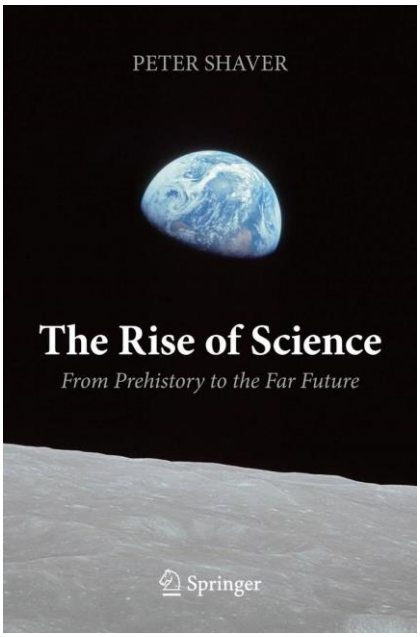

The Rise of Science
From Prehistory to the Far Future

Author: **Shaver**, Peter

SCIENCE
British Antarctic Expedition (1910–1913) led by Robert Falcon Scott:
"Some will tell you that you are mad, and nearly all will say, "What is the use?" For we are a nation of shopkeepers, and no shopkeeper will look at research which does not promise him a financial return within a year. And so you will sledge nearly alone, but those with whom you sledge will not be shopkeepers: this is worth a good deal. If you march your Winter Journeys you will have your reward, so long as all you want is a penguin's egg." (Cherry-Garrard, expedition participant: The Worst Journey in the World).

Preface: The Rise of Science
"These are the scientists who ask deep questions and systematically explore every niche out of pure curiosity about the world and our place in it."

According to author Peter Shaver, our early ancestors had no natural offensive or defensive weapons or armor but just their bare hands, so the development of tools was a consequent and very important step. The oldest known stone tool dates back 2.5 million years and from then onwards tools were developed slowly over the ages.

Struggling to survive in a harsh environment with many unknowns the urge was developed to explain and possibly influence the ever changing natural forces. The urge for explanation led to rudimentary "science" observations ("knowledge meant power") and in parallel to a belief in "higher forces" (religion) was developed for what could not be explained. It involved a belief in supernatural entities and concerned itself with the spiritual aspect of the human condition, life and death, and the possibility of an afterlife. So science and religion had a common reason and struggled, competed and interacted significantly over time, as described in the book.
Having set the starting conditions, the author goes very thoroughly through the three science development phases of the early civilizations by "connecting the dots" not only explaining the first "Greek Miracle" phase, peaking in 300 BC, but also the second Islamic (peaked 900 AD), the Roman transit to the third Medieval science phase, peaking around 1400 AD. A graphic representation shows the developments from 500 BC to 1500 AD and reveals an astonishing equal number of philosophers and scientists for each period (page 25).

Why was it all started by the Greeks? "A major reason was undoubtedly the fragmentary nature of the civilization they lived in, due in turn to the complex geography of Greece subdivided as it is by mountains, valleys, hills, rivers and waterways. And freedom was essential. Citizens in those cities were free from the confines of the village, from the state, and from religion. Ancient Greece was perhaps unique in that also religious cults and myths certainly existed they were fragmented often with different gods in different cities and some individuals even had their own personal gods. And finally there was no overall Priestly caste to impose dogma, so even religion itself could be questioned. The door was open for alternative views. If some of these citizens had independent wealth they could take the time to imagine and think radically new thoughts. Most of them knew how to read and write, they were relatively well educated, and had some knowledge of wider world through travelling. The Greek

language was innovative and relatively easy to read and write, and this certainly would have been conductive to the rise of sophisticated philosophy. Democracy itself was a Greek innovation citizens could revel in free debate and novel ideas of kind could flourish." (p 12-13)

The main body of the book takes a deep and thorough look into the scientific and philosophical breakthroughs. Science in the context of the book includes the "very large", the "very small", light, life itself and evolving perspectives. Starting with the "Greek Miracle" leading up to the 21st century highlighting and describing the achievements of all the scientific and philosophical "heavyweights" from Thales of Miletus, Socrates and Aristotle through Galileo, Newton and Einstein to the "breakthrough of the year 2015", CRISPR (American Association for the Advancement of Science) to latest Nobel Price laureates for experimentally proving gravitational waves with the Laser Interferometer Gravitational-Wave Observatory (LIGO) and the first direct observation of gravitational waves (2017).

When I started reading the book I was wondering whether I could get answers to the following questions: (1) What triggered the need for religion, science and philosophy? (2) How do religion and science correspond with each other, and eventually (3) Cost versus benefits in the future? – And yes - all answers can be implicitly found in the book.

So what is science really like? According to Peter Shaver any variety of characteristics, factors and methods can be involved in the scientific process. Some of them in no particular order are self-motivation, intelligence, passion, pragmatism, freedom, connections, mistakes, experimentation, curiosity, teamwork, education, Discovery, observation, deduction, persistence, socializing, judgement, lateral thinking, cross-pollination, creativity, Solitude, imagination, inventiveness, collecting, filters, tenacity, intuition, opportunity, inside, falsification, technology, instinct, skepticism, disagreement, open mind, honesty, timing, serendipity, determination, verification, exploration, interpretation, communication, inspiration, induction, experience, Theory, speculation, hypothesis, reflection and there are many others.

Modest beginnings employing all those human virtues led to an exponential growth of scientific creativity: 90% of all scientists who have ever lived are alive today. By contrast, less than 7% of all the people who have ever lived are alive today. It has been estimated that there were a few hundred scientists in the mid-1700s. If the number of scientists had increased at the same rate as the overall population the number of scientists today would be a few thousand instead according to UNESCO, about 8 Million researchers in the world today.

What can we expect for the future? It is understandable that short-term goal oriented research is mainly done by large corporations seeking financial returns, long-term curiosity driven research is left for governments to fund often enough through Universities. As there is no guaranteed economic return from curiosity driven research there is always a struggle to obtain adequate support even so it is ultimately pure science that underpins our modern world. One of the finest curiosity-driven examples of research leading to world changing technology is electricity.

Of course that blurs the borders between curiosity driven research and goal oriented research leading to technological applications. Will science be stopped when it becomes too expensive, like the Superconducting Super Collider (SSC) in 1993 due to high cost? Should science and technology have any values? "Both can do great things, but it does not want to do that on its own, it neither wants to do good nor evil, and whether it does one thing or another is entirely in the hands of its creators" (Tim Cook Apple, CEO).

Reading this book with engagement lets you marvel about the ingenuity of humankind and start thinking on your own about the un-solved “big questions” like what is the purpose of life and how life on the early Earth emerged from abiotic chemistry?

The book helps you to dare to ponder the various models and theories which in part by now have left the basic rules of experimentation, verification and falsification and might allow us to predict the (near) future, but a lot of uncertainties (“human factors”) have yet to be sorted out:
The fear of artificial intelligence taking over Homo sapiens? Peter Shaver gives you his answer: “In the very long term might our present era of human biology and brain power (wetware) be just a brief blip in the history of intelligence in the universe? Might our creations - thinking machines (mathematical algorithms) - takeover and continue the advance of progress that we initially set in motion? If it is our heritage that they take forward, then they would not really be "taking over" - they would be truly our descendants. It may ultimately be *our* robust thinking machines, rather than fragile biological humans, that colonize the galaxy.”(page 235)

Or you could hold it with Goedel’s incompleteness theorem: “No significant system of mathematics can be produced which is both consistent and complete. Science would be limited by the incompleteness inherent in axiomatic mathematics. So, on the basis of our present knowledge it seems that there are many hurdles preventing us from ever achieving the goal of absolute completeness in science. (page 231).

The attached registers for “further reading”, subject index and name index are impeccable and make it easy to enhance and/or intensify the provided information which is “up-to-date” to 2018 or simply use it as an elegant, compact reference.

I enjoyed reading the book because it allowed me to brush up on the developments which happened as recently during the past 100 years, the lifetime of our parents and ourselves as well as to judge the “rise of science” from a distant, but highly educated standpoint that allowes me to draw my own conclusions. A book that definitely inspires own reflections and expands the horizon.

“The future of science and technology is bright!” (Peter Shaver, page 87)