Museum

Waxing and waning

The art of using wax models to demonstrate anatomy in three dimensions reached its zenith during the eighteenth century in the work of Ercole Lelli, in Bologna, and Clemente Susini, in Florence.

The most renowned collections of wax anatomical models are displayed in museums in these two Italian cities. But the Orfila Museum at the University of Paris V in France also holds important examples, including later works such as this 1847 model by one of the university's own anatomists, which was created for the museum's opening.

If you want to see the Paris collection, you may need to be quick, however. Unlike the Italian museums, the Orfila has struggled to survive, despite having been listed as a French National Heritage treasure in 1991. The university is reclaiming the exhibition rooms, and the museum's entire collection will be packed away into a basement later this year.

The Paris museum's collection has always been subject to dramatic swings in fortune. In the Second World War, for example, many of the wax models made by anatomist Jean-Baptiste Laumonier at the beginning of the nineteenth century were used to make candles, and only a few hundred remain in the collection today.

Despite this, the museum still hosts almost 6,000 historical items. These include, in addition to the wax models, anatomical models using other early twentieth-century techniques and materials. There are also casts of brains commissioned by neuropathologist Paul Broca — best remembered for his discovery of the part of the brain that controls speech — and an extensive collection of anthropological specimens, including Neanderthal and *Australopithecus* skulls and bones.

The museum can be visited by appointment. **Achim Schneider**

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theories seem to be incompatible, but Wheeler insisted that, at some level, quantum effects must have a meaningful impact on gravitational physics. And because Einstein's theory intimately links gravitational physics with geometry, the net result must be some sort of quantum space-time dynamics. It was using this reasoning that Wheeler predicted in 1957 the existence of space-time foam, one of many of his ideas that survive to this day.

Wheeler is popularly known for having coined the phrase 'black hole', and professionally for his wide range of profound contributions in physics, ranging from the very large to the smallest scales of size. Gravitation was reborn, with Wheeler's influence, as a mainstream branch of science, leading to the explosive growth in astrophysics and cosmology that we see today. At the other extreme of scale, he developed the theory of nuclear rotation, with Edward Teller, and the fundamentals of electrodynamics, with Richard Feynman. And it was Wheeler's seminal question that led to the perception of the positron as an electron travelling backwards in time.

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A sign of success: John Wheeler is credited with coining the phrase 'black hole'.

His 90th birthday was celebrated with a symposium attended by a metaphorical galaxy of scientific stars, and this book records the event. Do not be put off by its length: at over 700 pages this is still only about ten pages per year of active research, and this is one of those rare volumes where quantity is matched by quality.

With such a variety of contributions — ranging from quantum reality (by Freeman Dyson and others), big questions in cosmology (including articles by Andreas Albrecht, John D. Barrow and Andrei Linde), higher dimensions (Lisa Randall) and the emergence of life (George Ellis) — how can a review do justice to them all? Perhaps I should focus on the man himself, aptly summarized in a readable and insightful opening chapter by Paul Davies.

Wheeler's gift has been in asking questions that are, in the modern parlance, 'outside the box'. While most of us rack our brains trying to determine and understand the implications of nature's laws, Wheeler wondered whether the very concept of physical laws might be an emergent property. Could law-like behaviour emerge stepwise from the ferment of the Big Bang, instead of being mysteriously and immutably imprinted on the Universe at the instant of its birth? As Davies says: "Wheeler was breaking a 400 year old scientific tradition of regarding Nature as subject to eternal laws."

As students we learn quantum mechanics, and as professionals we apply it with varying levels of unease as to what it actually means, but Wheeler had a singular attitude. He insistently asked: "How come the quantum?" Why is the world quantum mechanical? What would happen if we made small changes to quantum mechanics? The preface asks the same sort of questions as Wheeler: "Could it be that quantum mechanics is the simplest mechanics consistent with the existence of conscious beings?" Or does it "optimise the information processing power of the universe"? These are profound questions, as yet unanswered but extensively and profoundly discussed, and some sense of the debate can be found in this book.

Wheeler was the inspiration behind the most extreme connection of all: that quantum mechanics, a theory of subatomic dimensions, can be applied to cosmology, the largest system of all. In response to Einstein's question "Did God have any choice in the nature of his creation?", Wheeler has suggested that there are no truly fixed fundamental laws of physics at all. He was a remarkable man and this is a remarkable volume. ■

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