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Book review: ‘Brilliant Blunders’ by Mario Livio, on scientists’ breakthrough mistakes

By Marcia Bartusiak, Published: June 6

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At times, even Albert Einstein was no Einstein. The universe, to him in 1917, appeared stable and unchanging. So when his newly introduced general theory of relativity suggested that the cosmos would collapse under its own weight, Einstein added a fudge factor to his equations. This “cosmological constant,” a repulsive force that just balanced the gravitational force of attraction, kept the universe pleasingly immobile.

When space-time was later found to be moving (in fact, expanding), a condition his original equations could easily handle, Einstein eagerly took the constant back out. He supposedly told a fellow physicist, George Gamow, that inserting that extra term in the first place was the “biggest blunder” in his scientific career.

Scientists make mistakes all the time, but those bumps in the road are often smoothed out in the legends that surround the greatest discoverers. Mario Livio, an astrophysicist with the Space Telescope Science Institute in Baltimore, now turns the tables on those scientists. His intent is “to correct the impression scientific breakthroughs are purely success stories. . . . The road to triumph [is] paved with blunders.” Thoughtful, well-researched and beautifully written, “Brilliant Blunders” offers a distinctive — and far more truthful — perspective on the journey to scientific discovery.

Livio chooses carefully. He focuses on the colossal mistakes of “genuinely towering scientists,” including Charles Darwin, physicist Lord Kelvin, chemist Linus Pauling and cosmologist Fred Hoyle. And by providing enough background on each man’s achievements, placing every blooper in a broad context, the author takes the reader on a splendid tour of some key ideas about evolution, geology, physics and cosmology.

Darwin, of course, demonstrated that species on Earth were not independently created; instead, the diversity of plants and animals arose over time with adaptations to their environments through natural selection. His blunder in 1859 was failing to see that natural selection required a change in the accepted rules of heredity. At the time, it was generally assumed that the traits of two parents were somehow blended in their offspring, as if by mixing paints. But that meant any single variation, even if it greatly enhanced a species’s chance for survival, would be swamped in the blending. “A black cat introduced into a population of white cats,” Livio explains, would “on average produce two gray kittens, four lighter grandkittens, and so on.” Black fur would have no chance of enduring. Natural selection wouldn’t work if that were the case.

Gregor Mendel and others came along to prove that family characteristics are actually preserved as discrete entities, genes, that are handed down — sometimes expressed, sometimes hidden, yet passed to future generations. Darwin noticed this outcome in his Mendel-like experiments on snapdragons but failed to recognize its importance for natural selection. In this case, the blunder was an incentive; it paved the way for seminal research projects that proved that natural selection and Mendelian genetics worked side by side.

While Darwin was clueless, William Thomson (later known as Lord Kelvin) was simply stubborn. After achieving worldwide fame for formulating the laws of thermodynamics in the mid-19th century, Kelvin went on to estimate the age of the Earth based on the time needed for a primordial molten planet to cool to its current temperature. He figured 400 million years at most. Biologists and geologists were already estimating ages far older — billions of years — but Kelvin stuck to his guns for decades, even when a former pupil matched the geological age with a better physical model of the Earth and the discovery of radioactivity introduced a new source of energy for our cooling planet.

Psychological studies suggest that people make decisions based more on personal experience than on actual data. Scientists are no exception. Kelvin's sin was holding on to an opinion, even when confronted with massive contradictory evidence. He had been admired for his scientific prowess for so long that he couldn't give up the "drug" of being right.

Pauling was the complete opposite. A good friend recalled him saying that "mistakes do no harm in science because there are lots of smart people out there who will immediately spot a mistake and correct it. You can only make a fool of yourself and that does no harm, except to your pride." Pauling's pride must have been smarting after he hurriedly built a physical model for the molecular structure of deoxyribonucleic acid (DNA) that wasn't an acid at all. The world's greatest chemist had botched the chemistry, giving James Watson and Francis Crick more time to get it right.

Hoyle's greatest achievement was showing how most of the elements in the universe were forged inside stars. But he was led into blunders by the very philosophy that guided his work. "To achieve anything really worthwhile in research," he once wrote, "it is necessary to go against the opinions of one's fellows." That's how he joined with two colleagues in 1948 to fashion the steady-state theory of the universe, to serve as a foil against the idea that it all began with a Big Bang (a term Hoyle himself originated).

Hawking a universe that appears unchanging was simply an alternative view; it encouraged astronomers to look for evidence of the universe's true nature. It became a blunder when Hoyle, like Kelvin, kept the fight going, even after astronomers at last saw galaxies evolving and the universe awash in the leftover radiation of an initial cosmic explosion.

Now back to Einstein's insertion of a cosmological constant into general relativity. Was that truly his biggest blunder? Livio doesn't think so (and doubts that Einstein even said those words to Gamow). He believes Einstein's mistake was not keeping the added term in his equations, in a misguided effort to return his theory to a state of mathematical elegance. To Livio, that decision was as ill-chosen as Galileo's clinging to circular planetary orbits after Kepler proved that they are elliptical. Today, the extra push offered by a cosmological constant might be needed after all to explain why the universe is not just expanding but doing so at an accelerating speed, as discovered by astronomers more than a decade ago.

"The blunders of genius," Livio writes, "are often indeed the portals of discovery."

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