

The Evolution of Scientific Knowledge: From Certainty to Uncertainty
by Edward O. Dougherty, SPIE Press, Bellingham, 2016, ISBN:
9781510607354.



I came across this title at the book shop at a conference for the International Society for Optics and photonics (SPIE). The author is on the faculty of Texas A&M in the department of Electrical Engineering and Computer Science, as well as an SPIE fellow.

This book is about scientific epistemology—the theory of scientific knowledge. As the title suggests, the book covers how scientific knowledge has evolved from the time of Aristotle to that of genomics.

In the first two chapters the author takes us through an introduction to epistemology. In the next chapter he explains pre-17th century science.

The author posits the revolution in science occurs with the transition from the Copernican description of planetary motion to Kepler's three laws of planetary motion. Kepler's laws demonstrate the four basic components of a theory for the first time: observation, analysis, modeling and prediction of future events. This revolution culminates in the 17th century with Bacon, Galileo and Newton. The next step is determinism, in which Descartes, Laplace and Pascal all contribute greatly. Determinism is the paradigm that, given enough information, the future can be predicted.

Dougherty then spends a chapter looking at the philosophical changes brought about by the scientific revolution of the 17th century through the writings of Locke, Hume, Kant and Rousseau, as well as some later philosophers. The age of uncertainty in science begins with Maxwell and continues into the quantum era with the particle/wave duality crisis.

The last two chapters focus on the problem of big data and the modeling of large systems with complicated interdependencies. The author provides a brief description of Bayesian statistics using a simple mammalian cell cycle as an example.

The book is short—only 136 pages—but demanding, especially the chapter on philosophy.

Review by Joseph Ferrara
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