Daniel McKaughan & Holly VandesWall, eds. *The History and Philosophy of Science: A Reader*. Bloomsbury 2018. 1104 pp. $128.00 USD (Hardcover ISBN 9781474232739); $49.95 USD (Paperback ISBN 9781474232722).

The idea of editing a collection of excerpts from the major works in the history of scientific thought can be considered very original, and it proves helpful for students and researchers who want to get a deeper knowledge of that subject matter. Because of the relevance of the texts selected by the editors, this book can be adopted for a basic course focusing on the main topics of scientific development. The work is divided into seven parts; each one of them is devoted to a specific topic and includes a large selection of significant texts.

Highlighting the difference between science and other kinds of cultural expressions in the ancient Greek context would be impossible. Most of the Greek authors, indeed, advanced their theories as part of a broader philosophical view of nature. That was the case with Plato (15-52), whose animistic cosmology expressed in the *Timaeus* was developed by subsequent philosophers and exerted a deep influence on Renaissance thought. He took inspiration from the Pythagorean school to describe a world in which mathematical harmony was provided by the participation of objects in the perfect stability of the forms. Although knowledge of the sensible world is considered a likely story, Platonic pantheism represents an instance of a designed universe as an all-encompassing structure. As a natural philosopher, Aristotle (53-148) attracts special attention from the editors. His notion of a final cause was essential to present a model of the universe, which lasted until the achievement of modern science. If the greatest Greek mathematicians are household names many centuries after they lived, the overall success of Euclid's axiomatic method is probably the clearest instance of that tradition, because most of the following geometry textbooks are structured according to his *Elements* (155-164). As regards astronomy, Ptolemy's *Almagest* (177-186) is the first work treating all parts of mathematical astronomy in detail, and adopting a method based on mathematical rigor. This first part, however, should be integrated with some passages from Plotinus' *Enneads*. Plotinus' universe, indeed, represents the most significant interpretation of Platonic animism, and his emanationistic cosmology inspired some medieval Islamic astronomers.

Few areas of scientific history sound more interesting than medieval natural philosophy. In this book the selection of medieval texts succeeds in highlighting why the characterization of the Middle Ages as a 'dark age' is unsatisfactory. A careful analysis of the works written in that historical interval, indeed, belies any presupposition that medieval centuries were scientifically irrelevant. On the contrary, contemporary historians of science have found in medieval writings the roots of early modern science, as scholastic authors bridged the gap between Greek thought and modern scientific discourse. With regard to theories of movement, John Philoponus (195-200) criticized Aristotle's view about violent motions and the speed of free falling bodies depending on their weight. His criticism marked the beginning of the revision of Aristotelian natural philosophy, which culminated in the theory of impetus, formulated by John Buridan (249-254) in the 14th century. In Buridan's view, impetus showed why a projectile keeps moving without any medium, the increasing speed of a falling object, and the continuous motion of celestial spheres imparted by God. In sum, impetus regulated all kinds of movements in the world, and that innovation highlighted the commonality of natural laws, the core of the Newtonian synthesis.

The section devoted to the Scientific Revolution includes not only well known excerpts, as the ones from Galilei's *Starry Messenger* and dialogues (291-344), or Kepler's *Epitome of Copernican Astronomy* (277-290). The core of the Scientific Revolution consists in the adoption of mathematical realism, as its protagonists believed in the world as a book written by God in mathematical terms. Paradoxically, an exception can be found in Copernicus' *On the Revolutions of the Celestial Spheres* (261-266), the work that started this historical phase. Copernicus' book was edited by Andreas Osiander, a Lutheran theologian, who added a preface (267-268), without Copernicus' knowledge, in which he stressed that the heliocentric theory was only a convenient hypothesis to simplify astronomic calculations. In other words, it only aimed at saving the appearances. Among the authors of this section, Descartes (345-374) provided a metaphysical structure of knowledge and mechanistic account of phenomena as well. Francis Bacon (375-396) insisted on the elimination of final causes and on the religious dimension of natural investigation. In the *New Atlantis* (385-396) he portrayed an ideal scientific society led by an elite engaged in investigating the real causes of events. His method, consisting in the deduction of general principles from gathered data and aiming at avoiding quantification, however, excluded him from the protagonists of the 17th century scientific turning point. The key role played by Newton (399-438) is universally recognized by historians of science. His own synthesis, a combination of experiment and mathematics, can be evaluated as the definitive unification of terrestrial and celestial phenomena, and a major intellectual development which determined the definitive establishment of modern science.

Parts IV and V deal with new disciplines forming part of the modern scientific research, such as electricity, magnetism, atomism and chemistry. Electricity emerged in close association with magnetism, as some electric substances provoked repulsive and attractive phenomena. Christian Huygens (469-474) had the merit to formulate a wave theory of light, balancing mechanism and mathematical description. Newton, for his part, rejected the wave conception and believed that light consisted in particles emitted by a source. As a modern area of inquiry, chemistry emerged from Renaissance alchemy, which was based upon the Platonic correspondence between microcosm and macrocosm. The advent of corpuscular philosophy played a prominent role for the origin of modern chemistry. Robert Boyle (555-568), the most influential English scientist before Newton, was probably the first to believe in chemical experiments to support a broader mechanistic worldview. Despite the attention devoted to chemical practices in modern times, chemistry had to wait for Antoine Lavoisier's work to reach the status of scientific discipline. Chronologically speaking, Mendeleev (661-666) is the last author considered in this section. He is remembered for having compiled in 1869 the periodic table of the elements, based upon the periodic law.

In part VI, modern achievements in biological and geological sciences are taken into account. The selection made by the editors begins with William Harvey (689-700), one of the founders of modern medicine for having discovered the circulation of the blood. The progress in modern biology paved the way for the evolutionary theory. Thomas Malthus, in his *Essay on the Principles of Population* (769-774) proposed the idea of the struggle for existence, as a direct consequence of the fact that population increase outstrips food production. Lamarck (789-800) was one to develop a theory of evolution, according to which heritable traits are acquired through the interaction between organism and their environment. As regards geology, Lyell (825-840) concludes this part. He established geology as a purely scientific subject, as he upheld its independence from all kinds of biases. In his mind, the uniformity of nature can be extended to both organic and inorganic beings.

The impact of Darwinism is the subject of the final section. In addition to the most famous parts of Darwin's works (843-972 / 1013-1024), the collection includes reviews of *The Origin of Species* by Fleeming Jenkins (975-982) and Richard Owen (987-992). An excerpt from Gregor Mendel's *Experiments in Plant Hybridation* (1033-1050) concludes the book. Although the significance of his activity would be recognized only since the beginning of the 20th century, he proved the existence of discrete heritable units which determine physical traits. Thus, through his pioneering experiments, this Augustinian friar has become the father of modern genetics.

Science has played a preeminent function in shaping our way of life, and publications like this offer the opportunity to lay stress on the relevance of the history of scientific thought as a discipline every student should deal with. Although this collection is not meant to be an exhaustive survey of the rise of modern science, it can be deemed suitable for graduate and undergraduate courses. Moreover, questions at the end of each reading render it appropriate for class discussions. The topics chosen for this collection cover a wide range of authors and a broad historical interval. Different accounts of the progress of science have been offered by historians and, unfortunately, by many superficial popularizers, who often pay attention to some aspects at the expense of other relevant questions. The transformation of Western natural philosophy, which originated in the ancient Greek milieu, into modern scientific discourse extended over a period of several centuries, during which many historical characters, who have made lasting contributions, entered and exited the scene. That is why reading original texts represents an effective tool to understand what Thomas Kuhn called a paradigm shift, when scientists start wearing inverting lenses. To put it more simply, the texts of this anthology let students grasp how modern science has changed our perception of the natural world.

Alessandro Giostra, Deputazione di Storia Patria per le Marche