The great rogue wave

EXHIBITION

A red volcanic cone on a dark blue sky, a breaking wave in a stormy sea — Katsushika Hokusai's vivid depictions of Mount Fuji have become iconic for Japanese art. At seventy years of age, Hokusai began the work on Thirty-Six Views of Mount Fuji (*Fugaku sanjurokkei*), his masterpiece, in 1830. The woodblock print series actually consists of forty-six views of the mountain, the other scenes bearing Hokusai's new signature and being printed almost entirely in shades of Prussian blue. *The Great Wave off Kanagawa* (*Kangawa oki nami ura*) is the central piece of Hokusai's celebrated series, and of an exhibition at the Art Institute of Chicago (Beyond the Great Wave: Hokusai's Images of Mount Fuji, 20 July–6 October 2013).

Hokusai's *Great Wave* is very realistic and there is more to it than first meets the eye. It is not a tsunami as many might have thought. A recent study (J. M. Dudley, V. Sarano and F. Dias, *Notes Rec. R. Soc.* **67,** 159–164; 2013) suggests that it is a rogue wave — a very rare phenomenon caused by the combined effect of winds and ocean currents. Rogue waves occur spontaneously and are much larger than any other wave close by. By contrast, tsunamis refer to a massive water displacement propagating as a linear wave, and are created by a sudden movement of the ocean floor.

Both tsunamis and rogue waves are dangerous natural phenomena, but for ships far out at sea tsunamis do not represent a threat, whereas unpredictable rogue waves do. But, the *oshiokuri* boats in Hokusai's *Great Wave* may not be so vulnerable after all. This is because of the strong localization that could arise from linear propagation effects. Photographs of subantarctic waves show very similar localization and breaking dynamics. An alternative explanation for the characteristics of the *Great Wave* invokes solitons (J. H. E. Cartwright and H. Nakamura, *Notes Rec. R. Soc.* **63,** 119–135; 2009), but the role of linear and nonlinear effects in the formation of rogue waves remains controversial. Perhaps the absence of a complete understanding of the underlying physics makes the art more mysterious and allows us to enjoy it even more. ❐

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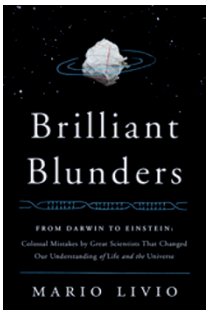
The human side of genius



Brilliant Blunders: From Darwin to Einstein

By Mario Livio

SIMON & SCHUSTER: 2013. 352PP. £18.99

In a breakthrough paper in 1953, Linus Pauling, the brilliant and much respected chemist, proposed the structure of DNA, the molecule of life. James Watson and Francis Crick frantically got hold of the paper, fearing they had lost the race to unravel the structure of DNA. But they soon drank a toast in The Eagle, their local pub in Cambridge, when they saw what Pauling had come up with: a helical structure — with three strands! It was shockingly wrong. The pair couldn't believe their luck and as a result of Pauling's blunder they were spurred on to finalize their own model, the now familiar double helix structure. For which they received the Nobel prize.

The account of Pauling's error is one of five fascinating stories told by Mario Livio in *Brilliant Blunders*, where mistakes made on the road to major scientific discoveries play a central role. These are not common or garden-variety mistakes, but large conceptual gaffes made by some of science's greatest heroes.

It may seem at first harsh that a handful of gifted scientists such as Linus Pauling — who went on to win Nobel prizes in two different categories — are singled out as blunderers. However, it soon becomes clear that Livio is far from out to take them down a peg. On the contrary, the stories are written with much detail and understanding and the end result is a more rounded picture of how some of the biggest scientific discoveries came about, with the intellectual stature of the five scientific heroes intact, if not increased.

Scientists are expected to make mistakes. It is the essence of scientific progress