their findings did not immediately fall foul of Soviet dogma.

Eventually the Stalinist state caught up with everyone. Egorov was detained in 1930 for "mixing mathematics and religion" and died in prison. Florensky confessed under torture and was sent to the Gulag, where he studied permafrost and seaweed before his execution in 1937. The case of Luzin is a miraculous exception. In 1936 he was accused of collaborating with foreigners by the Marxist mathematician Ernst Kolman, who proclaimed, "Soviet science will rip away your mask!" He was saved by a letter to Joseph Stalin from the physicist Peter Kapista, who argued that Luzin might yet be useful to the government. It is not clear why Stalin listened, but his whim ensured the future of a discipline.

It will be hard for the uninitiated to follow *Naming Infinity*, owing to the book's uneven exposition and narrow biographical focus. The connection between mathematics and mysticism is tenuous. The real drama appears around the edges, as the researchers survive famine, repression and war long enough to set the direction for a century of mathematics. It is a story of the persistence of intellectual life against the wrecking tide of history. ■

Jascha Hoffman is a writer based in New York.
e-mail: jascha@jaschahoffman.com

The hidden language of cells

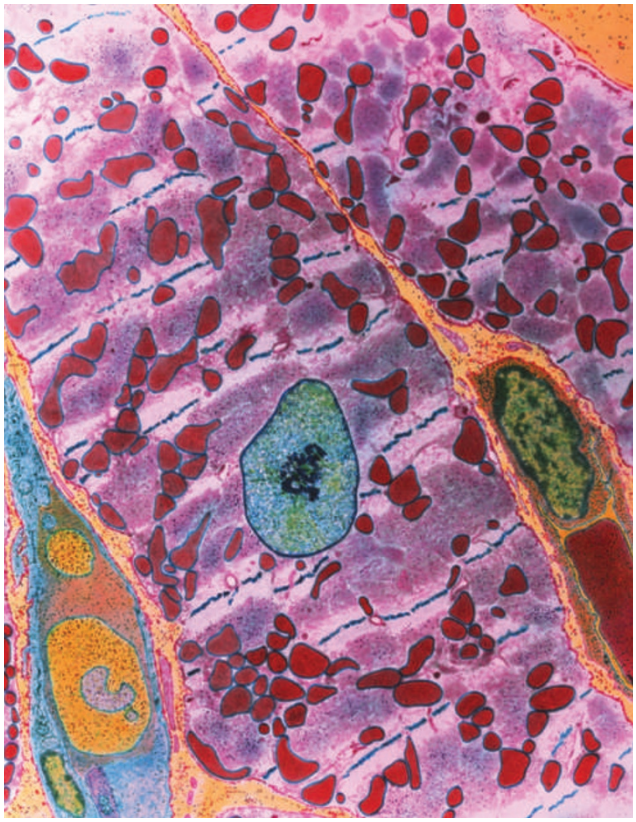
How We Live and Why We Die: The Secret Lives of Cells
by Lewis Wolpert
Faber and Faber: 2009. 256 pp. £14.99

The greatest implication of evolutionary theory is the common kinship of living things. It is expressed no better than by Henry Harris in *The Birth of the Cell* (Yale University Press, 2000) as "the doctrine that all plants, animals, or whatever, are composed of independent but co-operative units we call cells". And, whatever life's origin, "the universal solution to the problems confronting its further evolution was the progressive assembly of the cell".

Lewis Wolpert's latest book attempts to relate just how far that 'progressive assembly' has gone in our own evolution. And, more concretely, he asks what insights the 'cell doctrine' gives us into the processes through which, and by which, we are conceived, develop, function, mature, grow old — and die.

It is a book in a tradition, not limited to science, of explaining the visible in terms of the invisible. But however invisible the world of cells and their molecules once was, it is not now. Through scanning electron microscopy and X-ray diffraction, coupled with modern information technology, people have become acquainted with images of cells and 'living' biological molecules. We have seen what the world of the very small looks like in three dimensions and in dramatic full colour, even if that colour is false. What we don't know so well is how cells and molecules actually behave, and how their behaviour explains ours.

Wolpert's book has no pictures and few numbers. So, if you do not know about the size and appearance of cells and their molecules, you won't discover it here. This matters because in biology, size is so often the key to understanding both anatomy and physiology. A cell's size is conceptual, not merely a fact. Being the 'right' size places it correctly in its — and our — physical universe.



SPL

Modern microscopy reveals the many mitochondria (red) in a heart cell.

How We Live and Why We Die is a translation from another language — biology. Years ago, Bob Burchfield, then the editor of the *Oxford English Dictionary*, told me that biology had more words of its own than any other area of knowledge, 60,000 or so — a greater number than most of the world's languages. Thus the scale of biological language is a measure of how biology has overwhelmed its history. The meanings of these words — the things and ideas that lie behind them — have to be negotiated into the semantic space of our everyday, more familiar world. Indeed, the book shows just how unfamiliar, eclectic, mongrel, or simply borrowed and recycled, the biological vocabulary is: *HOX* genes, sonic hedgehog, spindle, apoptosis, aster, telomere, P53, French flag model, and so on.

Translation from biology is harder than that from a national language where much in its culture would be recognizable and the negotiation of meaning easier. It is a difficulty all too apparent in *How We Live and Why We Die*. And it is a difficulty emphasized by the telegraphic style Wolpert has adopted. The book says, for instance, that "Animal cells like ours generate energy from the breakdown of their food when combined with oxygen, while plants make use of sunlight". A teenage student would not get away with that. Both animal and plant cells break down 'food' using oxygen to produce energy. It is simply that plants make that food in the first place, using sunlight, whereas animals do not — they have to forage for it. Sloppy language adds to the confused picture in sentences like this: "The factory for producing energy in animal cells comprises special structures known as mitochondria". "Factories" don't produce energy, they use it. A power station is the right analogy. "Comprises" is the wrong word and "special" tells us nothing.

Rendering science into understandable everyday language without losing its point may be hard. "Language is the dress of thought," wrote Samuel Johnson. How well do the new linguistic clothes fit the ideas? The example above — only too typical of the book — shows that sometimes the answer is, badly. The author seems to have been lost for words. And regrettably, so am I. ■

John Galloway is at the Eastman Dental Hospital, 256 Gray's Inn Road, London WC1X 8LD, UK.
e-mail: john.galloway@uclh.nhs.uk