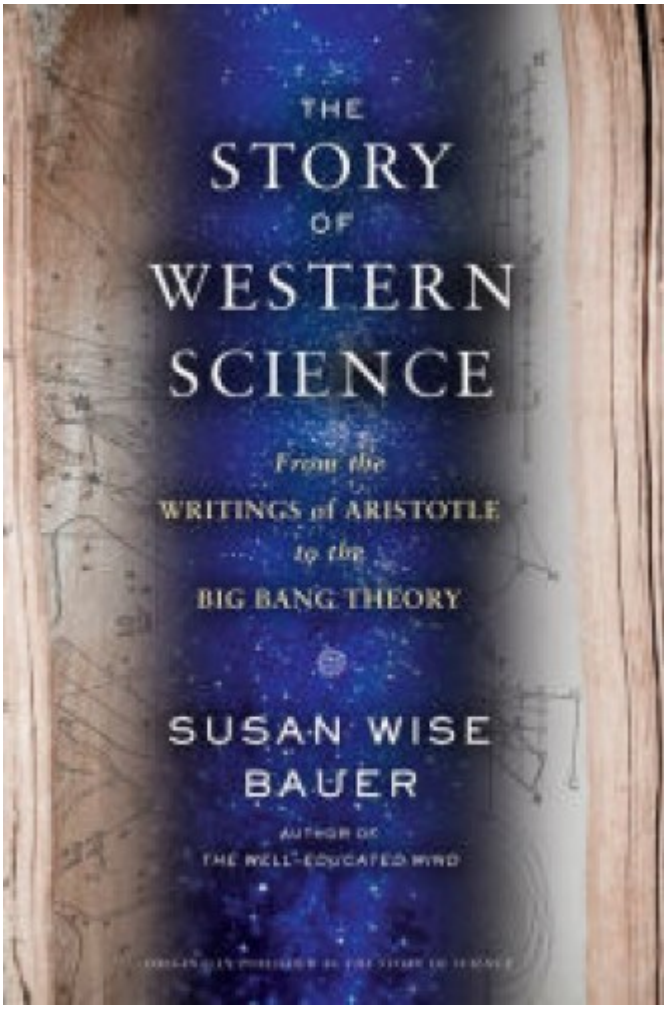
The complex, beautiful history of science

by Karl W. Giberson in the March 16, 2016 issue

In Review



The Story of Western Science

By Susan Wise Bauer
Norton

Susan Wise Bauer, a wide-ranging scholar who formerly taught at William and Mary, provides both a short course in the history of science and, for the ambitious, a syllabus for a whole degree. She chronicles the path science has taken from its

emergence in Greece 2,500 years ago, to its refinement in the scientific revolution of the 17th century, to its present status as the caretaker of knowledge critical to the future of our species. Bauer's telling crackles with adventure and surprise. The book is an easy read.

For readers who want to dig deeper, Bauer ends each chapter with a short bibliographic essay, pointing to the most accessible versions of the original texts on which her story is built. Many of the sources are available online, and in all cases she explains which translations are clearest and have the most helpful notes.

The Story of Western Science tells several related, overlapping stories. The most obvious is the story of how the best minds of our species figured out how the universe and many things in it work. This story is braided—like the double helix Bauer describes in the chapter "The Secret of Life"—with the story of discovering the best methods and most ingenious techniques for interrogating nature and for coaxing nature into revealing its many secrets. The secrets uncovered by science have often been startling and counter to intuitions about how the world is. As the scientific method developed, researchers were forced to stop asking Mother Nature why she behaved as she did and what purposes were being served by this or that phenomenon. It turned out that these were secrets she would not reveal.

Bauer begins with the precursors to modern science that appeared centuries before Christ. Thinkers like Pythagoras on the rocky, windswept coasts of Greece made the astonishing discovery that everything, at some level, is mathematical. This insight—initially protected by a secretive religious order—became the code that deciphered everything from music to planetary motions, from the atom to the shape and size of the earth. Mathematical arguments would one day establish that the sun, not the earth, is at the center of the solar system; that the universe is expanding; that the electron is making quantum leaps inside the atom; and that the earth is billions of years old.

Modern scientific method was born in the 17th century, with Francis Bacon as its first publicist hammering out the importance of matching countless observations to the simplest explanations and warning against trying to reason our way to truth, as had been the pattern. Careful observation revealed the elliptical orbits of the planets, the moons around Jupiter, the mountains on the moon, and the universality of the law of gravity. Scientists built telescopes and microscopes, boldly taking the human eye where it had never been and opening up entirely new fields. Increasingly

larger telescopes revealed a universe of unimaginable size and complexity, and even showed that it was born in a Big Bang billions of years ago. Microscopes revealed countless worlds inside the world, from cells to tiny structures within cells diligently performing mysterious tasks related to life.

The great Isaac Newton stands at the center of the story of science, making sense of what had gone before—Kepler's elliptical orbits, Galileo's falling bodies, and the mysterious beauty of the rainbow—and laying a foundation for sciences yet to be born: geology, which would discover the long, tortured history of the earth, including the startling motion of the continents as they drifted; chemistry, with its invisible dancing atoms; and biology, the science of life, with its mechanical models for how living things develop, operate, and reproduce. Astronomers discovered that the universe had a history. Gone was the tidy world presented in the opening pages of Genesis, which suggest that a few thousand years ago God spoke everything into existence in its present form and placed humans in a garden under a heavenly dome.

As odd as it sounds, science has also formalized our ignorance. Heisenberg's uncertainty principle shows that we must content ourselves with some vagueness in the world of the very small. Poking around in one phenomenon disturbs others such that we can't know them both at the same time. Chaos theory reveals that we can never know enough about the initial conditions of a system to predict how it will unfold. Ironically scientists discovered chaos theory while studying weather patterns, and it is no doubt comforting to meteorologists everywhere who are weary of defending their spotty record on long-range forecasts.

Although we think of the sciences as a set of distinct disciplines—biology, chemistry, physics, astronomy—the reality is that they shade into one another, answering one another's questions, challenging one another's conclusions, rounding out one another's pictures. The asteroid that struck the earth 65 million years ago belongs to the astronomers; the crater it created in the Yucatan Peninsula belongs to the geologists; the layer of iridium it deposited belongs to the chemists; the great extinctions it caused belong to the biologists. The ecological space opened up by the extinctions was crucial to the evolution of our species. The various sciences cannot be teased apart any more than the colors in a sunset can be fully appreciated individually.

Consistent with her bibliographic emphasis on the texts that have driven science forward, Bauer divides *The Story of Western Science* into five parts covering overlapping historical eras and based on the key texts that drove each investigation. This structure allows her to pick up a theme—life, for example—and carry it from the first systematic investigations in the 18th century through to recent work in genetics.

Bauer breaks no new ground in *The Story of Western Science*, and she avoids detours onto controversial side roads like ethics, the gender imbalance in science, the “Western” focus, and what should be taught in the public schools. As a result the book provides a balanced and accessible narrative and a perfect introduction to its subject.