

Redox Genetic Switches in Photosynthesis

Draft popular summary

The 2010 Royal Society Prize for Science Books was awarded to Nick Lane for “Life Ascending: The Ten Great Inventions of Evolution” (Profile Books, 2009).

In previous books, Nick Lane published accurate and clear accounts of two of John Allen’s contributions: the CoRR hypothesis for maintenance of organelle genomes; mitochondrial division of labour as the function of separate sexes.

Life Ascending revisits these topics, while presenting a lucid description of a third contribution – John Allen’s redox switch hypothesis for the origin of cyanobacteria and, thus, of free atmospheric oxygen*.

The following introduction to Nick Lane’s account of the hypothesis is taken from Life Ascending Chapter 3, Photosynthesis (pages 81-82).

“...we have no real genetic evidence for how the photosystems came to be assembled together in the Z-scheme. But that doesn’t mean we can’t work out the answer. The great value of hypotheses in science is that, by making imaginative leaps into the unknown, they suggest new angles and experiments that can corroborate or refute the postulates. Here is one of the best – a beautiful idea from John Allen, professor of biochemistry at Queen Mary, University of London, and an inventive mind. Allen has the dubious distinction of being the one person I’ve written about in three consecutive books, with a different groundbreaking idea in each. Like the best ideas in science, this hypothesis has a simplicity that cuts straight through layers of complexity to the quick. It may not be right, for not all the great ideas in science are. But even if it’s wrong, it shows how things could have come to be the way they are, and by suggesting experiments to test it, guides researchers in the right direction. It offers both insight and stimulus.”

The redox switch hypothesis is also presented and described in Professor Brian Cox’s 2013 BBC2 series Wonders of Life, and referenced in the companion book: Cox, B. and Cohen, A. (2013) Wonders of Life. BBC publications, London.

*Allen, J. F. 2005 A redox switch hypothesis for the origin of two light reactions in photosynthesis. FEBS Letters 579, 963-968.