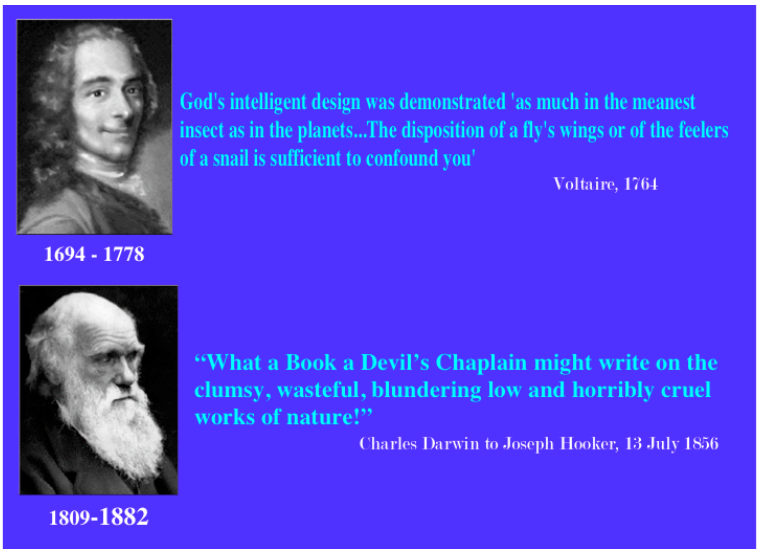
Denis R. Alexander

You may have noticed that Rodney Holder chose to dispense with a question mark in his title, whereas when it comes to design and biology I've chosen to keep my question-mark firmly in place.

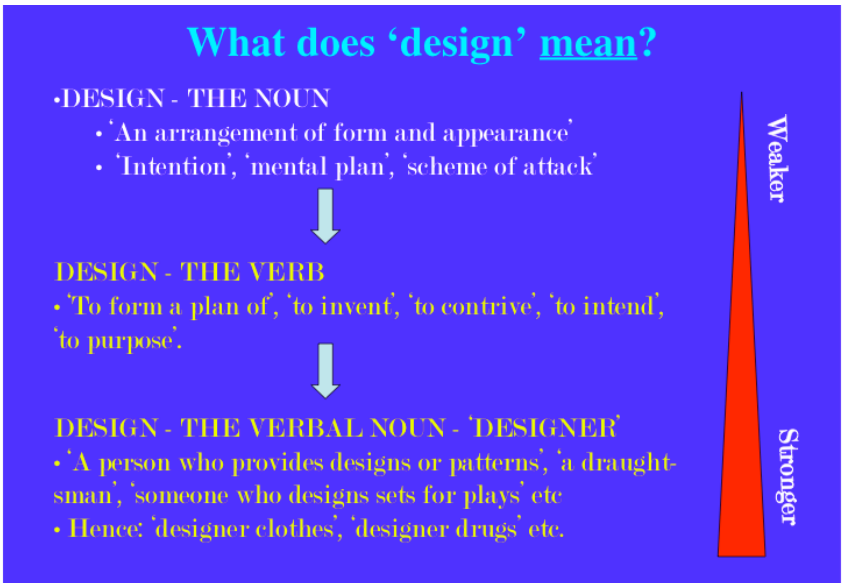
The reason is simple. The word 'design' is used with so many different nuances in our contemporary culture, that its possible to have a lengthy conversation about design in biology, and all those involved have completely different ideas in their heads about what the conversation is all about. And as we've already seen from Michael Roberts' historical overview, the history of the design concept in biology has been a complex one.



Here is Voltaire's take on design: **God's intelligent design was demonstrated 'as much in the meanest insect as in the planets...The disposition of a fly's wings or of the feelers of a snail is sufficient to confound you'**, wrote Voltaire as he carried on an imaginary debate with an atheist in his Dictionary of Philosophy, published in 1764.

And here is Darwin on a bad day at Down House nearly a century later as he studied the breeding habits of the jelly-fish: **"What a Book a Devil's Chaplain might write on the clumsy, wasteful, blundering low and horribly cruel works of nature!"** wrote Darwin to the botanist Joseph Hooker on 13 July.

Two views of the biological world, one with the rose-tinted glasses on, seeing it all as evidence of god's design, and one with the dark glasses on, seeing the waste and the cruelty. A reminder that the task of natural theology has always faced profound ambiguities when tackling the question of design and purpose in biology.

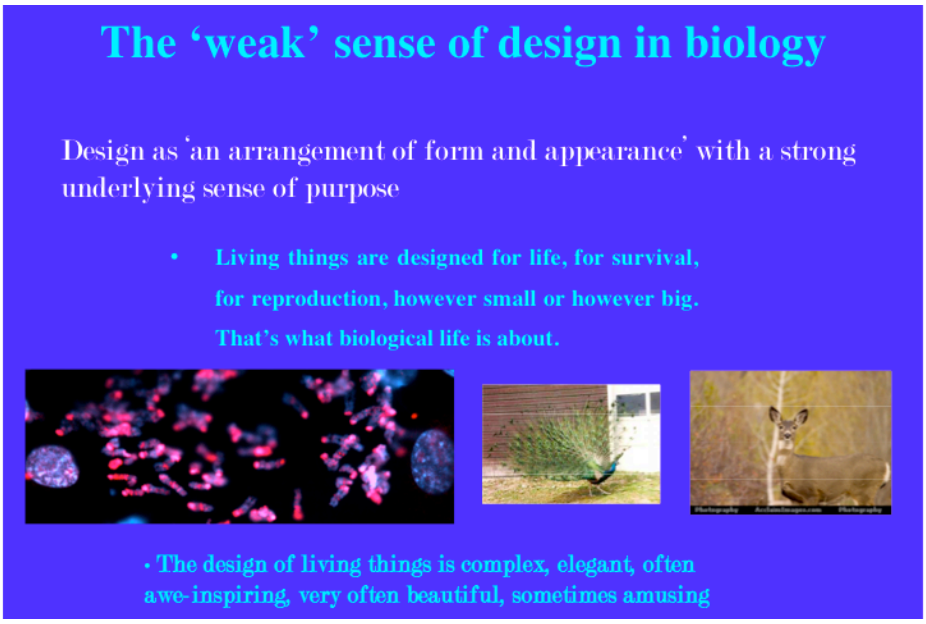


So what do we mean by design in biology? I want to spend the first half of my talk on some general issues, and then I'll spend the last part considering the particular case of Intelligent Design. If we go to the dictionary then we find:

Design, the noun:

- **An arrangement of form and appearance.** The definition that leads least easily to the notion of a designer.
- '**Intention', 'mental plan', 'scheme of attack'** – these other dictionary definitions for the noun all have the idea of 'purpose' lying behind them, and so give a much more direct link to the idea of a designer.
-

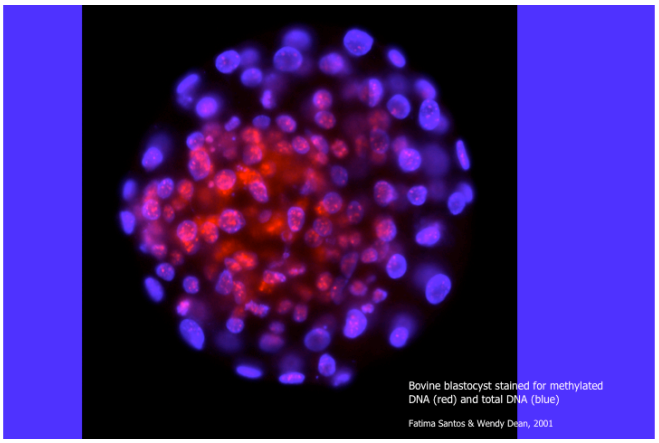
So that brings us to the **Verb 'To Design'** and here the dictionary gives us:
'To form a plan of', 'to invent', 'to contrive', 'to purpose', 'to intend' etc. Clearly once you have a transitive verb involved, then you have to have a designer, which brings us to the **Verbal Noun 'Designer'** = 'a person who provides designs or patterns', 'a draughtsman', 'someone who designs sets for plays, operas, films', a 'fashion designer' etc. And that in turn of course goes on to the **adjectival use** of the verb, so that we now have 'designer clothes', 'designer drugs' and on it goes. The word design seems to possess almost endless versatility in terms of reinventing itself.



Now if we take the meaning of design in its 'weak definition', as **An arrangement of form and appearance,** with a strong underlying sense of purpose, then there seems little doubt that all living things with out exception cry out with the characteristics of specified forms and purposes:

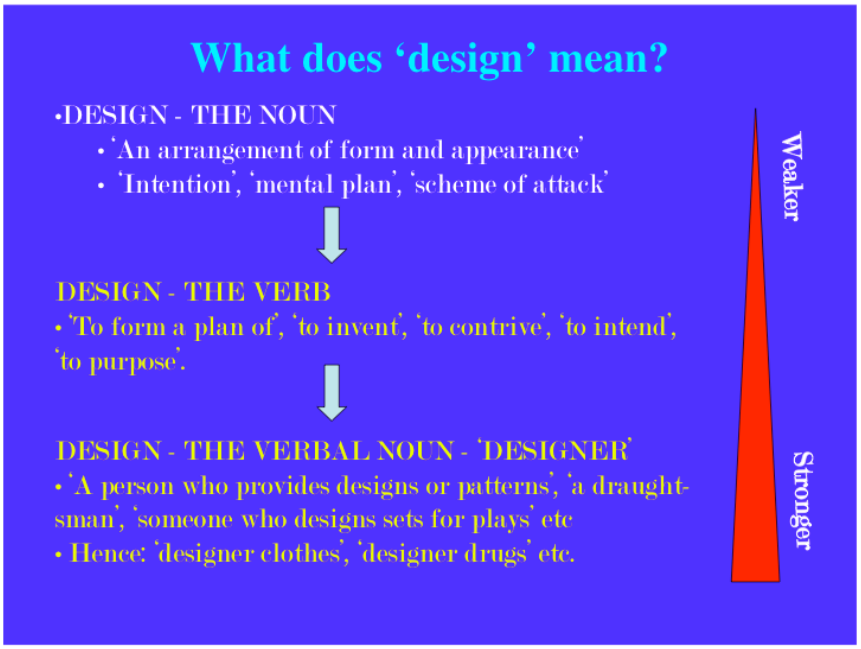
- Living things are designed for life, for survival, for reproduction, however small or however big. That's what biological life is about.
- The design of living things is complex, elegant, often awe-inspiring, very often beautiful, sometimes amusing.

At this level of biological functionality we have no problem in saying that all living things display the characteristics of design - they display 'an arrangement of form and appearance' which perfectly fulfils the purposes of their biological existence to survive and to reproduce.

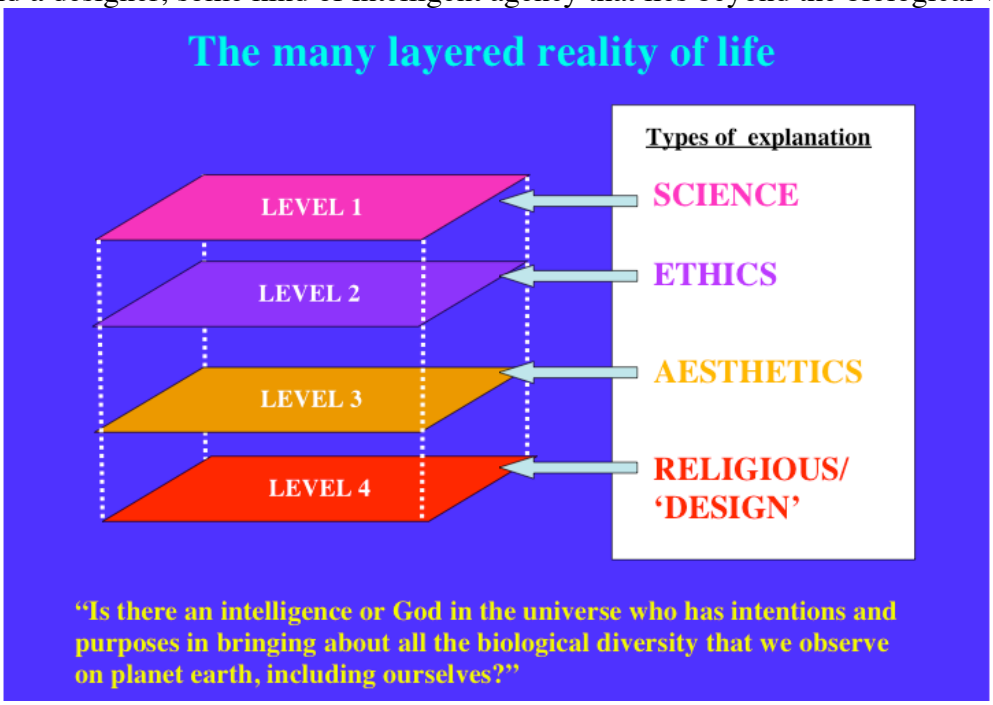


Every biologist enjoys the great privilege of investigating the beautiful world of living cells, as illustrated here by selective staining of an early bovine blastocyst, showing the staining of DNA, indicating a particular kind of gene regulation.

Now this is all fine – I could go on showing you beautiful biological pictures for the rest of the day – and it doesn't matter if you're an atheist or an agnostic or a Christian or whatever, I think we'd all agree that as we look out on the biological world we all go 'wow', that's really amazing, really beautiful – and if you want to say things like 'what a beautifully designed system', then I don't think anyone will argue with you.



So lets now look at our design definitions again and lets see what happens as we start moving down the arrows to the 'design verb' and then on to the 'designer'. Does this wonderful display of design in the biological world that we've just been looking at demand a designer, some kind of intelligent agency that lies beyond the biological world?

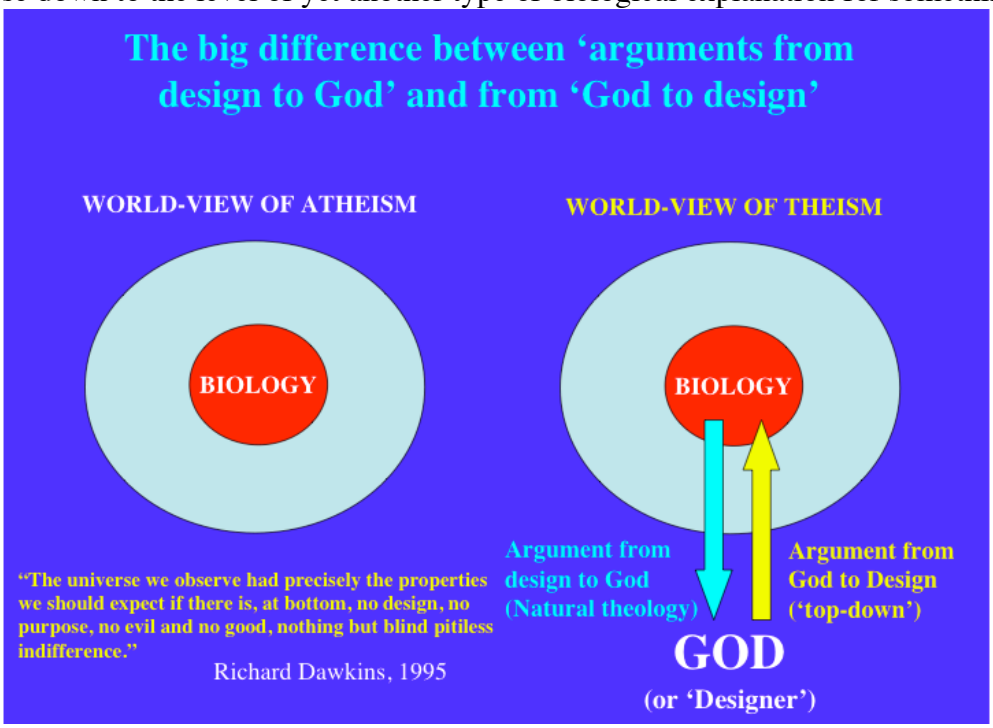


And in trying to answer that question there are two critical points to remember: The **first** is that we have now moved well into the realm of a metaphysical question, that is, a question that lies beyond science. Life, taken as a whole, is a many layered reality. You know how you read some novels and they deliberately set out to tease you because there are many layers of meaning in the narrative? Well, it's a bit like that with the world around us. You need all the various complementary levels of explanation to do justice to this complex reality that we call life.

So where does 'designer' language belong in its stronger sense in the context of biology? Well it belongs to the religious or philosophical level, because it's referring to questions about ultimate meaning – "Is there an intelligence or God in the universe who has intentions and purposes in bringing about all the biological diversity that we observe on planet earth, including ourselves?" That's not a scientific question, it's a religious question. It cannot be resolved by appeals to scientific data alone, which is not at all to say that such data are irrelevant to answering the question.

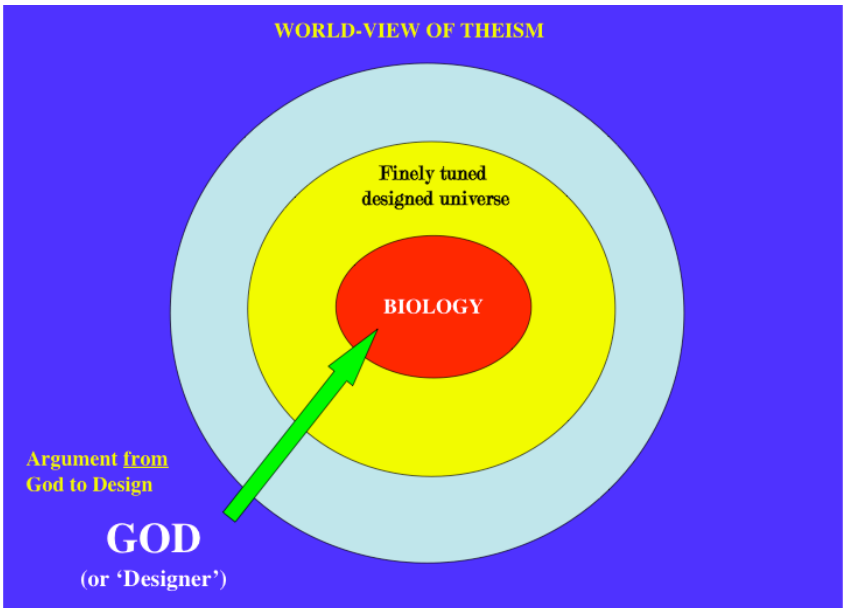
But if you start bringing the strong sense of design into biology – into level 1

here, as yet one more type of biological explanation – then you invariably end up in a muddle, and what is more serious theologically, in reducing god from the creator of the universe down to the level of yet another type of biological explanation for something.

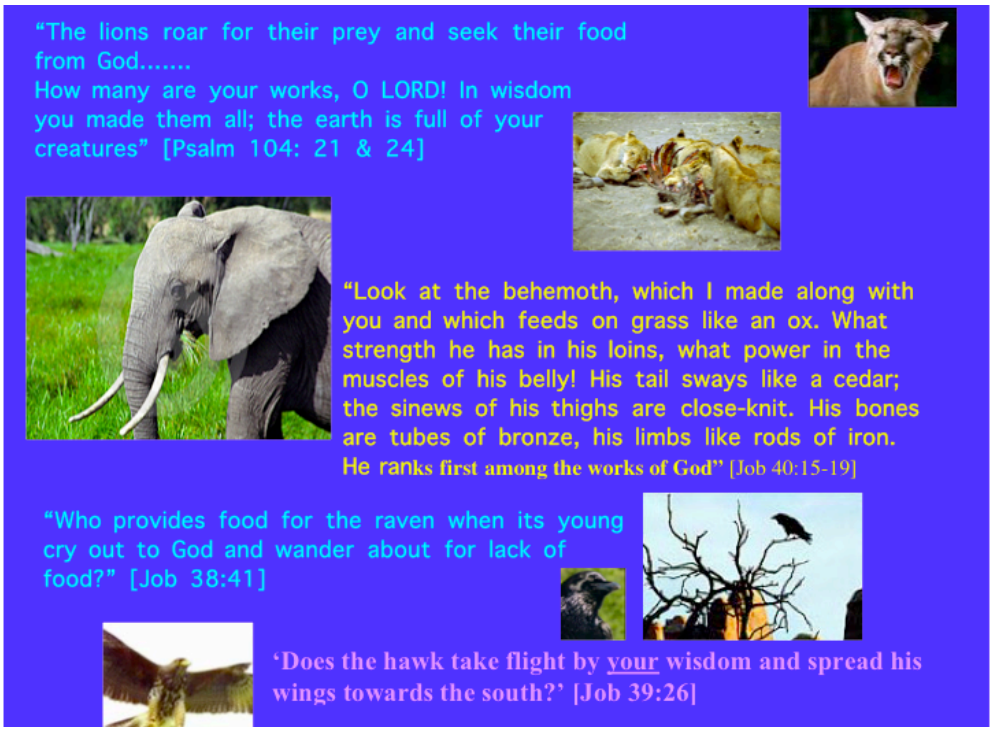


This brings us to the **second** critical point to bear in mind, which is that there is a big difference between arguments that try and lead from design in biology to God or a Designer – the bottom-up approach of natural theology - and arguments that start with God and go the other way, from a prior belief in God to an appreciation of the idea of design and purpose in the created order.

Now all scientists, as much as anybody else in an occupation or profession, encompass their knowledge within an overarching metaphysical framework. So atheism, which I take to be a metaphysical world-view just as much as theism, for both lie beyond science, can be used to encompass biology. So the atheist will tend to interpret all biological data within the overarching matrix or world-view of atheism. So here is the compulsory Dawkins quote that makes this point rather well: **"The universe we observe had precisely the properties we should expect if there is, at bottom, no design, no purpose, no evil and no good, nothing but blind pitiless indifference."** So the atheist's reading of the biological text is clearly going to be one that lacks any notion of ultimate purpose, let alone a designer or God.

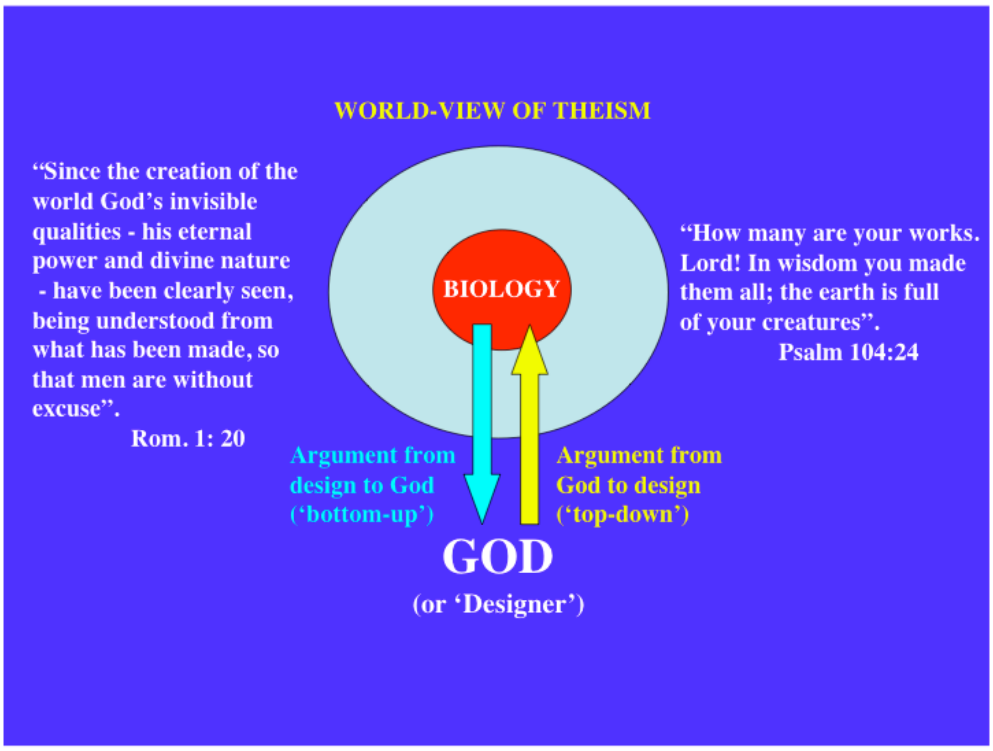


Contrast that with the other arrow, the one pointing from God to design. In this case biology is being incorporated within a Christian theistic worldview, and so the whole biological narrative is told within that framework. Indeed the whole of biology is incorporated into the anthropically fruitful universe which Rodney has just been telling us about. The emphasis here is the kind of thing that many of us write in the Discussion sections of our scientific papers: "the data are consistent with the model that such-and-such". And so the Christian who has come to faith in God and therefore encloses the circle of biology within their theistic world-view, might want to say, "well taken overall the biological world is consistent with a God who has plans and intentions for humankind".

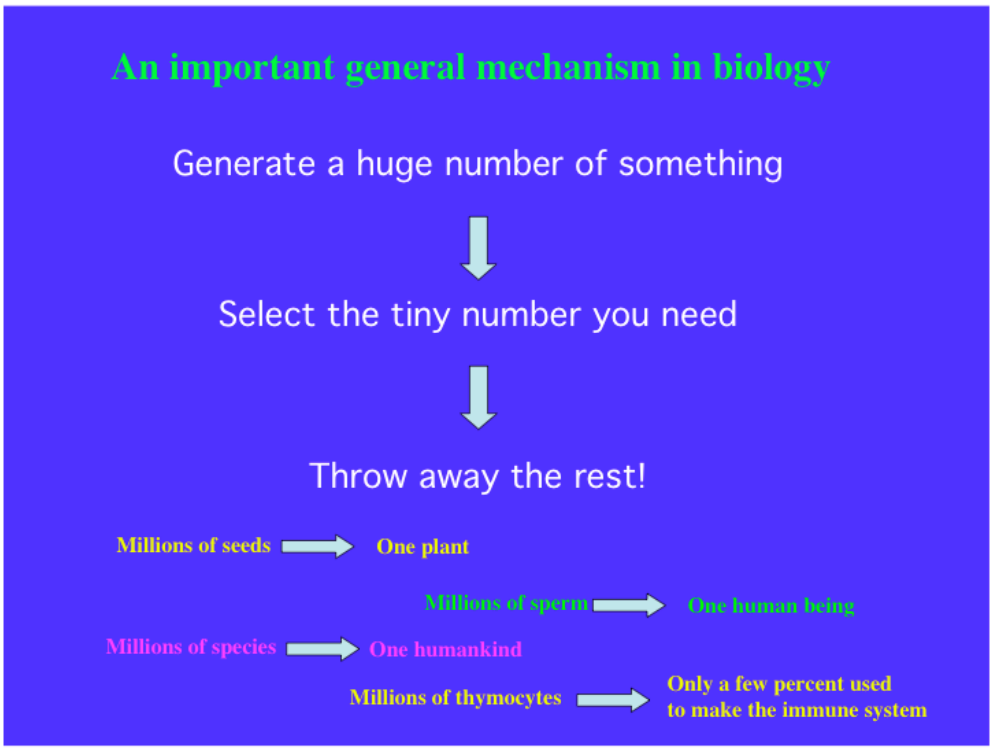


And its certainly the case that as you look at the Biblical doctrine of creation, it's not primarily concerned with how things began, but why they exist. And the hundreds of Biblical passages that describe God's creative actions are in their context not really directed at atheists trying to persuade them that everything is designed – as it happens the design word itself is never used in the Bible anyway to describe the relation between God and his creation. Rather what we find in the Bible are these wonderful reflections by believers on the amazing properties of the world, including the biological world, as seen through the eyes of faith:

"The lions roar for their prey and seek their food from God…How many are your works, O LORD! In wisdom you made them all; the earth is full of your creatures" [Psalm 104: 21 & 24], and hundreds of other passages. What we see here is a delighted fascination and wonder with the whole of God's created order -'Does the hawk take flight by your wisdom and spread his wings towards the south?' [Job 39:26] - note that the question that God is concerned to ask Job is not 'could you explain that?', but rather: 'Did *you* do that?' This is the arrow from God to the world of biological diversity, where the created order becomes a reason in our context to stimulate praise to the God who is first believed in and trusted by Christians for His great atoning work through Christ for us at the Cross.



Now of course it's perfectly possible to believe in both arrows simultaneously. You can believe that the biological world displays clear evidence of design and that this provides a solid basis for your belief in God as Creator, based on Romans 1:18-20, and you can also trust God for your salvation because of what He has done for you in Christ, and praise Him not only for your salvation, but also for His wonderful creation. That's a perfectly consistent position to hold, you're a balanced two-arrow person.

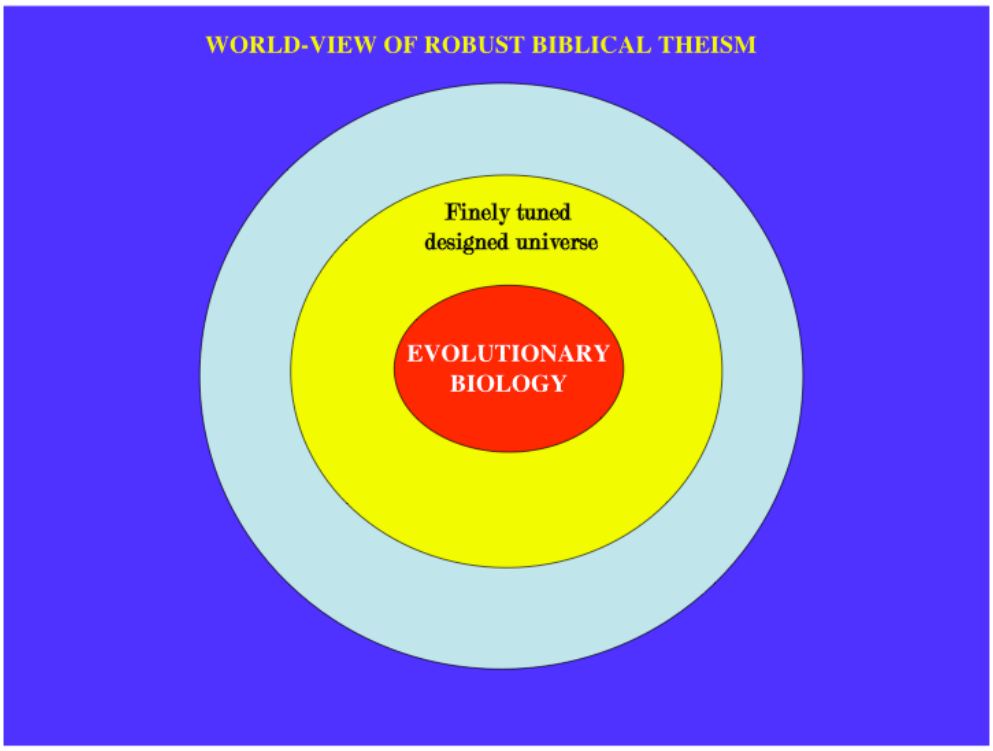


But there are of course problems for the arrows in both directions, because when we start using this slippery word 'design', our ideas are so often derived from human notions of design – in engineering, architecture, and so forth, and then we look at the way things work in the biological world, and we find a mismatch. Its just not the way we would have done it!

For example biology works by making a huge number of something – select the tiny number you need – then throw away the rest – that principle is being worked out in our bodies all the time. It's a very different way of doing design.

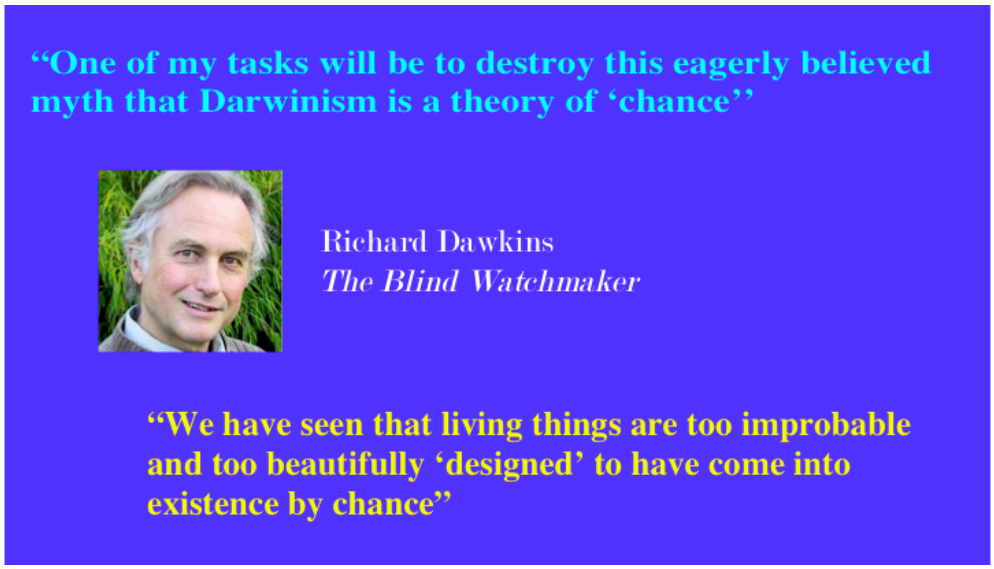
So all cells with a nucleus can commit suicide – they can undergo apoptosis. And that's a really important mechanism in development, in the immune system, and in renewing the cells of our bodies – it's intrinsic to life as we know it - but when it goes wrong then you can also get cancer or various genetic diseases. It also involves throwing away the billions of cells that you don't need. We also know that more than 99% of the species that have ever existed are now extinct, and went extinct millions of years before we ever came on the scene. We know that all living things exist in complex food-chains whereby the energy from the sun are channelled along these food chains by a complex process of life and death. Death is intrinsic to carbon-based life, which is the only kind of life we know about. And all carnivores are designed to kill and to feed on others, designed also in such a way that they can defend themselves.

So certainly if you're going to try and build a case from biology to the designer, with a strong emphasis on natural theology, without recourse to Biblical revelation, then you have a problem. What kind of a designer are you going to end up believing in?

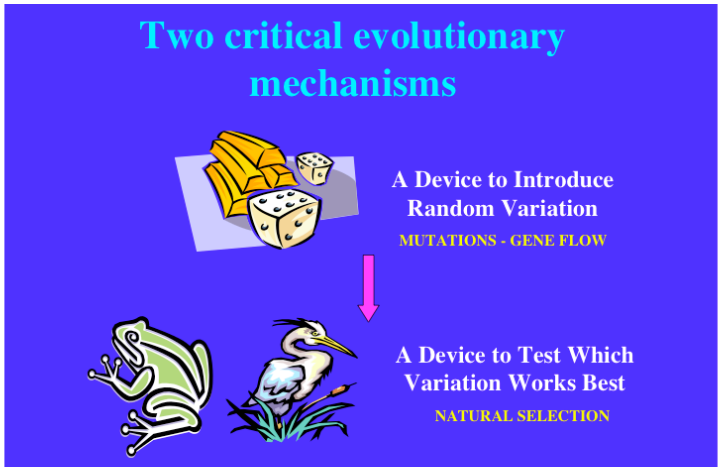


Another ambiguity that people sometimes raise in this context is the role of chance in generating biological diversity. But in this case the answer is much simpler because it's based on a straightforward misunderstanding. Of course all biologists such as myself carry out our biological research within the framework of evolutionary theory. This is the theory that gives coherence to our field. For most Christians, evolution simply represents the best description that we have as to how God has chosen to create, and continues to sustain, all the biological diversity that we observe – the lion is still roaring, seeking its food from God.

Now the strange notion has arisen that evolution is somehow a chance process taken as a whole. Nothing could be further from the truth – it is a tightly regulated process that has, to some extent at least, predictable outcomes. Curiously this is where I find myself singing from the same song-sheet as Richard Dawkins. In the Preface to his book 'The Blind Watchmaker', Dawkins says that in his book **"One of my tasks will be to destroy this eagerly believed myth that Darwinism is a theory of 'chance''**.

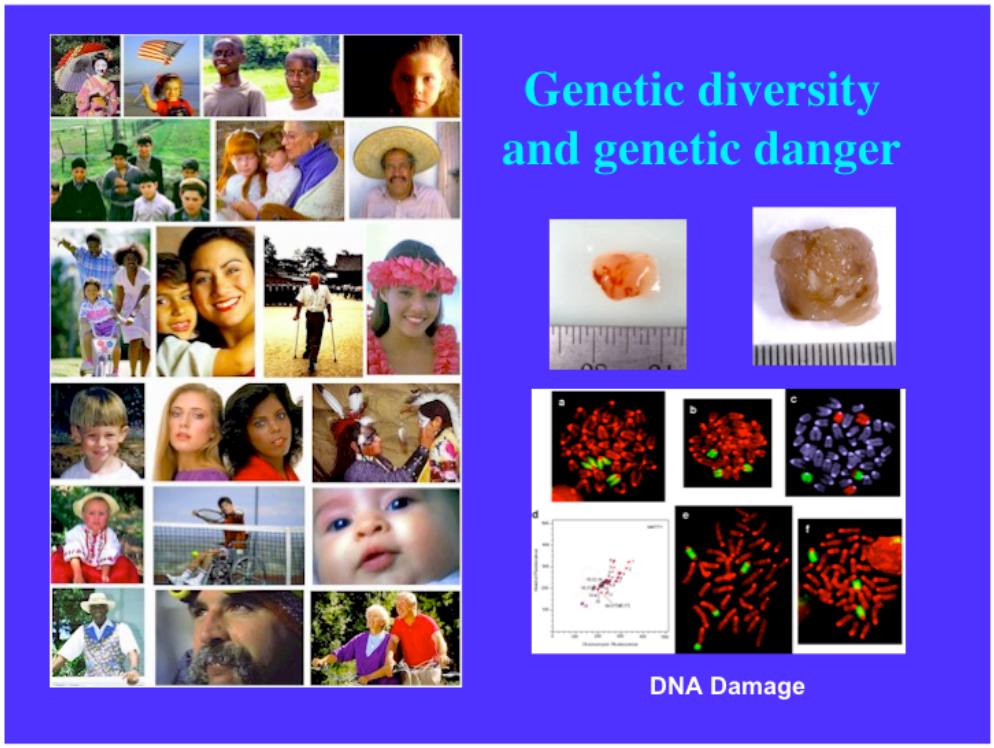


Now I am sure that most if not all here have a pretty good grasp of the basics of evolutionary biology, but let me just remind you that its really rests on two mechanisms glued together – a device that generates variation in gene sequences – mutations, gene flow - and second you have a filtering device – natural selection - that filters out the changes that reduce reproductive success. So in one sense evolution is like a giant workshop for testing genomes – meaning all the genes in one individual - and only certain genomes actually work at all in a planet with certain types of properties and certain types of ecological niches.



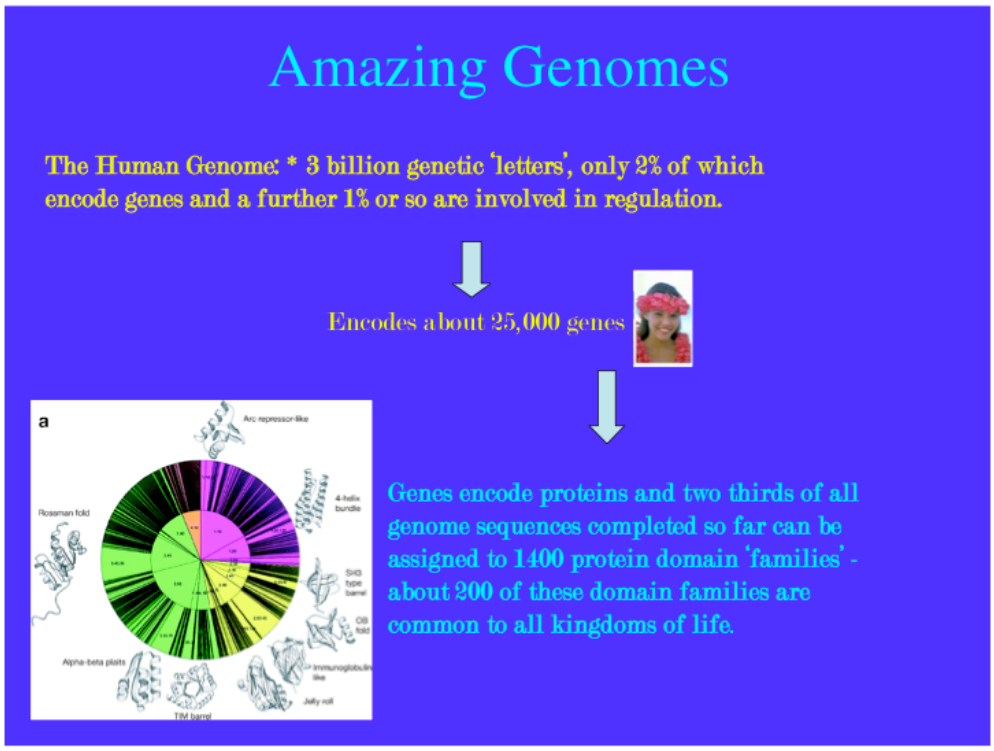
But don't miss here again the ambiguity when it comes to the question of natural theology and design, because on the one hand it's our genetic variation that is necessary

for our own human uniqueness – without it we would all be a single clone here today, all looking identical – but on the other hand it's that same genetic variation which is the cause of genetic diseases and of cancer.



And there are plenty more similar ambiguities if you take a closer look at our own human genomes, which really are amazing. Our genomes have 3 billion genetic letters in them but only about 2% of those letters actually encode genes and another 1% or more are involved in gene regulation. That means that we have about 25,000 genes to encode the proteins that make up the most complex known object in the universe, namely us. So our genomes are superbly elegant and complex systems that are duplicating themselves in our bodies billions of times in billions of our cells every day.

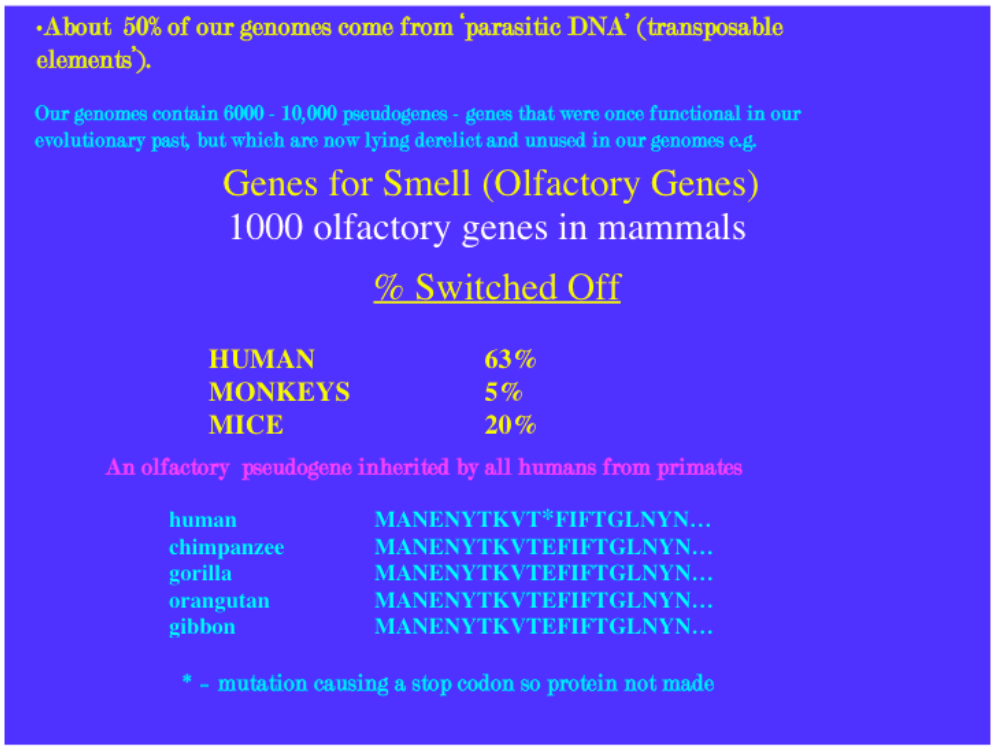
And if you look at all the known proteins in the world, and their structural motifs, based on all the genomes that have been sequenced so far, you find that the great majority can be assigned to only 1400 protein domain 'families'. In other words, all living things are united not only by having the same genetic code, but also by possessing an elegant and highly restricted set of protein structures. Biological life is turning out to be more platonic than people ever imagined a decade or so ago.



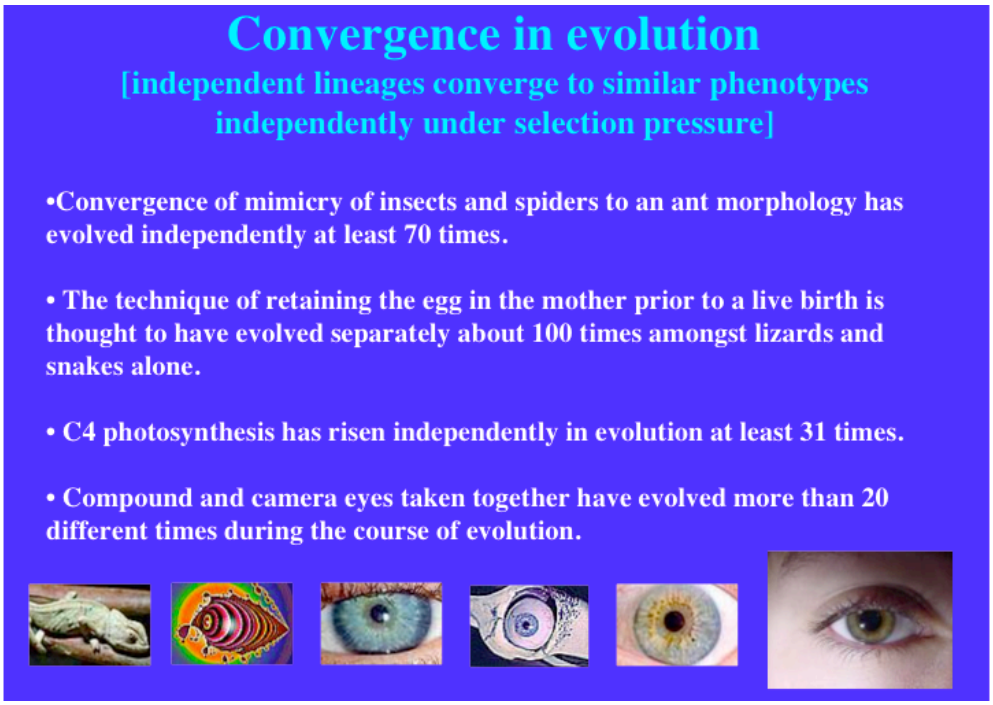
But what <u>also</u> strikes you as you take a virtual tour round our genomes is the fact that they contain about 50% of parasitic DNA – about 1 in 200 babies born has a new piece of parasitic DNA incorporated into their genome. Actually our genomes are a bit like those garages that some of us have where you never want to throw anything away, just in case it might be useful one day. Our bodies with their 10^{13} cells are a complete Natural History Museum of our own evolutionary history, a gene fossil museum that provides definitive evidence for our evolutionary past.

Just one example of what I mean. Our genome contains between 6,000 and 10,000 derelict genes or gene fragments, known as pseudogenes, that no longer produce functional proteins. Some are disabled versions of genes which remain fully functional in other species. The number of pseudogenes is especially high in those regions of the genome responsible for functions that we no longer need so much. For example – olfactory genes – the genes that encode proteins that give us our sense of smell, contain an archaeological record of our genetic past. There are 1000 genes involved in enabling mammals to smell properly, all pretty much the same. In the human 63% of these are switched off – its just as if you went into a factory and saw lots of derelict machines lying around, no longer being used. They might be obsolete, but they would still tell you a lot about the evolution of the factory. Each mutated pseudogene is unique, and therefore

must be considered to be the product of an unrepeatable unique event. Some of these genetic fossils are found in humans and other species, and contain precisely the same inactivating lesions in the different species. It is vanishingly unlikely that they would arise independently in two or more species. It follows that all the species that possess a particular genetic relic must have inherited it from a common ancestor in which the gene sustained its unique inactivating damage. For example this olfactory gene, switched off in all humans due to a mutation here*, but present as clearly the same gene in a functional form in all other primates.

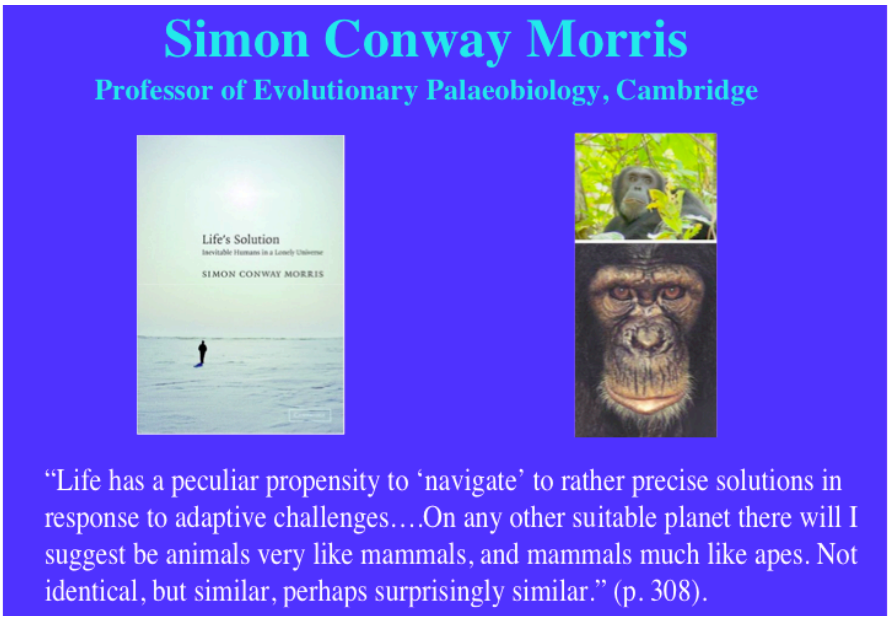


And there is another striking fact in the evolutionary narrative to which Simon Conway Morris has recently drawn attention in his book 'Life's Solution – Inevitable Humans in a Lonely Universe' (CUP 2003), and that is the phenomenon of convergence. For example the convergence of mimicry of insects and spiders to an ant morphology has evolved at least 70 times independently. Compound and camera eyes taken together have evolved more than 20 different times during the course of evolution. If you live in a planet of light and darkness, then you need eyes – that's what you're going to get. The late Stephen Jay Gould was fond of pointing to the contingency of evolutionary history – if you re-played the tape of life again, said, Gould, then you would get something quite different.

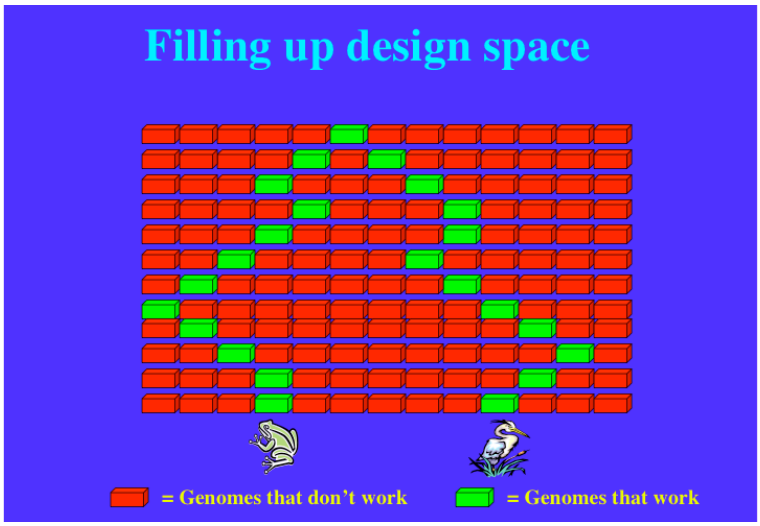


Not so, says Conway Morris, if you replay the tape of life again, things are going to look pretty similar. As Simon remarks:

"Life has a peculiar propensity to 'navigate' to rather precise solutions in response to adaptive challenges….On any other suitable planet there will I suggest be animals very like mammals, and mammals much like apes. Not identical, but similar, perhaps surprisingly similar." (p. 308).

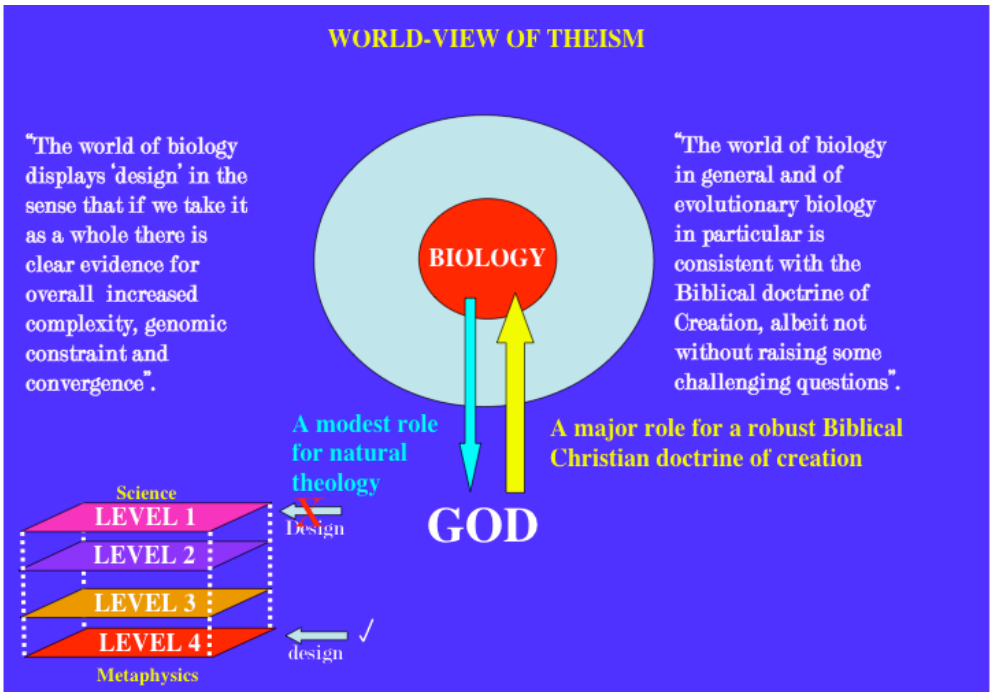


So yes the rolling of the genetic dice is a wonderful way of generating both novelty and diversity, but at the same time it appears to be restrained by necessity to a relatively limited number of living entities. If you live in a universe with this kind of physics and chemistry, and on a planet with these particular properties, then this is what you are likely to get. If we imagine design space in the evolutionary process as a matrix of millions of little boxes, each box representing a possible genome, then the number of boxes that can be filled successfully appears to be really small. Biological diversity is definitely not a case of "anything goes".

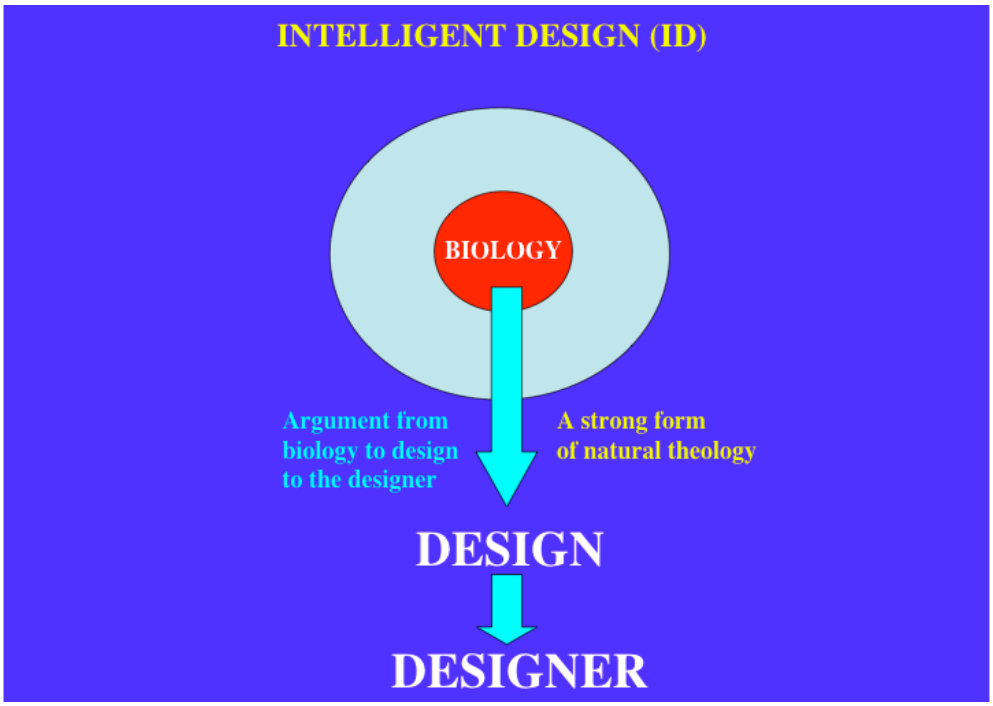


So overall what I am proposing is that its impossible to build a case for the Christian God based on biology alone, but instead I'm suggesting a rather modest form of natural theology, with a strong emphasis on a robust Christian Biblical doctrine of creation, which encompasses our biology and gives it a coherent framework.

So our understanding of design in biology in its strong sense is down here at metaphysical level 4, not up here at science level 1. And at this level 4 we can make these two balancing statements: "The world of biology displays 'design' in the sense that if we take it as a whole there <u>is</u> clear evidence for overall increased complexity, genomic constraint and convergence, consistent with the idea of purpose in the created order". And in the same breath we can also say that "The world of biology in general and of evolutionary biology in particular is <u>consistent with</u> the Biblical doctrine of Creation, albeit not without raising some challenging questions".



Now in the last part of my talk I want us to focus on the Intelligent Design movement, which I'm going to call ID. ID suggests that there is one big arrow going from biology to design and from design to a designer, so I would want to call it a form of strong natural theology.



ID highlights three key points:

First, the claim is that science in general, and evolution in particular, are infused with the philosophy of naturalism. Since naturalism is anti-God, Christians should therefore be against it and the best strategy for undermining naturalism is therefore to attack Darwinian evolution.

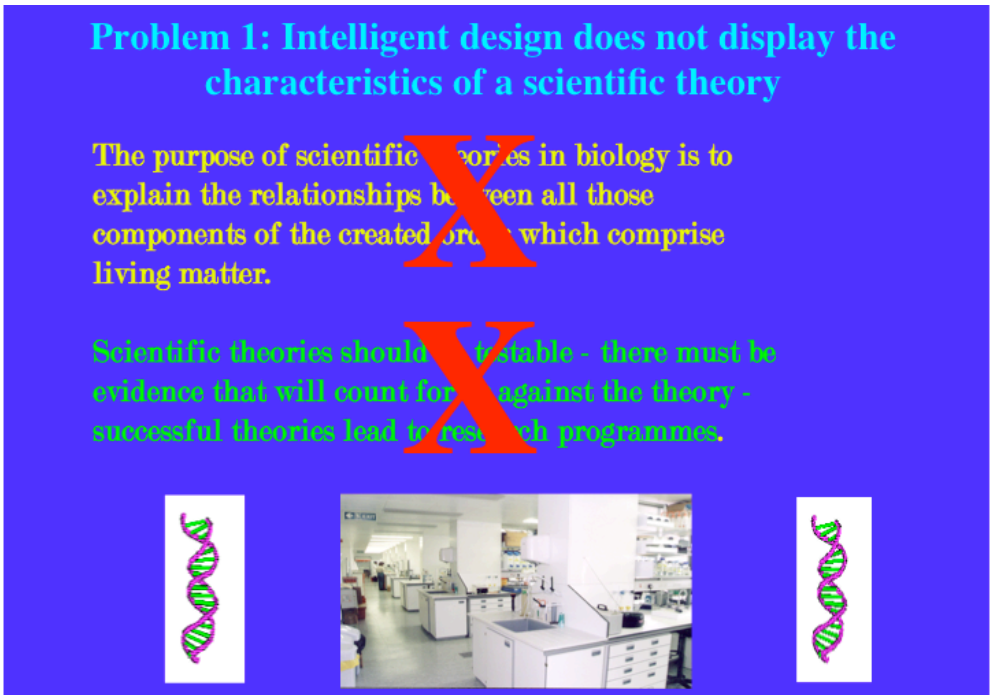
Second, there are biological entities, such as the bacterial flagellum, that are 'irreducibly complex', meaning that they are only functional if all components are present. Since Darwinian evolution requires small incremental changes, therefore such entities could not have evolved. The origins of 'Irreducibly Complex' entities are explained by a 'design inference' viz such entities in nature can be identified as displaying design.

Third, ID proponents also claim that their ideas are strictly scientific, not religious, and should therefore be taught in the science classroom as an alternative view to evolution – hence the current American court cases.

So now what I'd like to do is to flag up what I think are three very significant problems with the ID position:

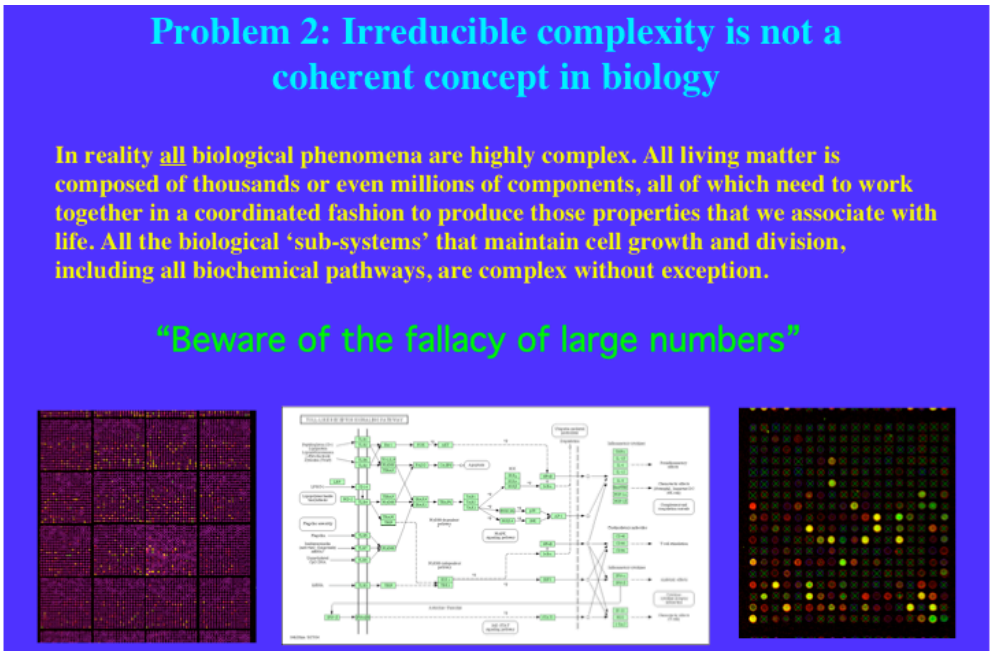
Problem 1 is a problem from science – in reality ID has none of the characteristics that make it recognizable as a scientific theory. The purpose of scientific theories in biology is to explain the relationships between all those components of the created order which comprise living matter. And a further important criterion of biological explanations in science is that they be testable – there must be empirical evidence that can count for or against the theory, otherwise it remains vacuous. A successful theory will therefore lead to a research programme which will aim to establish its truth status. At the end of the day a head of lab wants testable ideas to write in her next grant application.

But ID fails on both counts. First, simply saying that something is 'designed' in biology leads to no increase in our understanding of the relationships between the various material components that comprise living matter. Second, labelling a biological entity as 'designed' leads to no experimental programme that could be utilised to test the hypothesis, a fact which presumably explains the lack of scientific publications arising from ID writers. Simply pointing out presumed difficulties in Darwinian explanations does not in itself count as theory construction – you do not need a 'design inference' to carry out such a critique and in itself it adds nothing to the discussion. All biologists know that there is much more work to do on the theory – and are thankful that this is the case, otherwise some of us would be out of a job!



Problem No 2 comes from the suggestion that it is possible to define certain biological entities as 'irreducibly complex' in a meaningful fashion. In reality it just isn't possible. All living matter is composed of thousands or even millions of components, all of which need to work together in a coordinated fashion to produce those properties that we associate with life. All the biological 'sub-systems' that maintain cell growth and division, including all biochemical pathways, are complex without exception. I could easily argue that all of them fall within the ID criteria used to identify an 'irreducibly complex' system, since in each and every case the sub-system only functions properly providing all the components are in place, although there is also some degree of redundancy.

So what we have in ID is the 'fallacy of large numbers': as soon as you have a multi-component system, then of course the chances of it coming into being all at once as a fully functional system are remotely small, but of course no biologist thinks that's how evolution works. And the fact that at present we do not know, by any means, all the incremental evolutionary steps involved in all biological systems, should be a motivation for hard work in the lab, not for armchair theorising. Certainly that level of scientific ignorance provides no basis for philosophical or theological speculation.

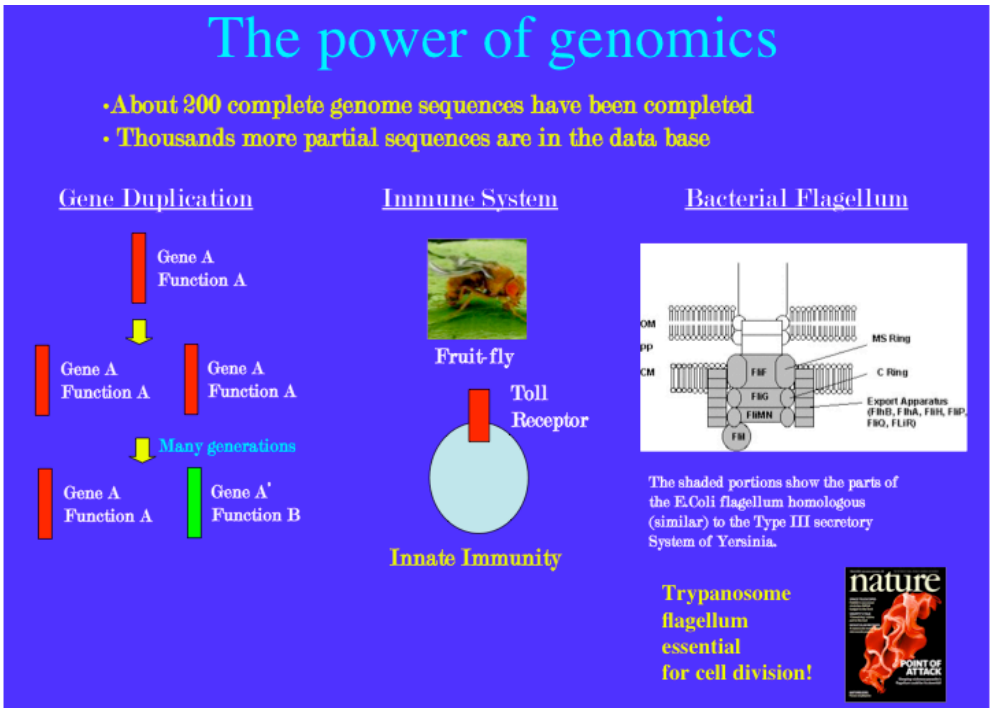


Interestingly we now know a lot more about the evolution of some of the systems that Behe was flagging up as supposedly 'irreducibly complex' back in the mid 1990's. Much of these insights has come about through the complete sequencing of multiple genomes from about 200 different animals, plants and bacteria, plus partial data from the sequences of thousands more genomes. By comparing these different genome sequences it is now quite easy to delve back in evolutionary time to see where a particular gene crops up for the first time.

- So we now know that much evolution has occurred by the process of gene duplication, whereby a gene ends up being copied twice by mistake on a single chromosome, leaving the second copy to drift by a process of mutation and acquire new functions. Almost certainly this is the way that the enzymes involved in blood clotting have evolved, and you can find further details of that in my book Beyond Belief. So the evolutionary origins of the blood clotting system now look a lot clearer than 10 years ago when Behe published 'Darwin's Black Box'.
- In my own field of the immune system – that highly complex system of cells and antibodies that defend our bodies against attack by pathogens – we now have a much better understanding of how it evolved. Many of the molecular components of the innate immune system are found in fruit flies and this has turned out to be a valuable system for investigating their molecular functions.

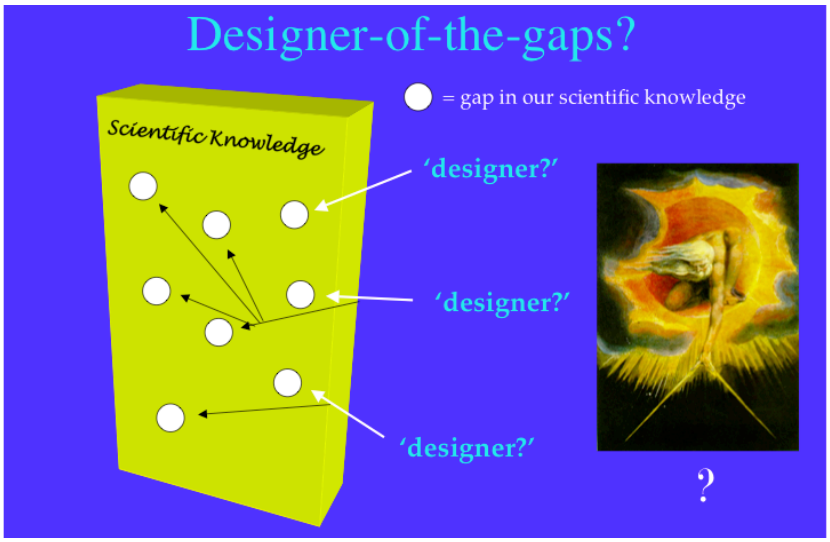
- And as far for the favourite ID example of the bacterial flagellum, we now know that the sub-set of proteins that form the base of the bacterial flagellum are utilised for a quite different function in the Type III secretory system used by certain gram-negative bacteria. So in fact sub-components of bacterial flagellar do have different functions in other organisms, helping us to see how natural selection could have operated on individual components separately. And in last week's Nature we even learnt how the Trypanosome flagellum (containing 331 proteins!) – the parasite that causes African sleeping sickness – is essential for cell division! So organelles are under all kinds of selection pressures, some of them quite unexpected.

What the ID proponents have been trying to do is to simply re-define as irreducibly complex those systems for which we do not currently understand the evolutionary pathway. But those gaps are closing very fast.



And it's for this reason that ID proponents are very often accused, and I think rightly so, for propounding the old god-of-the-gaps arguments, except that in this case it might be more accurate to call it the designer-of-the-gaps argument. Christians have always been tempted by the 'argument from personal incredulity' – "wow, I can't imagine how that could have happened, so the designer must have done it" - but this is really very weak theology. And invariably what happens is that in the fullness of time the gap in scientific

knowledge closes and the designer disappears - the history of science is full of such examples.

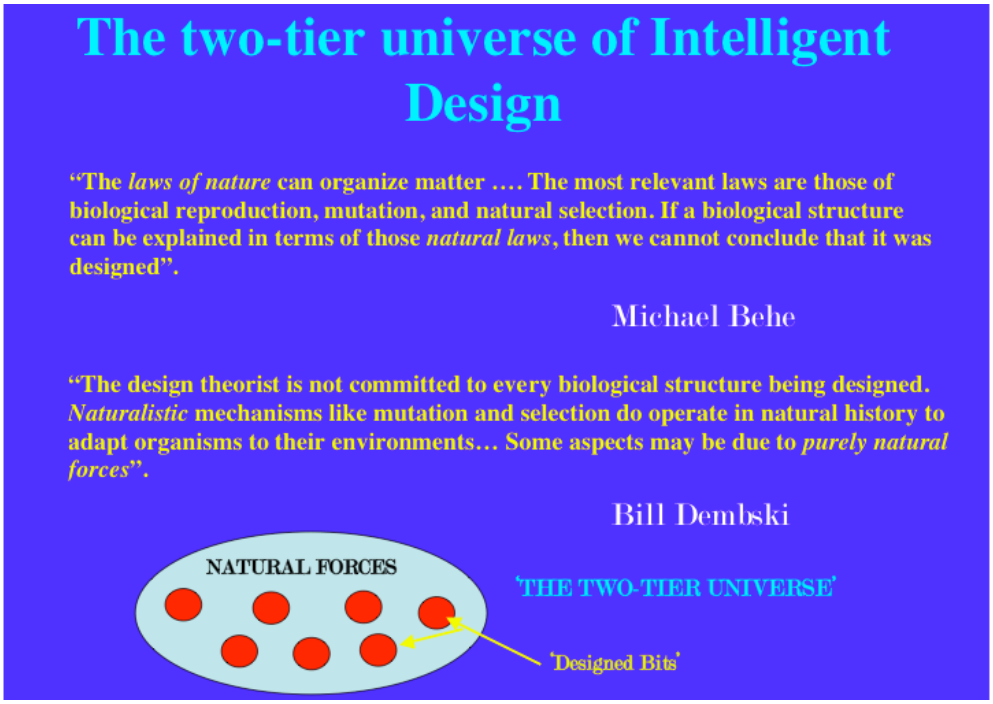


That brings us to Problem 3, which this time is a cluster of theological and philosophical problems. The Bible insists that all things came into being and continue to exist by the creative and sustaining power of the Lord Jesus, the Word of God. "Through him all things were made; without him *nothing* was made that has been made" (Jn. 1:3, my italic). The Bible therefore has no concept of 'nature' for the simple reason that the term is redundant: instead it speaks of 'creation' to refer to the complete panoply of God's activities.

Now as it happens ID proponents tend to use the word 'naturalism' in a manner very different from the normal understanding of that word. Go to a dictionary and you will find 'naturalism' defined in its philosophical sense as: "view of the world that excludes the supernatural or spiritual" (Oxford Dictionary). Go to Philip Johnson and you will find comments such as the following: "It is conceivable that God for some reason did all the creating by apparently *naturalistic* processes…*naturalistic* substitutes like the blind watchmaker mechanism are inadequate and contrary to the evidence…" And "theistic evolution can more accurately be described as theistic *naturalism*". But according to the dictionary understanding of 'naturalism', a term like 'theistic naturalism' is an oxymoron, that is, a contradiction in terms, like calling someone a 'fascist communist'. Christian theism, the kind of theism to which Johnson is referring in this passage, refers to the belief in a creator God who is the origin and sustainer of all that exists. So God cannot possibly create by 'apparently naturalistic processes' for the simple reason that if there is a God who creates, then there are no 'naturalistic processes' because naturalism is false. Unless you are really post-modern (or very confused) you can't believe in both God and naturalism simultaneously.

And this undermining of the Biblical understanding of creation does extend quite deeply into the ID literature. For example, Behe says that: "The *laws of nature* can organize matter …. The most relevant laws are those of biological reproduction, mutation, and natural selection. If a biological structure can be explained in terms of those *natural laws*, then we cannot conclude that it was designed". This seems to be a very clear statement expressing the belief that there is a 'two-tier universe', one tier involving 'natural laws' and the other tier involving 'design'.

We find the same type of idea in Bill Dembski's recent book 'The Design Revolution'. (For example, Dembski comments that "The design theorist is not committed to every biological structure being designed. *Naturalistic* mechanisms like mutation and selection do operate in natural history to adapt organisms to their environments… Some aspects may be due to *purely natural forces*". So both Behe and Dembski envisage a biological world largely explained by 'naturalistic mechanisms' and 'natural forces', and it is against this backcloth that 'designed systems' may be detected. Indeed, if there is no such backcloth, the rest of their arguments would make little sense, since if the identification of designed entities is to be possible, then clearly a non-designed 'naturalistic' backcloth is essential, otherwise the detection of the so-called designed components would be impossible.



Does all this matter? I think it matters a lot, because ID promotes the idea of a two-tier universe, part ruled by natural forces and part designed, whereas the robust Biblical theism which I hold to as a Christian sees everything that exists, without exception, as being completely dependent upon the personal triune God.

So my proposal for you this morning is to see the <u>whole</u> of this elegant universe, including <u>all</u> of its biology, on this planet and elsewhere for all we know, as reflecting God's design, his intentions and his purposes.

Intelligent design contrasted with Biblical theism
The two-tier ID universe
'Natural forces' (do most things)
'Designer' (the occasional tinkerer)
'Natural laws'
'Irreducible complexity'
'No design'
'Designed parts'
Biblical Theism - the one-tier universe
PERSONAL TRIUNE GOD
CREATES AND SUSTAINS EVERYTHING
It's all 'designed' in the sense of being consistent with the intentions and purposes of God for the created order