Book Review

"Nature's Destiny: How the laws of biology reveal purpose in the universe." By Michael J Denton

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This is Michael Denton's second book, a follow up to his earlier thought provoking book, *Evolution: A Theory in Crisis* published in1986, where Denton dealt with difficulties associated with the chemical origin of molecules required for the biochemical evolution of the cell and subsequent problems connected with contemporary evolutionary theory as an explanation for life on this planet. *Nature's Destiny* examines the fitness (for carbon based life as we know it on this planet) of a wide variety of essential factors. These factors range from the carbon atom to the very challenging idea that man is uniquely adapted for the use of fire, argued by Denton as the essential ingredient for the development and advancement of technology. Denton revisits the evolutionary discussion suggesting that given the complexity of the cell and its constituents, organic evolution would have to be the result of some kind of directed program rather than a consequence of random undirected processes. The complexity of organs such as eyes and lungs argues against current undirected Darwinian evolutionary mechanisms. Denton concludes that the entire universe, from molecules to galaxies is uniquely tuned and perhaps programmed for one purpose, the development of carbon based life with mankind as its eventual climax.

By way of introduction Denton looks at the basic physical forces behind the fabric of the universe including gravity, electromagnetism, weak and strong nuclear forces. As noted by others, the strength of these forces varies over many orders of magnitude. Gravitational forces are weak compared to strong nuclear forces allowing the universe to be the size that it is and permitting the development of stars and galaxies. If these forces were other than what they are, the universe may have been too small (and existed only for a very short period of time) or have not have existed at all as the matter composing stars and galaxies would never have formed. Nuclear forces are just what they should be to allow the development of the wide range of different atoms necessary for the development of complex molecules whose structures must coordinate in the production of the living cell; fine tuning beyond comprehension!

He examines a range of fundamental entities such as the carbon atom, the water molecule, light, gases etc that contribute either directly to the fabric of organisms (not only in terms of their structure, but also in terms of their required biochemistry) or the environment in which they live. Water is composed of molecules that impart to it very unique properties that if different in any way from what we observe, would have made life impossible. Water's unique thermal properties allow for maintenance of body temperature by evaporation. It has low viscosity allowing for easy flow in biological systems and the ability to dissolve and permit diffusion of molecules within it, upon which all biochemistry depends. Water has a high surface tension facilitating the production of droplets and concentration of molecules needed for the development of life. Denton argues that the very density of water permits us to be the size we are. If it were heavier we would not be upright bipedal humanoids, but only a fraction of our size—and as Denton suggests, we would never then be able to handle fire. Our size uniquely fits us for this activity. Like water, light is uniquely tuned for such diverse processes as photosynthesis and vision; the atmosphere absorbing out the harmful radiation emitted by the sun allowing life to flourish on this planet.

The humble carbon atom, the basic building block of all life is uniquely tuned for just this purpose. For instance, its chemistry enables it to form biology's required compounds in precisely the temperature range at which water is a fluid. The ready formation of chemical bonds between carbon, hydrogen and oxygen allows for the existence of an almost unlimited variety of molecules known as hydrocarbons, lipids, proteins and carbohydrates that make up not only the structure of cells, but also serve as the molecules that supply the cell with energy during metabolism. It is the relative ease with which bonds form between these three atoms and the combinational varieties of the resultant molecules that is reflected in the diversity, richness and adaptability of life on earth. Other molecules such as the gases oxygen and carbon dioxide are also uniquely fit for their role in life's process. Oxygen is highly reactive but has low solubility in aqueous solutions; it is transported and manipulated by protein molecules containing iron and zinc atoms allowing it to participate in the intricate biochemical reactions of cellular life in a very controlled way. Carbon dioxide, the end product of many biochemical reactions combines with aqueous solutions such as blood, acting as a control of acidity, buffering the body's fluids while returning to the lungs for excretion only then to be used as atmospheric carbon dioxide by green plants replenishing the earth's oxygen and glucose supply.

His discussion turns to the fitness of biological macromolecules such as DNA and protein and other essential molecules necessary for the construction and operation of the fundamental life unit—the cell. These macromolecules are enormous assemblages of carbon, hydrogen and oxygen atoms arranged with such precision allowing for distinct biological sense, function and purpose. DNA, the molecule of heredity, the blueprint molecule of life has the ability to replicate with the aid of protein molecules whose synthesis it directs. The replication of DNA is essential for cell division that life might propagate and flourish. DNA is uniquely tuned for this purpose, its long double helical strands separating along a line of weak hydrogen bonds allowing for the reading of a literal chemical language, the order of its nitrogenous bases (adenine, guanine, cytosine and thymine) and reproducing this order in newly synthesised molecules.

DNA is found as the same structure in all life, differing only in the amount and order of bases. The order of these bases is the genetic code for that organism, directing its cellular biochemistry and determining its structure. Ordered base sequences dictate the order of amino acids in protein molecules which in turn determine their three dimensional structure and function. The proteins are the micro-machines of the cell, the most basic operational components of cellular biochemistry, without which there would be no life. All molecular interactions in the cell are mediated by unique three dimensional interactions and as Denton rightly points out, the basic α helix of protein structure is uniquely fitted for interaction with the major groove in the structure of the helical DNA molecule. These tuned structural interactions allow for recognition of base sequences in DNA needed for a host of metabolic activities including the control of gene expression and DNA repair following chemical damage.

And what of the fitness of the cell itself? Composed of a great variety of carbon-based three-dimensional molecules, the cell is a self-replicating membrane bound molecular factory found in various forms and in various degrees of differentiation and specialisation in all organisms. The membrane is made of fluid lipids, self-sealing and selectively permeable to the multitudes of molecules it encounters. The membrane is also capable of communication with other cells via the specialised protein molecules acting as receptors and signal transducers found floating in its sea of lipids.

Advancing several orders of magnitude from the cell, Denton considers man himself. What unique attributes are displayed by *Homo sapiens* and how do they relate to man's interaction with the cosmos? Orchestrated

and organised from this staggering array of macromolecules making up the cells of the body comes man, as Denton suggests, uniquely fit to explore and comprehend the universe in which he dwells. The unique adaptations of man include intelligence, language, the hand, vision, a unique upright stance and sociability. Language allows the communication of ideas (the hallmark of intelligence); the hand and vision allow coordination of complex practical tasks including the manipulation and exploration of his environment. Denton points out that only a social creature could develop advanced technology. He explores the interesting concept that interaction between the optimal size and upright stance of humans is uniquely suited to manipulate and use another unique property of the interaction between carbon-based molecules and oxygen—fire. Denton argues that fire allowed technology to advance via metallurgy and the development of tools and that only mankind's size and bipedal form allowed him to manipulate and control fire. Denton suggests that the smallest sustainable fire is only about 50 cm across and an organism smaller than man, for example the size of an ant or even small dog would have difficulty in manipulating this precious resource. Denton also discusses the contractile power of muscles, the fine control between neurones and muscles, the speed of nerve conduction limiting the size of organisms with respect to agility and the size of man's organs as all uniquely tuned components necessary for the function of man.

He also addresses the question of whether the fitness for life observed in atoms, molecules and macromolecules composing the cell then lend themselves to some form of directed evolution particularly when the complexity of life with respect to the staggering array of interacting subsystems is considered. Is there an inbuilt generative program explaining the development of life on earth? As an extension of the thesis of his first book, Denton finds it hard to accept that life could develop without generative laws guiding the assembly of carbon-based molecules into the many self-replicating systems seen in the cell. He asks if life's origins are so apparently "built in" (with respect to his 'fitness for life argument' at a chemical and molecular level), then the biologists 'tree of life' may also be "built in" (in more recent times this concept has been referred to as *convergence*, where independently evolving biological systems find the same solution for a given need or requirement, for example, the independent development of intelligence and tool-making in different species).[1] This would necessitate some form of directed evolutionary process in comparison to an undirected process that would be challenged to produce the myriad of

complex life forms around us. Thus Denton envisages the existence of life as the result of a directed evolutionary process based on the incredible set of coincidences necessary for its origin and development. Indeed, Denton would suggest that mankind is the goal and purpose of the universe. Adding to his arguments in favour of directed evolution is the complexity of interacting systems and subsystems covering the depth of biochemical, anatomical and physiological integration observed in living organisms. While not alluding directly to current arguments of intelligent design, Denton follows a similar reasoning. The sheer integrative complexity of any organism from basic chemicals and biochemicals through to macromolecules such as DNA and protein underpinning the resultant anatomy and physiology of an organism challenges contemporary Darwinian evolution theory. Denton investigates such challenges when complex systems such as eyes, avian lungs and brains are considered. He argues that these remarkable structures and adaptations present evidence for something more than Darwinian processes.

Denton concludes that such a long chain of events that lead to the development of life on this planet can only be considered as an overwhelming set of coincidences that is evidence of the anthropic principle. Some have expressed disappointment with Denton's arguments and see his second book almost as a recant of his first. However, his second book is truly an extension of *Evolution: A theory in crisis*. As a scientist, Denton has explored the insurmountable problems associated with chemical evolution and the development of life on earth. He has addressed the anthropic principle (the fitness for life argument), which surprisingly has been overlooked by many in the diversity of the intelligent design movement. Denton's conclusions are that given the complexity of life within the framework of the 'tree of life', Darwinian evolution as an explanation is found wanting and something more is needed; for Denton this is directed evolution. Science moves quickly and the faster it seems to move, the greater the complexity it discovers in the natural world. Scientific explanations must move and quickly adapt just to keep up. Design, the anthropic principle and the concept of directed evolution advocated by Denton all would be in harmony with the overriding concept of an intelligence behind the universe.

Reference

1. Simon Conway Morris, "*Darwin's Compass: How Evolution Discovers the Song of Creation*" The 2005 Boyle Lecture (http://www.stmarylebow.co.uk/?Boyle_Lecture).