



Was
Darwin
Wrong?



Nature's Destiny.

From the impossibility of evolution to the inevitability of evolution: Anti-Evolutionist Michael Denton turns into an 'Evolutionist'.

A review by Gert Korthof
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He who finds coincidences, was looking for plan and purpose (gk)



Nature's Destiny. How the Laws

of Biology reveal Purpose in the Universe.

by Michael Denton

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454 pages

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1. The Harmony of the Spheres
2. The Vital Fluid
3. The Fitness of the Light
4. The Fitness of the Elements and the Earth
5. The Fitness of Carbon
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'Nature's Destiny' is one long argument for the biocentric Fine Tuning of the Universe. In that sense it is a greatly expanded version of the chapter "The Puzzle of Perfection" in his *Evolution: a theory in crisis*(1986). However the Fine Tuning Argument does not only imply cosmological evolution, but it also implies biological evolution. And that is exactly what his previous book *Evolution: A Theory in crisis* attacked in the most thorough way. And biological evolution, that is the common descent of all life, is exactly what he defends now in *Nature's Destiny*. Not a limited version of evolution. No, complete naturalistic evolution from inorganic materials to the first cell to humans.

Thereby he directly opposes 'special creationists' such as Phillip Johnson (6). Above that he claims that evolution is directed and the origin of life is inevitable if conditions are right.

Does he present new facts about evolution to support his claim ? Do we learn from his new book what exactly was wrong with the anti-evolution arguments in his previous book?

In my review of [The Anthropic Cosmological Principle](#), I wondered why anti-evolutionists like Johnson, Denton(1986) and Behe never exploited the Fine Tuning argument to prove the existence of a designer. If they knew about the Fine Tuning at all, then the reason must be that fine tuning involves evolution and evolution involves randomness. And this was seen as contradictory to a purposeful universe by the creationists. Therefore they were unable to utilize the Fine Tuning Argument. Paradoxically, an argument for the Design of the Universe wasn't available to creationists!

Denton is the first anti-evolutionist and anti-Darwinist I know who uses the FT argument to prove design of the universe. He gave up his opposition to evolution. This is nothing less than going from the impossibility of biological evolution to the inevitability of evolution ! How could he do so ? For he had not only shown in his [Evolution: A Theory in crisis](#), that the Darwinian *mechanism* for evolution could impossibly do what it was supposed to do, but also that all the biological facts pointed to his anti-evolutionary Typological Model, which denied the reality of (macro-)evolution. According to Denton (1986) there were no intermediates; there were gaps in the fossil record; protein sequence data prove discontinuity; in the end Darwinists failed to provide evidence for macro-evolution; failed to establish the fact of evolution and failed to provide an adequate mechanism capable of transforming species on a macro-scale. However Denton did accept a limited form of evolution : micro-evolution. So in *Nature's Destiny* he had to overcome two of his own obstacles: the **mechanism** and the **fact** of evolution. Did he succeed and how ?

First: the **fact** of evolution. In *Nature's Destiny* Denton does not

quote from the book :

"it is important to emphasize at the outset that the argument presented here is entirely consistent with the basic naturalistic assumption of modern science - that the cosmos is a seamless unity which can be comprehended ultimately in its entirety by human reason and in which all phenomena, including life and evolution and the origin of man, are ultimately explicable in terms of natural processes. This is an assumption which is entirely opposed to that of the so-called "special creationist school". According to special creationism, living organisms are not natural forms, whose origin and design were built into the laws of nature from the beginning, but rather contingent forms analogous in essence to human artifacts, the result of a series of supernatural acts, involving the suspension of natural law. Contrary to the creationist position, the whole argument presented here is critically dependent on the presumption of the unbroken continuity of the organic world - that is, on the reality of organic evolution and on the presumption that all living organisms on earth are natural forms in the profoundest sense of the word, no less natural than salt crystals, atoms, waterfalls, or galaxies." (page xvii-xviii).

address the issue directly, so it is difficult to point to one or two facts which made the difference. Remarkably, he refers to Kauffman (1) and deDuve (2), to show that, given the right initial conditions, the origin of life and evolution is inevitable.

Second: the **mechanism** of evolution. Denton is clearer about that. Denton presents 'new' evidence for the adequacy of the Darwinian mechanism of evolution (surprise!) and he tries to escape the randomness of the Darwinian evolutionary process by postulating 'directed evolution' (surprise!). This remarkable paradigm change of Denton, necessitates exclusive attention to Evolution in this part of my review.

What is his goal ? The aim of *Nature's Destiny* is first, to present the scientific evidence for believing that the cosmos is uniquely fit for life as it exists on earth and for organisms of design and biology very similar to our own species, *Homo sapiens*, and second that this is entirely consistent with the older teleological religious anthropocentric view of the cosmos.

Why does Fine Tuning imply biological evolution?

Life did not exist at the beginning of the universe. The 'purpose' of the fine tuning is to 'ensure' the production of life by fine tuning the initial conditions of the universe.

What is his 'new' evidence for evolution ?



Can we find crucial evidence in his book which converted him to evolution ? The key passage, I think, occurs in the paragraph "The Closeness of All Life in DNA Sequence Space" of CH 12 (p276). It must have been *the* key insight for Denton. It reads:

"One of the most surprising discoveries which has arisen from DNA sequencing has been the remarkable finding that the genomes of **all** organisms are clustered **very close** together in a tiny region of DNA sequence space forming a **tree of related sequences** that can all be **interconverted** via a series of **tiny incremental natural steps**". [emphasis is mine]

I wished Denton showed evidence for this (9). It is neo-Darwinism in a nutshell, it is what neo-Darwinists assumed all the time! He continues:

"So the sharp discontinuities, referred to above, between different organs and adaptations and different types of organisms, which have been the bedrock of antievolutionary arguments for the past century (3), **have now greatly diminished at the DNA level**. Organisms which seem very different at a morphological level can be very close together at the DNA level." [emphasis & note are mine]

So his main obstacle to believing in a step-by-step change of organisms has been blown to pieces. That's why he now can accept evolution. And the special

character of the DNA evidence is, I think, that it unites evidence for the **fact** of evolution (DNA looks like a tree of sequences) and evidence for the **mechanism** of evolution (DNA is subject to small mutations). DNA-evidence is the fact and the mechanism of evolution.

Is this the whole story? No. DNA has the potential to overcome the obstacle of functionless intermediates by 'going underground': simply not being translated into proteins. Then it can mutate in any direction without being harmful to the organism. In Denton's words:

"Thus, new organs and structures that cannot be reached via a series of functional morphological intermediates can still be reached by change in DNA sequence space." (p279)

Taken together with the previous argument, the whole argument eliminates Denton's 'last' obstacle to evolution and so there is 'nothing' which prevents him anymore from acceptance of the fact and mechanism of biological evolution. He could have known in 1986 the *theoretical possibility* of DNA's capacity, but was blinded by selfconstructed discontinuities in enzymes like Cytochrome-C. Now Denton has the facts that support this theoretical possibility: a diverse group of cichlids differ only 0.4% in their DNA, human and chimpanzee differ only 1% in their DNA, etc.

Is this the whole story? Again: NO. This is because the Fine Tuning argument implies teleology, that is a goal, a purpose, a direction. The universe is fine tuned for something and that something is life and humans. This is not really compatible with the Darwinian trial and error process! So Denton's acceptance of evolution would be for nothing? He still finds the obstacle called 'randomness' on his road to the purposeful universe. What is Denton's solution? His answer is: 'directed evolution'.

What is the evidence for 'directed evolution' ?



Let us state the problem again: the outcome of a trial and error process is unpredictable. The existence of humans could be a lucky accident. Natural selection is undirected according to neo-Darwinism. The possibility of letting some designer do some tampering during the evolutionary process is blocked by Denton's rejection of any supernatural intervention (see quote from page xviii). So where does the direction come from? There isn't a chapter devoted to 'directed evolution', instead of that one learns about 'directed evolution' in Ch 15, where he, remarkable enough, again challenges neo-Darwinian evolution with new examples like the unique eye of the lobster and old ones like the avian lung! However, the most remarkable change is, when we compare it to Denton(1986), that the challenge is now for *the mechanism* of evolution, not for *the fact* of evolution. Let us have a look at Denton's new logic:

"Again, as in the two cases cited above, it is hard to believe that any sort of **unguided** evolutionary mechanism would have realized such an unusual adaptive end." (p360). [emphasis is mine]

"Just how such a different respiratory system could have evolved gradually from the standard vertebrate design **without some sort of direction** is, again, very difficult to envisage..." (p 361) [emphasis is mine].

What was a challenge to evolution and Darwinism in 1986 is now evidence for directed evolution against a background of inevitable evolution. Denton does not account for this paradigm change. It is clear from these quotes alone that Denton's 'evidence' for directed evolution is negative. Some adaptations cannot be explained by the random Darwinian mechanism, so they must be somehow 'directed'. A footnote is revealing where 'direction' is coming from :

"We can envisage such a contriving or tampering of the **DNA space** to be analogous to rearranging the structure of the English **lexicon** to permit the evolution of a particular word tree, ... However, by playing God and restructuring the **lexicon** we would be able to arrange a vast word tree within the letter space, so that all functional words were clustered together..." [emphasis is mine] (page 434). (4)

By DNA space he means the set of all possible DNA sequences. My criticism is that if restructuring the lexicon is analogous to restructuring the DNA space, then this boils down to intervention and Denton excludes intervention from the beginning of his book. Why does this imply intervention? Because one cannot fine tune the 4 DNA-bases A,T,C,G so that the DNA-sequences are restricted to easily interconvertible useful DNA-sequences. And this is so because the 4

bases *do not and cannot* restrict DNA sequences in any way. Why ? Because there is nothing in the 4 bases that enforces a sequence ATACGATCGA rather than CTACGTTACC. Or any other sequence. And this is necessarily the case. Otherwise DNA would not be fit for the task of information storage. Each of the 4 bases can be linked to each of the 4 bases. *Every* DNA sequence can be produced with the 4 bases (8). There is no restriction in length and composition, *which derives from the 4 bases*. The **information content** of DNA is irreducible to the properties of the 4 bases. Just as a book is not reducible to the properties of the alphabet. In my view evolution is essentially an open ended adventure. Contrary to Denton I believe a trajectory through *DNA space itself* cannot be pre-programmed. See also his paragraph "Constraints in Sequence Space" (p281), where he makes very clear that he believes in a "prearranged DNA sequence space". No, constraints must be found *outside* the DNA space. I do not object to constraints, but they cannot be a substitute for *searching* the DNA space. Denton's insistence on the tampering with the DNA space as the main mechanism of 'directed evolution' conflicts with his rejection of unnatural interventions. Denton assumes manifold occurrences of tampering in the history of the cosmos and life:

- 1) tampering with the physical constants
- 2) tampering with the chemical properties of C,N,O,H, etc.
- 3) tampering with the selection of the 4 most efficient bases to be included in DNA
- 4) tampering with the structure of DNA (and proteins)
- 5) tampering with the DNA space

The last action surely is intervention. The bottomline is this: either fine tuning of initial conditions is sufficient for a biocentric universe or one needs tampering **during the evolutionary process**, which is intervention, which conflicts with his naturalism. Conclusion: impossible to fine tune the 4 bases A,T,C,G to produce directed evolution! In my view there is only one conclusion open for Denton: the designer of the 'Intelligent Design Theorists' (8). And what can I say more about Denton's evidence for directed evolution, than what Denton says himself (on another page): "*Of course, these discoveries do not prove directed evolution*" (p292).

Is Denton a Darwinist ? Above we saw that Denton accepted that organisms are genetically linked (common descent). In that sense he is an evolutionist and a Darwinist. However, in so far Denton accepts *directed* evolution, and in so far he accepts that the course of evolution is preprogrammed, and in so far he accepts Sheldrake-forces (p365), and in so far he defends foresight in evolution (p362), he rejects neo-Darwinism.

Is this the whole story?

I cannot tell the whole story, because Michael Denton does not tell the whole story. The whole story includes answers to questions like: What about The Enigma of Life's Origin ? What about The Typological Perception of Nature ? What about The Fossil Record ? What about The Failure of Homology ? What about The Biochemical Echo of Typology ? (these are chapters in *Evolution: A Theory in Crisis*) (5). Since Denton does not tell us about it, the only thing I can do is read between the lines. In the 'Note to the Reader' Denton makes an important and revealing remark:

"Because the validity of the argument [biocentric design of the universe] depends on so many independent lines of evidence, the conclusion is not materially threatened because the whole picture is not yet complete or because this or that phenomenon such as **the origin of life** or **the mechanism of evolution** is not understood. Just as the meaning of a jigsaw puzzle may be obvious long before all the pieces are perfectly placed, so too my argument does not necessitate that everything be explained." (p xvi.) (emphasis mine)

Phenomena such as **the origin of life** or **the mechanism of evolution** were his main obstacles in *Evolution: a theory in crisis*. And now they are just insignificant pieces of the jigsaw puzzle! This is a nothing less than a paradigm change. If he had that attitude in 1986, there would have been no point in writing *Evolution: a theory in crisis*. Books like *Evolution: a theory in crisis* are based upon the view that as long there are missing pieces of the jigsaw puzzle of the origin of life, we have not solved the puzzle and are not justified in claiming we know the whole picture. The most remarkable thing is that Denton doesn't account for this dramatic change of attitude at all. We can only guess that the attitude change follows from his acceptance of the biocentric design of

the universe and the necessity of evolving life. And consequently any problems with evolution do not have the serious consequences they had in 1986.

There is a second reason why problems with evolution do not have the impact they had in 1986 and that is the inevitability of life:

"that carbon-based life is therefore inevitable on any planetary surface where conditions permit it."(p265)

It should be clear that once the inevitability of the origin and evolution of life is accepted, all problems we have in understanding *how* it all happened, are not falsifications, but a sign of our own ignorance. Problems now falsify *non-directed Darwinian* evolution. One of the pearls of Denton's insight is that both the Darwinian and the creationist worldview see life as **contingent** (p xviii). Darwinists see life as an accident and creationists see life as divine artifact. Denton's new paradigm is that life is inevitable because preprogrammed in the laws of nature. I agree to a large extent with Denton's new evolutionary paradigm, but the complete lack of any explicit explanation of what was wrong in *Evolution: a theory in crisis* is highly unsatisfactory. It certainly is unsatisfactory if one knows that Denton(1986) caused a lot of misunderstandings by non-biologists and other outsiders! Let the reader judge Denton's scientific integrity. To me this is dishonesty. *Nature's Destiny* could have been the most dramatic and instructive account of a paradigm change, *if Denton fully accounted for the change*, if Denton explained what was wrong in *Evolution: a theory in crisis* and why, but he did not.

The case of the nematode

I was delighted by Denton's story about the nematode. It gave me an surprising new insight, unintended by Denton, into the long standing question of why some species don't change over a period of million of years. In a curious paragraph called "The Genetics and Development of the Nematode" (p334) Denton explains that the nematode, a small and simple multicellular worm, is assembled in such a way that practically all the organs are intimately interconnected to all other organs or parts of the organism. The result is that virtually every (7) mutation will disrupt the development and functioning of the nematode. He further says that this is an *extreme* example of "interconnectedness", but the same interconnectedness has been found *to some degree* in the development of all higher organisms. [italics are mine]. My point is, that the nematode is still a nematode, (and never made it to become a mammal) *because of* the way it is assembled! And that higher organisms have a less interconnectedness not by accident, but because their development is more open to change! So the *degree* of developmental constraints could be a beautiful explanation why some organisms evolve and others do not. The nematode is still a simple worm. Other simple organisms became mammals. Denton was looking for reasons why Darwinian gradualism cannot work, so he overlooked the possible explanation of why there are still 'lower' organisms around. Such unexpected insights make the book worth reading for me.

A fascinating metaphysical story

"The basic thesis of the book is that the cosmos is uniquely fit for human existence".
(p xii)

"The atom-building system is *designed* specifically to generate the elements of life." (p76). [italics are mine]

Above I discussed Denton's new evolutionary views, here I am trying to understand the basic thesis of *Nature's Destiny*. The first problem I have is that Denton is not clear about what his basic thesis is: biocentric or anthropocentric? My second problem is what is the *nature* of his basic thesis? Is it science, metaphysics or religion?

I would advise the reader to pay attention to the way he formulates his thesis. One mostly encounters the expression "fit for carbon-based **life**"; "**biocentric** adaptations in the design of the cosmos"(p14); "the universe is profoundly **biocentric** and gives every appearance of having been specially

designed for **life**."(p16). But also: "The basic thesis of the book, that the cosmos is uniquely fit for **human** existence" (xii). Remarkably, when it comes to a formulation of a falsifiable scientific hypothesis he gives: "the cosmos is uniquely fit for **life**" (p386) in stead off "uniquely fit for **humans**". My point is that Denton switches easily between **life** and **human** and mostly uses **life**. Why not consistently claim 'the cosmos is anthropocentric' ? A biocentric cosmos would not satisfy a theist. The Earth with life but without human life, would be a failure.

Evidence

I think Denton does not consistently claim anthropocentric fine tuning because the evidence is enough for **life**, but nonexistent for **human** fine tuning. His case for anthropocentric design would be convincing if he could give properties of nature *specifically* and *exclusively* designed for humans and not for chimpanzees or air-breathing organisms. But he doesn't and he can't. This will be difficult if not impossible because humans and chimps differ genetically only 1%. Denton writes that "Six adaptations have been widely cited as being crucial to the unique success of our species: intelligence, language, good vision, the hand, walking upright, social." No problem with that. But those features are evolutionary adaptations under the influence of natural selection and are no examples of fine tuning of physical-chemical laws. From the fact that the human species has 6 unique adaptations, I would conclude the origin of the human species is improbable. In fact Denton agrees with me because he gives a chance of one in a million for the origin of Homo sapiens on an earth-like planet (p388). This is hardly an inevitable event! Further, Denton is really confusing us when he discusses 'Inertia'(!), 'The speed of nerve conduction', 'The size of nerve axons',etc. in the chapter 'Homo Sapiens'. These topics do not belong exclusively to humans, but by placing them in the chapter, Denton suggests they do. When will a writer stand up who writes in an unbiased way about these matters? (14)

When I read in chapter 15 his story about the extraordinary eye of the lobster, and I realized that the lobster is in possession of the only perfect natural square in the cosmos, I can draw one and only one conclusion: the universe was designed with the lobster in mind.

the nature of his claim

My second problem is: what is the nature of his claim ? I start with the second quote: "The atom-building system is *designed* specifically to generate the elements of life". The context of the quote is this: All the elements were synthesized in the interior of the stars, starting with the most simple: Hydrogen. Through a process of fusion by which atoms combine with each other in various ways, gradually all the 92 naturally occurring atoms of the periodic table are built up.

I think it is interesting and important that organisms depend upon (and are constrained by) highly specific properties of the chemical elements. It's also important for the question of 'replaying the tape of evolution'. (11) The properties of chemical elements (such as iron and oxygen) are preconditions for large vertebrates not often considered in the literature on evolutionary constraints. If that is Denton's message, I agree (14). But then Denton states that the atom-building system is *designed* to generate the elements of life. Whatever the evidence he thinks supports his claim, think about the claim itself. It is an answer to the question: "What is the purpose of the atom-building system ?", which is a teleological question. Please note that the usual kind of question in physics is "What are the causes of the atom-building system ?" (the causal problem). Please note further that we are talking about a problem of the physics of stars, not a problem of biology. Biologists ask questions such as: "What is the purpose of the lungs?", whereas physicists usually don't ask: "What is the purpose of the sun, the planets, the moon ?". Denton does not say the question for causes is unimportant, but seems to think, the answer to that question doesn't explain everything and leaves the (metaphysical) "why-question" unanswered.

Now let's have a look at the claim that the cosmos is uniquely **fit** for human existence, the basic thesis of *Nature's Destiny*. For Denton that means that all constituents of life are uniquely fit for life. In line with the "purpose-question" above, Denton uses the *biological* concepts 'adaptation', 'adapted for', 'fit' and 'fitness' *for molecules and their properties*. This is unusual, if not totally wrong, because *in physics there is no known mechanism which explains how the*

fundamental properties of atoms become 'adapted to' future functions they have in organisms living on the planet earth. This is why Denton's basic thesis is metaphysics and not science. The error is easily overlooked because we know the concepts 'adapted' and 'fitness' so well in the Darwinian context: organisms are adapted for environments, not the other way round. The purpose-question in physics is inadequate, as is the use of 'adapted' and 'fit'. There is no variation and selection process in physics, so there is no 'adaptation'. The right way to express facts would be: organisms depend on a series of unique properties of the chemical elements; they utilize them. The reader who is getting used to Denton's use of 'fitness' now easily overlooks the big jump Denton makes: For example Denton calls the basic thesis of his book: 'the cosmos is uniquely *fit* for humans', but in other places he jumps to: '*designed* for humans'. The jump of an, in principle, harmless descriptive statement to a metaphysical interpretation. Here are a few examples:

- CH 2: jump from fit to 'the laws of nature are **arranged for** carbon-based life' (p19)
- CH 4: jump from fitness to 'the inevitable **end** of natural law' (p71)
- CH 5: jump from coincidences to 'a cosmos **adapted for** carbon-based life' (p101)
- CH 6: jump from properties of oxygen to **adaptations of oxygen** (p117)
- CH 9: jump from chemical properties of metals to "particular metals are **adapted for** specific biological processes" (p195).

Denton blurs the borderline between acceptable descriptions and unacceptable teleological interpretation, by using 'fit for', 'adapted for', 'designed for'. Atoms do not vary, like organisms. So there can be no selection for the 'fittest atoms'.

I will give 2 examples where Denton makes a teleological interpretation of the facts, but when he comes to *explaining*, he uses the causal explanation. This indicates to me that Denton's teleology cannot really explain, but merely interprets. Questions : "What is iron for ?"; "Why does iron have the properties it has?" If Denton is serious about 'iron is *adapted for life*', then a good answer would be:

"Iron has these properties because large terrestrial vertebrates need iron in combination with hemoglobin to supply their organs with enough oxygen".

It would surely be an oddity on the part of a modern physicist were he to accept this explanation for the properties of iron!

Next let's consider Denton's claim that the light of the sun appears to be of optimal biological utility (p47).

"Remarkably, although the wavelength of electromagnetic radiation in the cosmos varies over such a colossal range, 70 percent of the electromagnetic radiation emitted from the surface of the sun is concentrated in an exceedingly narrow radiation band extending from the near ultraviolet (0.3 microns) through the visible light range into the near infrared (1.50 microns)." (p 51)

Question: Why is 70% of the electromagnetic radiation emitted from the surface of the sun, concentrated in an exceedingly narrow radiation band (0.3 - 1.5 microns) ? Denton's answer:

"Because the sun's surface is 6.000°C and all stars with that surface temperature have the same radiation pattern." (p51)

Why not invoke the teleological explanation? :

"Because only the range 0.3 - 1.5 micron is useful for life on earth."

Although he favours this kind of *interpretation*, he doesn't use it as an *explanation*. In stead he uses a causal explanation. And to me this shows that biocentric 'explanations' aren't explanations at all. And that is because the biocentric theory is a metaphysical worldview, which doesn't permit scientific explanations. If the above teleological explanation sounds absurd, that is exactly the reason why teleological explanations have been eliminated long ago from physics. Does it help if we know that physical constants were designed for life? Does a teleological explanation help us in understanding *the mechanism and processes* underlying the behaviour of the sun ? Of course not! If scientifically useful, the teleological explanation should be able to answer question like: Why does there exist radiation *harmful to life* at all in a supposedly biocentric universe? and: If the sun's purpose is deliver useful energy for life on earth, why radiating harmful radiation at all? "[The sun's ultraviolet light is the chief culprit in causing genetic mutations in skin cells](#)".[\(12\)](#)

George C. Williams developed an argument in *Plan and Purpose in Nature* [\(13\)](#), which I am unable to forget. If the sun exists to serve the planet earth, he asks, why should the sun radiate in all directions ? As a consequence the earth is able to intercept less than a billionth of the sun's light. The rest is radiated in space in all directions (for no use). The efficiency of the sun's use of energy in illuminating the earth, is microscopically small. Clearly a wasteful design! I could add that, since the sun has a finite lifespan and finite resources, it seems doubtful that the sun's purpose is to deliver a constant flow of energy to the earth for an unlimited time. Williams goes on to suggest that a reflector would strongly improve the efficiency of the sun. A reflector? Yes, that's what a human engineer would use to prevent wasteful radiation in all directions. So why could the sun-designer not use a reflector? Why impose such constraints upon the design of the sun? Denton does not discuss this inefficiency. Denton does not discuss at all how one could establish the design-criteria of the sun-designer, let alone in sufficiently precise way to handle the kind of objections Williams made.

These considerations are further evidence that Denton's biocentric theory is not a scientific theory at all. Denton's conclusion '*Cosmological Fitness by Design*' is really not much different from '*Biological fitness by Design*'. And the last concept is supernatural creation of biological species. 'Fitness by design' is neo-creationism, is metaphysics, falls outside science. The inconsistency in Denton's story is that 'design' conflicts with "[the basic naturalistic assumption of modern science](#)." (p xviii), which he accepted. One difference with creationism is that Denton positions the supernatural at the origin of the universe and reduces the number of interventions to one. Another difference is that he needs evolutionary processes to produce life on the basis of the initial fine tuned conditions, which is vastly more ambitious than any creationist scenario. Science would need a couple of centuries to figure out how life is generated on the basis of an initial set of physical conditions.

Denton told a nice story inspired by many scientific facts, but surely a metaphysical story. A fascinating metaphysical story, which relates human beings to many details of the cosmos. He showed that many unexpected physical details of the universe do matter for human existence.

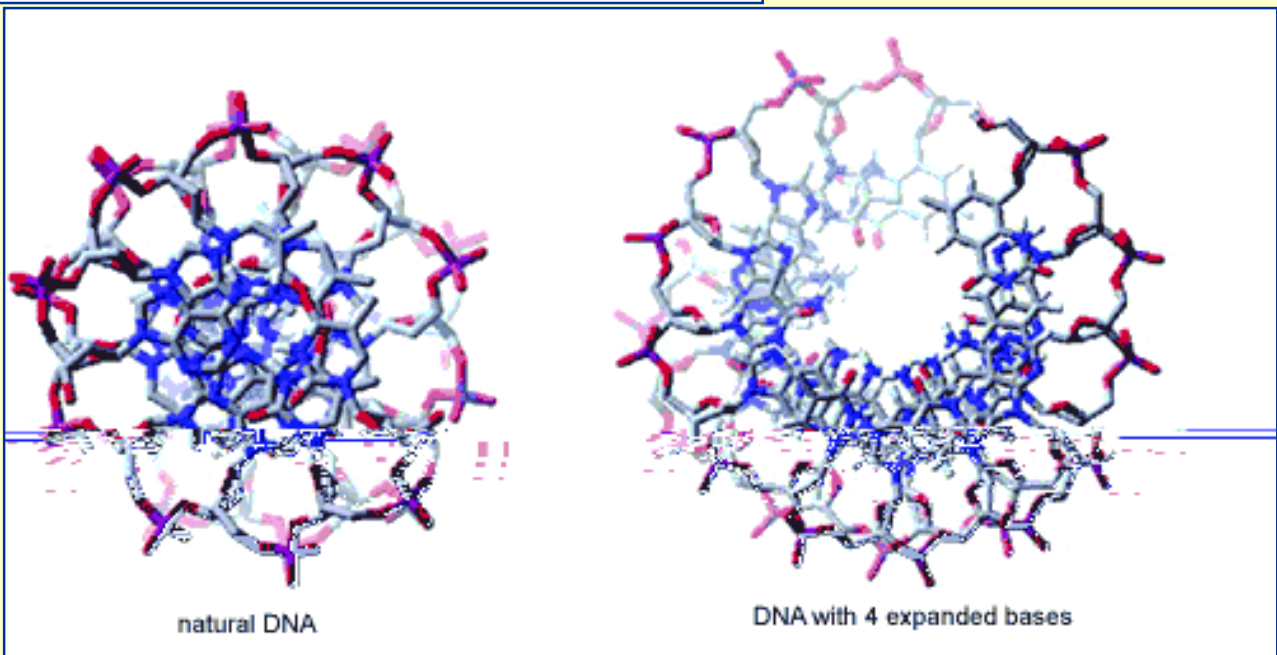
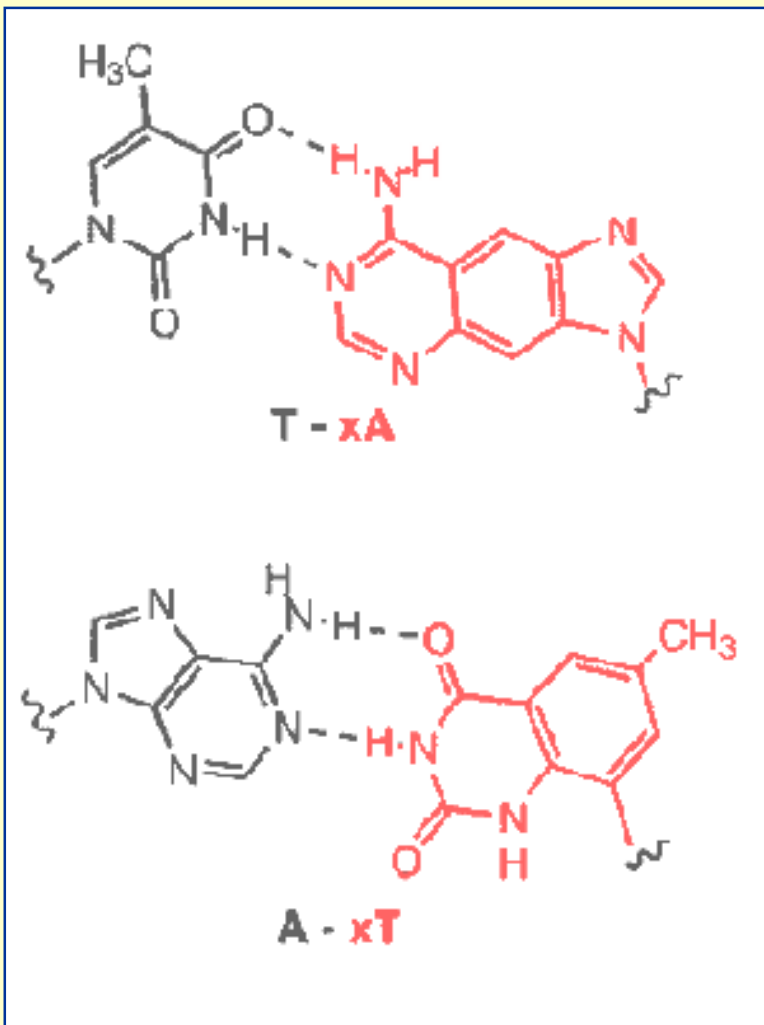
Is DNA uniquely fit for its task?

In Chapter 7 Denton discusses the question if DNA is uniquely fit for its task as carrier of genetic information. Of course it is *fit*, otherwise we would not be here and there would not exist a million species. It is not scientifically nonsense to say that some properties of DNA are optimal. For example mathematical simulations suggest that the 3-dimensional packing of DNA is optimal (15).

Another remarkable property of DNA (not known at the time Denton wrote his book) is how DNA protects itself against damage by ultraviolet light. When a base is hit by UV light it enters an excited state, but returns in 290 - 720 femtoseconds, that is very rapidly (!), to its ground state. The result is less damage. This photo-stability would have been all the more critical when first life appeared on Earth, because there was no significant ozone layer in the atmosphere to shield against ultraviolet radiation (18). Of course the question remains why the laws of physics are designed in such a way that ultraviolet radiation is damaging to DNA in the first place.

Although all the details of how fit DNA is are interesting to know, the question is: is DNA **uniquely** fit? That is: are there *better* alternatives? For example are there alternatives for the 4 bases A,T,C,G? Denton states that an imaginary 6-base system (3 pair of bases) is only hypothetical. However recently *Science magazine* (16) reported that the Romesberg-Schultz team had designed a new base called "PICS" and incorporated it in DNA and showed that the new DNA could be replicated with a new DNA polymerase. Furthermore, a team of Japanese investigators (19) introduced two synthetic complementary bases S and Y. DNA molecules modified in this manner formed normal double helices with S pairing with Y. So the four bases A,T,C,G are not uniquely fit for forming DNA.

In 2003 Haibo Liu et al (22) reported a DNA which has all four base pairs replaced by new, larger pairs. The expanded double helices are more thermodynamically stable than the Watson-Crick helix. The new pairs apparently form hydrogen bonds analogous to the natural Watson-Crick pairs. The new bases pair with the natural bases, so DNA with 8 bases can exist and has an increased potential for encoding information. The authors conclude that there is no apparent prohibition against genetic systems having sizes different from the natural one. Again Denton's claim that the 4 natural bases are uniquely fit for forming DNA, is refuted. The question remains whether these modified bases could occur naturally (origin of life problem) and we need information about how this form of DNA can be packaged with (modified) histones to form a chromosome.



Mixed DNA. A and T are natural bases, xA and xT are modified bases. Figures from: Liu et al (2003) 22.

What about the ribose component of DNA? Schöning et al (17) have synthesised a chemical analogue of RNA, which is derived from a sugar ring that contains four carbons (tetrose) instead of the more usual five found in ribose. This simple RNA called TNA, can form **stable** double helices with itself and also with complementary RNAs and DNAs. The cross-pairing properties and the simplicity of its self-assembly make TNA a good candidate for a natural nucleic acid and a possible precursor of DNA.

Deoxy-ribose can be replaced by a simpler sugar: **threose**. This kind of DNA, called TNA, can be assembled by natural enzymes. The amazing thing about TNA is that even though the sugar-phosphate backbone is one carbon atom shorter than RNA or DNA, it still shows excellent base-pairing (20).

What about amino acids? There are 20 amino acids occurring in proteins. Can other amino acids be incorporated into proteins? Schultz team has added now more than **80** different non-natural amino acids to proteins. Chin et al have developed a technique that potentially expands the eukaryotic genetic code with an arbitrary unnatural amino acid (21). So clearly those 20 are not the only possible amino acids.

Concluding: Denton challenges the idea that any alternative DNAs could outperform natural DNA in terms of replication, stability, interaction with proteins, etc. On the other hand without those scientists searching for alternatives, we would never know if better alternatives exist at all.

The ethical issue

Osmium-oxide is the most poisonous substance on Earth. Concentrations in the air of more than 2 parts per 10 billion ($=10^{10}$) parts cause blindness, lung- and kidney damage. This is an extreme low concentration. So it is extremely effective. Conclusion: Osmium-oxide is uniquely fit for killing humans. In other words: Osmium-oxide gives every appearance of having been specially designed for damaging human life. Or is it just a coincidence...?

Notes

1. Stuart Kaufmann: *At Home in the Universe* (1995). It is instructive to compare what Phillip Johnson wrote about Stuart Kaufmann : "...and some plausible rescuers will invite the officers to take refuge in electronic lifeboats equipped with high-tech gear like autocatalytic sets and computer models of self-organizing systems." (p170, *Darwin on Trial*,1993). It is clear that the stuff is just too difficult for the nonscientist Johnson. It is also clear that there is now an unbridgeable gap between Johnson and Denton(1998). The most important reason however is that Denton accepts the naturalistic assumption of science, which Johnson rejects. Michael Behe wrote a view 'words of praise' at the back cover of *Nature's Destiny*, Johnson is absent.
2. de Duve: *Vital Dust*(1995).
3. Including Denton(1986) himself ! He forgets to mention himself !
4. The analogy of the lexicon with DNA space is severely limited because the biological DNA-protein system is a two-level system and language is not. On the level of DNA there is no 'meaning'. Meaning enters when DNA is translated into proteins. Language is a one-level system: words have meaning. There are no encoded words. To use the language analogy is misleading, because it blocks the insight that a discontinuity on one level can be overcome by a continuity on the deeper level.
5. These are chapters in *Evolution: A Theory in Crisis*. However there is a 4-page paragraph 'The Origin of Life' (p292-296) in *Nature's Destiny*.
6. "Persons who believe that chemicals unassisted by intelligence can combine to create life, or that bacteria can evolve by natural processes into complex animals, are making an a priori assumption that nature has the resources to do its own creating.", Phillip Johnson in [God and Evolution: An Exchange](#).
- 7.

9. Later I found in Scott Gilbert(2000) *Developmental Biology*: "Adult organisms may have dissimilar structures, but the genes instructing the formation of these structures are extremely similar." (p704).
10. -
11. This biocentric and anthropocentric story is also told, to my surprise, by Conway Morris(1998) in his *The Crucible of Creation: The Burgess Shale and the Rise of Animals*. Conway Morris argues that humans are 'the intended goal of evolution'. He directly attacks Gould's whole rerunning-the-tape idea which implies that the outcome could be significantly different than what we observe. Gould's *Wonderful Life*(1989) and *Full House*(1996) attack the idea that evolution inevitably produced humans. See [the review](#) of Conway Morris' book by Peter Bowler.
12. American Scientist, March 2001, p15 : "Every year about 1.3 Americans are diagnosed with basal or squamous cell carcinoma, the two most common forms of skin cancer."
Robert Weinberg(1998) *One Renegade Cell. The Quest for the Origins of Cancer* : "The short-wave radiation from the sun can create substantial damage in skin cells by striking DNA molecules" (page 92).
13. G.C. Williams, *Plan & Purpose in Nature*. 1996. Weidenfeld & Nicolson. London.
14. However, Denton overlooked the importance of the unique properties and the unique history of the Earth itself for the origin and evolution of life on Earth. Carbon-chemistry may be universal but planets like the Earth are rare. See: **Peter Ward and Donald Brownlee(2000): *Rare Earth. Why Complex Life Is Uncommon in the Universe***. This book is supplementary to Denton, because the authors discuss mainly external, environmental factors at the expense of internal, biological factors.
15. A. Stasiak and J.H. Maddocks "*Mathematics: Best packing in proteins and DNA*", *Nature*, **406**, 20 July 2000, p251-253.
16. Robert F. Service "*Creation's Seventh Day*", *Science*, Volume 289, issue of 14 Jul 2000 p232-235.
17. K. Schöningh "*Chemical etiology of nuclei acid structure*", *Science* **290**, 1347-1351 (2000).
18. Bern Kohler quoted in a News feature in *Nature* **5412**, 474-476(2001). 1 femtosecond = 10^{-15} second.
19. Hirao et al (2002) *Nature Biotechnology*, vol. 20, pp. 177-82, quoted by Christian de Duve(2002) *Life Evolving*, p. 249.
20. Andy Coghlan (2003) New clues to identity of first genetic molecule, *New Scientist*, News Service 23 July 2003.
21. Jason Chin et al (2003) "An Expanded Eukaryotic Genetic Code", *Science* 301 (5635): 964, 15 Aug 2003.
22. Haibo Liu et al (2003) "A Four-Bae Paired Genetic Helix with Expanded Size", *Science* 31 Oct 2003 868-871.

Further Reading

- [a review of *Nature's Destiny*](#) by Darel Finley.
- [an interesting and amusing discussion](#) of *Nature's Destiny* by the leaders of the Intelligent Design movement: Paul Nelson, Jonathan Wells, William Dembski, Phillip Johnson and Michael Behe.
- Michael J. Denton, C.J. Marshall, M. Legge (2002) "The protein folds as platonic forms: new support for the pre-Darwinian conception of evolution by natural law". *Journal of Theoretical Biology* 2002 Dec 7; 219(3):325-342. [Abstract](#). (This article does not discuss 'intelligent design theory' and does not support IDT).
- Michael J. Denton, Peter K. Dearden, Stephen J. Sowerby (2003) "**Physical law not natural selection as the major determinant of biological complexity in the subcellular realm: new support for the pre-Darwinian conception of evolution by natural law.**", *Biosystems*, Vol 71, Issue 3, October 2003, pages 297-303. [Abstract](#). (This article does not discuss 'intelligent design theory' and does not support IDT).
- Michael J. Denton "The protein folds as complex natural forms: Evidence that the properties of matter may be 'fine tuned' for protein based life.
- [Michael Denton](#) is in the [Department of Biochemistry](#), University of Otago, New Zealand.
- Michael Denton published a 'concepts article' titled "Laws of form revisited" in *Nature*, **410**, 417 (22 March 2001) in which he argued that pre-Darwinian eternal platonic forms have been (re)discovered in basic protein folds.
- Guillermo Gonzalez and Jay W Richards (2004) *The privileged Planet: How Our Place in the Cosmos is Designed for Discovery*. Reviewed by Douglas

A. Vakoch in *Nature* **429**, 808-809 (24 June 2004): "Drawing on a framework for inferring design proposed by philosopher and mathematician William Dembski, Gonzalez and Richards argue that the correlation between the conditions that make habitability possible and those that make it possible to learn about the universe is so exquisite and improbable as to suggest intelligent design".

- Philip Ball (2004) **Synthetic Biology: starting from scratch**. *Nature* **431**, 624-626 **7 Oct 2004**. Genetic engineering is old hat. Biologists are now synthesizing genomes, altering the genetic code and contemplating new life forms.
- **Is carbon uniquely fit for life?** Japanese chemists have made the first stable molecular ring of **silicon** atoms. Various carbon-ring compounds, such as benzene, contain delocalized electrons that give rings extra stability, but no analogous molecules have been made for carbon's cousin, silicon. The silicon ring contains three silicon atoms arranged in an equilateral triangle, carrying two delocalized electrons and an overall positive charge. Akira Sekiguchi and his fellow authors from the University of Tsukuba suggest that the rings could be stuck to metals to form catalysts. They now plan to generate all silicon equivalents of benzene, and even buckminsterfullerene (C60). *Nature*, 21 July 2005, p.307. **22 Jul 2005**
- John Emsley (2005) *The Elements of Murder: A History of Poison* points out that heavy metals which are natural constituents of the Earth's crust like mercury, arsenic, lead, antimony and thallium are elements that are toxic enough to cause human death. (*Nature*, 11 Aug 2005). A universe fine-tuned for life should not contain poison.

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