BOOKS & ARTS

Great inventions of life

A book setting out the ten greatest transformations delivered by evolution contains surprises but neglects crucial innovations such as proteins and embryos, **Lewis Wolpert** finds.

Life Ascending: The Ten Great Inventions of Evolution
by Nick Lane
W. W. Norton & Co./Profile Books: 2009.
352 pp/288 pp. $26.95/£18.99

J. EFFNER/DPA/CORBIS

Flowering plants that rely on pollinators could evolve once organisms had developed the ability to move.

The variety of living things is astonishing — as is their evolution. Nick Lane describes in *Life Ascending* "the greatest inventions of evolution, how each one transformed the living world, and how we humans have learned to read this past with an ingenuity that rivals nature herself". The ten inventions he has chosen are the origin of life, DNA, photosynthesis, the complex cell, sex, movement, sight, hot blood, consciousness and death. Not everyone will agree with his choice. But his writing and explanations are excellent and imaginative and, similar to life itself, the book is full of surprises.

The origin of life — the evolution of the single cell from which all life is derived — is not yet solved. Particularly difficult to explain is the evolution of cell division. The first cells were simple bacteria, but they were complex in that their constituent molecules interacted in a reliable way. Eukaryotic cells with a nucleus and with mitochondria came later. The book mentions the origin of mitochondria — thought to have occurred when a primitive eukaryotic cell swallowed a bacterium — but explaining the origin of the nucleus is harder.

Surprisingly, Lane pays little attention to proteins. He discusses genes in detail, but in the cell they are passive, coding for the true workers: the proteins. Proteins provide the cell with the ability to synthesize and break down molecules, and they turn genes on and off and replicate DNA. They give the cell its basic structure. But how did proteins evolve?

A major omission from Lane's list of inventions is the embryo and the development of complex forms from a single cell. The origin of multicellularity is not discussed, yet it is fundamental to the evolution of all animals. My view is that it may have evolved when a group of cells stuck together after dividing and then, when food was in short supply, some cells survived by eating each other. This could have given rise to the egg, which is a cell fed by other cells.

Lane believes that it was the evolution of movement after the Permian extinction some 250 million years ago that transfigured life. Flowering plants could evolve once there were motile organisms to fertilize them. A key stage was the origin of muscle proteins, which are not present in bacteria. But Lane neglects to relate this development to the origin of the brain, a major function of which is to control movement.

Looking at consciousness, Lane admits that there is as yet no understanding of how neuron firing gives rise to intense personal sensations. He pays little attention to language and to what makes us human. In my view, it is our belief in physical causality that led to tool-making and drove human evolution.

The evolution of vision is fundamental — 95% of animal species have eyes, and the ability to see may have played a key part in the rapid burst of evolution known as the Cambrian explosion as prey had to adopt new survival strategies. Lane counters the critics who claim that an eye must be fully functioning to be adaptive: the naked retina of the supposedly blind shrimp is indeed adaptive. A surprising example of the cleverness of evolution is the nature of the crystallins that make up most of the proteins in the human lens. Many other crystallins are enzymes with housekeeping functions in the body that are unrelated to vision.

On evolution and sex, Lane argues that "men are a heavy cost" and states that "a woman who solved the problem of virgin birth would be a worthy madonna". He regards as a great advantage of sex that it allows good genes to recombine away from the junk residing in their genetic background.

On the evolution of warm blood, which lets animals such as birds and mammals maintain a constant temperature, Lane points out that it is a surprising outcome given the energy expended. He explains it as a means of giving stamina to animals.

Death, in Lane's view, is about ageing: "Death may seem a cruel cosmic joke, but ageing is mirthless." Only the germ line is immortal; he supports the 'disposable soma' idea that evolution has no interest in animals once they have reproduced.

Life Ascending is a fascinating book for anyone interested in life and evolution, and how these discoveries were made. ■

Lewis Wolpert is emeritus professor of cell and developmental biology at University College London, Gower Street, London WC1E 6BT, UK.
e-mail: l.wolpert@ucl.ac.uk