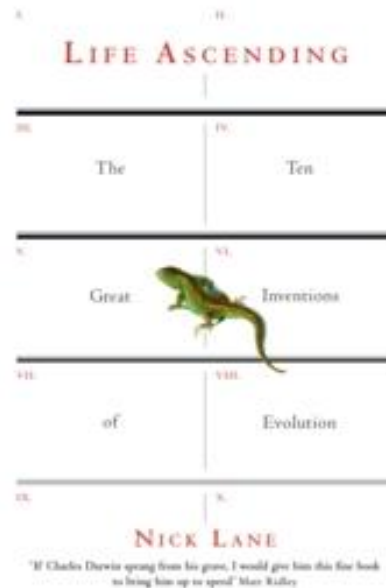


Book Review

Life Ascending – The Ten Great Inventions of Evolution, Nick Lane, Profile Books, London, 2009.

This book is a good read for school students who have completed a course in Higher Biology or Human Biology and are progressing to Advanced Higher Biology. It is written in an engaging and thought provoking style and the biology underlying the themes and topics is introduced sequentially enabling students to follow the science from the familiar to new ideas. Much of the book, although based on closely argued evidence, is speculative making it a stimulating read for teachers as well as interesting, although at times challenging, for students. Potential readers can get a flavour of what the book is about by viewing Nick Lane's mini-lecture *The Origins of Complex Life* on [YouTube](#).



The ten aspects of evolution selected by the author are his personal choice and within them include areas relevant to the Advanced Higher course (detailed below) as well as topics of wider and more general interest. The book also touches on topics students will be familiar with from Higher Biology and Higher Human Biology such as: respiration and Krebs cycle (Origin of Life), fast and slow twitch muscle fibres (Movement), circulation and lung arrangement in reptiles, birds and mammals (Hot Blood) and perception (Consciousness) as well as the chapters on DNA, Photosynthesis and Sex.

Chapter 1 approaches the Origin of Life from two sources of evidence. A 'bottom up' approach that considers the geochemical conditions on early earth and their ability to generate organic molecules and energy that could be precursors for life and that can still be found in the hydrothermal vents of today. The other approach is 'top down' which looks at the metabolic processes likely to be found in the Last Universal Common Ancestor. This charts the evolutionary importance of processes that will be familiar to Higher students such as Krebs cycle and the generation of ATP, reinforcing and extending their knowledge of these processes. Chapter 2 covers the familiar territory of DNA but considers how DNA, the genetic code and RNA could have evolved to result in the synthesis of proteins. Chapter 3 looks at the importance of oxygen from photosynthesis and the origin of chloroplasts for the evolution of life beyond bacteria. The evolution of photosynthesis as a process is considered from the point of view where energy from the transfer of electrons is used to split water, generate ATP and to produce carbohydrate as an energy source for respiration. Chapter 4 draws from the first three chapters to consider the evolution of the eukaryotic cell. Here the author makes the case for the eukaryotic cell arising from a combination of a bacterium and an archaeon, which provided the potential to develop mitochondria, a nucleus and phagocytosis. The remaining six chapters of the book deal with aspects of evolution in multi-cellular organisms.

Chapter 5 on Sex covers the AH Biology topics of the rate of evolution, co-evolution and the Red Queen, costs and benefits of reproduction and the independent assortment and recombination of meiosis. Chapter 6 on Movement covers the AH Biology topics of the role of ATP in the binding of myosin and actin in muscle contraction (the reversible binding of phosphate and control of conformation of proteins) and the remodelling of the cell's cytoskeleton in cell division. It is suggested that this evolution of motility resulted in a greater interaction between species leading to more rapid evolution with new lifestyles and the emergence of things like predation, sensory mechanisms, pollination, ecological dispersal and more complex ecosystems. In Chapter 7 the suggestion is that the visual pigment rhodopsin in the retina of the eye evolved in a common ancestor only once whereas the lens of the eye evolved in different animal groups from different crystalline proteins. The role of rhodopsin in photoreceptor protein systems is part of AH Biology. Chapter 8, Hot Blood, deals with the evolution of homeothermy. Here the selective advantage is seen as being increased activity and stamina leading to success. The evolution of mammals and birds is tracked from reptile survivors of the Permian extinction; one group leading to the mammals and the other to crocodylians, pterosaurs, dinosaurs and birds. Chapter 9 deals with the evolution of Consciousness. Here the author suggests that if emotions and feelings, the basis of consciousness, consist of synchronised patterns of firing neurones (for which he provides evidence) then these patterns can be the subject of selection in evolution. Finally Chapter 10 deals with Death. Here mention is made of caspases and their role in programmed cell death (apoptosis) which is part of AH Biology. Here the author looks at the degenerative diseases and cancer associated with ageing as the loss of the normal control of apoptosis resulting in excessive cell death and cell proliferation respectively. He speculates that seeking the genetic control of ageing is more likely to lead to successful management of good health in ageing rather than seeking treatments for individual age related conditions. If interventions to manage the genetic changes in ageing can be developed then almost all of these conditions could disappear as a consequence.