

## DESIGN IN NATURE: SOME CURRENT ISSUES

René van Woudenberg

### 1. Design in nature and Darwinism

Up into the 18th century many scientists and philosophers, not to speak of the ordinary folk, believed that the physical-biological world shows signs of being created by God. The 18<sup>th</sup> century Scottish philosopher and scientist Thomas Reid, for instance, was a Newtonian and involved in applying the inductive method to various areas of scientific research. At the same time he believed that the world displays signs of design.<sup>1</sup> In his *Essays on the Intellectual Powers of Man*, he formulates a principle to the effect 'That design and intelligence in the cause may be inferred, with certainty, from the marks or signs of it in the effect'.<sup>2</sup> Although the principle doesn't specify 'marks or signs of design and intelligence', from scattered passages in his work we may conclude that what Reid had in mind are such features as contrivance, order, organization, intent, purpose, usefulness, adaptation, aptness of means to ends, regularity, and beauty. So, from the presence of these features in objects, so the principle tells us, it may be inferred that those objects are designed, and hence that a designer of those objects exists. According to Reid not only artifacts like hammers, watches, and houses etc. display the indicated features; he held also 'that there are in fact the clearest marks of design and wisdom in the works of Nature'<sup>3</sup>, one example of which is 'the structure of the human body'.<sup>4</sup> Reid's principle, then, licenses the inference that whatever displays such marks, is designed and brought forth by an intelligent cause, either human or divine.

Expounding on the principle, Reid makes it clear that he thinks that an object's displaying the marks cannot be due to chance. With approval he quotes Cicero who had said, in *De Divinatione*, 'Can any thing done by chance have all the marks of design? Four dice may by chance turn up four aces; but do you think that four hundred dice, thrown by chance, will turn up four hundred aces? Colors thrown upon canvas without design may have some similitude to a human face; but do you think they might make as beautiful a picture as that of the Coan Venus? A hog turning up the ground with his nose may make something of the form of the letter A; but do you think that a hog might describe on the ground the Andromache of Ennius?'<sup>5</sup> So Cicero's (and Reid's) point is that certain features cannot be ascribed to chance but only to design—thus signaling their belief that design and chance are mutually exclusive.

Now Reid, of course, lived in the pre-Darwin era. Darwin's theory of evolution, however, rendered application of Reid's principle to the biological world obsolete, hence 'arguments from design' without force and belief in design without justification. At least, so many have claimed. This claim rested on the observation that many of the marks mentioned above, especially adaptation (to local environment) and aptness of means to ends, at least in so far as they seem to occur in the world of living animals, can be accounted for by means of Darwin's theory, i.e. by means of a theory that makes no reference whatsoever to design. In succinct form, Darwin's theory boils down to the following set of theses:

[1] All organisms tend to produce more offspring than can possibly survive.

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<sup>1</sup> For an assessment of Reid as a scientist, see Paul Wood, 'Thomas Reid and the Culture of Science', in Terence Cuneo & René van Woudenberg (eds), *The Cambridge Companion to Thomas Reid*, Cambridge, 2004, 53-76.

<sup>2</sup> Thomas Reid, *Essays on the Intellectual Powers of Man*, ed. D. Brookes, Edinburgh, 2002, 504.

<sup>3</sup> Reid, *Intellectual Powers*, 509.

<sup>4</sup> Reid, *Intellectual Powers*, 510.

<sup>5</sup> Cited from Reid, *Intellectual Powers*, 505.

[2] Offspring vary among themselves.<sup>6</sup>

[3] At least some of this variation is passed down by inheritance to future generations.

[4] If [1], i.e. if not all offspring can possibly survive, and if [2], i.e. if offspring vary among themselves, then, on average, survivors will tend to be those individuals that happen to be best suited to the local environment. Since [3] is true, i.e. since hereditary exists, the offspring of survivors will tend to resemble their successful parents. The accumulation of these favourable variants through time will produce evolutionary change.

Thesis [4] is generally referred to as ‘the principle of natural selection’. By means of it Darwinists explained the adaptedness of organisms to their environments without referring to design. The existing organisms display adaptedness only because ill-adapted forms have been eliminated by natural selection. Appeal to design or a divine designer seems not needed.

Darwin’s theory constituted a death-blow for all theorizing about the living world in terms of design. Since Darwin, arguments from design (arguments for the conclusion that there is a God, from premises about observed design in the world) are therefore highly suspect. In recent decades, however, ideas about design seem to make something of a comeback. The task of this chapter is to show where and how that is the case.

## 2. Darwinism and design: are they incompatible?

As indicated, it has often been repeated that Darwinism meant the death stroke for the thesis that living creatures are products of divine design. One reason for thinking that Darwinism had undermined that thesis was that according to Darwinism chance plays an uneliminable role in the emergence of the various species of living creatures. And the general idea was that where there is chance, there can be no design, and where there is design there can be no chance. A number of philosophers, however, have recently argued that Darwinism and design are compatible. This is, of course, an important point, for if Darwinism and design are compatible, then the truth of Darwinism cannot, all by itself, refute the thesis that the various living species are products of design.

In order to be able to see how the arguments for the compatibility of Darwinism and design go, we need to be clear on what we take Darwinism to be, for Darwinism is different things to different people. It seems to me that we need to distinguish a least the following theses:

1. Progress Thesis: there was unicellular life before there was multicellular life, there were worms before fishes, fishes before amphibia, amphibia before reptiles, birds, and mammals; and finally there is human beings.
2. Common Ancestry Thesis: life originated on one place on earth; all living creatures are literally distant cousins of one another.
3. The Thesis of Natural Selection: the mechanism that is responsible for the progress of simple to complex forms of life, as well as for the formation of the various species, is natural selection working on some source of randomness, e.g. random genetic mutation.
4. Naturalistic Origins Thesis: life itself developed from non-living matter without any divine creative activity but just by virtue of the ordinary laws of physics and chemistry.

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<sup>6</sup> Darwin spoke of ‘descent with modification’. We should keep in mind that Darwin did not know the mechanism of heredity (Mendel’s principles) nor did he specify the source of the variation [2] talks about (later Darwinists have specified that mechanism as random genetic mutation).

It should be noted that these theses are logically independent of one another, except for 3 that presupposes 2 (it wouldn't make sense to propose a mechanism for the emergence of more complex forms of life, if one doesn't think the evolution has indeed occurred). For example, the Progress Thesis does not entail the Common Ancestry Thesis, nor does the latter entail the former. Again, the Thesis of Natural Selection does not entail the Naturalistic Origins Thesis, nor is it entailed by it. Let us now turn to the question what we shall take 'Darwinism' to be the name of? Is it the name of the set of all four theses? Or is it a subset of them? Since different authors take different approaches here, I will simply announce that I will use 'Darwinism' to denote the Thesis of Natural Selection.

In a famous quotation, where he speaks of events that have been identified as the sources of mutation, Jacques Monod has hinted at the incompatibility of Darwinism and design:

'We call these events accidental; we say that they are random occurrences. And since they constitute the only possible source of modifications in the genetic text, itself the sole repository of the organism's hereditary structure, it necessarily follows that chance alone is at the source of every innovation, of all creation in the biosphere. Pure chance, absolutely free but blind, at the very root of the stupendous edifice of evolution: this central concept of modern biology ... is today the sole conceivable hypothesis, the only one that squares with observed and tested fact'.<sup>7</sup>

Mutations, the only source of biological innovation, says Monod, are random occurrences, and hence all biodiversity is the result of 'free but blind chance'. This last expression signals Monod's denial of the thesis that the biodiversity is the product of intelligent design.

Contrary to what is Monod claimed, however, Darwinism, i.e. the Thesis of Natural Selection, is not incompatible with the thesis that the living species display design. To suppose that they are incompatible, as Peter van Inwagen has argued, is to commit the fallacy of composition, the fallacy one commits when one reasons 'because a cow is entirely composed of quarks and electrons, and quarks and electrons are non-living and invisible, a cow must therefore be non-living and invisible'.<sup>8</sup> The argument for this claim is that it is possible that God brought about the enormous diversity of living species through natural selection. The idea is that it is possible that God, so to speak, 'used' natural selection 'as a means', or an instrument, to attain his purposes, and that this possibility isn't forestalled by the fact that this instrument involves an ineliminable element of chance. In order to make this clear, Van Inwagen draws an analogy with a device for calculating the areas surrounded by irregular closed curves that works according to what is sometimes called the dartboard technique. Suppose you draw the curve on a screen; then the device randomly selects points on the screen, and then looks at each point to see whether it falls inside or outside the curve; as the number of points chosen increases, the ratio of the chosen points that fall inside the curve to the total number of points chosen tends to the ratio of the area enclosed by the curve to the area of the screen. Every point on the screen is randomly selected, but the device in which the randomizer is built-in serves a certain goal that is not due to chance: the goal of calculating areas surrounded by irregular closed curves. Likewise, even if Monod is right and every mutation that ever occurred is due to chance, it doesn't follow that every aspect of the biosphere is due to chance. Even if none of the mutations has a purpose, it doesn't follow that the biosphere has no purpose. To think otherwise is, to say it again, to commit the fallacy of

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<sup>7</sup> Jacques Monod, *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology*, New York, 1971, 112-3.

<sup>8</sup> Peter van Inwagen, 'The Compatibility of Darwinism and Design', in Neil A. Manson, *God and Design. The Teleological Argument and Modern Science*, London, 2003, 354-5.

composition. Therefore, a process that involves ineliminable chance is capable of being used as a means to attain a certain goal.

The same point can also be made via a slightly different route. Mutations, we are told by Monod and others, are chance events. But what, exactly, does this mean? Any textbook on evolutionary biology will give you the following answer: mutations are chance events in the sense that mutations do not occur in response to changes in the environmental perils or opportunities: there is no correlation between the ‘usefulness’ of a particular mutation and the likelihood that it will occur. The thesis that mutations are due to chance in the sense indicated, however, is compatible with the thesis that God has been guiding evolution by deliberately causing certain mutations. Mutations aren’t responses to environmental perils and opportunities, but this by no means rules out the possibility that God brought them about!

There is, however, another sense in which mutations may be called chance events and that is such that one might think that if mutations are chancy in that sense, any process that involves chance in that sense is incapable of being used as an instrument by God or any other agent. What I have in mind is this: something may be called ‘due to chance’ when it is uncaused, as is the case with certain quantum events. Monod thinks that mutations are ‘due to chance’ also in this sense, they are uncaused.<sup>9</sup> And one may think that something that involves uncaused events cannot be anyone’s ‘means’ to attain a certain goal.

But the thesis that mutations are due to chance in the sense of being uncaused is, as Del Ratzsch has argued, compatible with the thesis that certain aspects of the biosphere are products of design.<sup>10</sup> His argument supposes that there are true counterfactuals of chance. A counterfactual is a statement that says that something would be the case if something else had been the case. *If John had been offered a bribe, he would have refused it* is a counterfactual—a counterfactual of freedom (thus named because the statement tells us what a certain person would do out of his own free will). One might suppose that counterfactuals have truth value, i.e. that it is either true or false that John would have refused the bribe, had he been offered one. One might furthermore suppose that just as there are counterfactuals of freedom, there are counterfactuals of chance. *If God were to create an atom in such and such a condition, it would decline at time t1* [GET THIS EXACTLY RIGHT] would be an example of a counterfactual of chance. One might suppose that counterfactuals of chance have truth value and furthermore that God, knowing their truth values, reckons with them in order to bring about whatever he intends to bring about. If so, the thesis that mutations are uncaused is compatible with the thesis that God designed the biosphere. Ratzsch calls this possibility ‘subjunctive governance’.

Many philosophers, however, reject the idea that counterfactuals of freedom have truth value, and those who do will almost certainly also reject the idea that counterfactuals of chance have truth value. Let us, if only for the sake of the argument, suppose that counterfactuals of chance don’t have truth value. In that case God could not know in advance when a certain quantum event is to take place and hence he cannot reckon with when he plans to bring something or other about. Wouldn’t this imply that God could not use anything that involves this kind of chance as a means to bring about whatever he intends to bring about? Wouldn’t this imply the incompatibility of the thesis that mutations are chance events (in the sense of being uncaused events) and the thesis that God created the biosphere? As Ratzsch has argued, it does not. His argument consists in the depiction of a possible scenario he calls ‘subjunctive supervision’. In this scenario God initiates the process that eventually leads to the coming about of the biosphere and God intends the coming about of the biosphere. It is assumed that God doesn’t know when any of the mutations, necessary for the coming about of the variety

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<sup>9</sup> ‘A mutation is in itself a ... quantum event’, *Chance and Necessity*, 114-5.

<sup>10</sup> Del Ratzsch, ‘Design, Chance, and Theistic Evolution’, in William Dembski (ed.), *Mere Creation*, Downer’s Grove, 1998.

of species, will occur. Still, God oversees the evolutionary process and is prepared to act whenever chance threatens to turn the process in a wrong direction. As a matter of fact, however, the process stays on track and God never has to intervene in the chance processes. If this scenario were to obtain, it would still make good sense to say that God designed the biosphere and that he brought it about by means of a process that involved chancy, i.e. uncaused, events.<sup>11</sup>

To round off this discussion, I would like to make a few remarks. First, those who argue for the compatibility of Darwinism and design, need not be committed to the truth of either Darwinism or design, nor to the truth of both of them. The compatibility claim is a claim as to what is, or is not, excluded by Darwinism or design and this claim can be made irrespective of any commitment as to the truth value of Darwinism or design. Second, the previous point implies that the arguments reviewed in this section by no means establish that the biosphere is in fact designed. So, in the context of a discussion about the truth or falsehood of Darwinism, compatibility arguments have no force whatsoever. The only context in which such arguments are relevant is a discussion in which it is claimed that because mutations are due to chance, the biosphere is not designed. In other words, compatibility claims are only relevant in a context in which design claims are countered by an appeal to chance events in the evolutionary process. Third, compatibility claims are typically made by philosophers—they typically are the products of armchair reflection, i.e. the kind of reflection that is required for conceptual analysis (such as the analysis of such concepts as ‘chance’ and ‘design’) as well as for logical analysis (that has to do with implicative relationships between statements); compatibility claims are not the result of empirical investigation. The next section is devoted to a highly interesting empirical claim concerning design, one that also directly relates to the truth value of Darwinism.

### 3. Darwinism and irreducibly complex systems

In the *Origin of Species* Darwin proposed an explanation of the great variety and complexity of the biosphere and, as indicated in the previous section, his explanation referred to the mechanism of natural selection working on some source of random variation. Darwin did not propose his explanation as being apriori correct, nor as necessarily true.<sup>12</sup> As a matter of fact, he indicated that certain empirical data, if they were to turn up, would constitute problems for his theory: ‘If it could be demonstrated that any complex organ existed which could not possibly have been formed by numerous, successive, slight modifications, my theory would absolutely break down’<sup>13</sup>. Darwin reported that he could find no such organs and he placed the burden of proof, i.e. the proof that there exist complex organs that could not possibly have been formed by numerous, successive, slight modifications, on his opponents. Nevertheless, Darwin formulated a criterion such that if something satisfies it, it would constitute a counterexample to and hence a problem for his theory. As he says, if such a counterexample were to be found, his theory would absolutely break down. No, what might satisfy Darwin’s criterion? The biochemist Michael Behe has argued that ‘irreducibly complex systems (or organs)’ satisfy Darwin’s criterion for being a successful counterexample. In his book *Darwin’s Black Box: The Biochemical Challenge to Evolution* he defined an irreducible

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<sup>11</sup> Further arguments for the compatibility of Darwinism and Design can be found in René van Woudenberg, ‘Darwinian and Teleological Explanations: Are they Really Incompatible?’, in: Jeffry Schloss & Philip Clayton (eds), *Evolution and Ethics: Human Morality in Biological and Religious Perspective*, Oxford, 2004; René van Woudenberg, *Toeval en ontwerp in de wereld*, Budel, 2003, 13-50.

<sup>12</sup> At least one of Darwin’s followers, however, has suggested that Darwinism is an apriori truth. Richard Dawkins, ‘Darwinism Triumphant: Darwinism as a Universal Truth’, in Michael Robinson & Lionel Tiger (eds), *Man and Beast Revised*, Smithsonian Institution Press, 1991, 23-39.

<sup>13</sup> Charles Darwin, *On the Origin of Species* [1958], New York, 1999, 154.

complex system as ‘a single system which is composed of several well-matched, interacting parts that contribute to the basic function, and where the removal of any one of the parts causes the system to effectively cease functioning’.<sup>14</sup>

As an example of something that is irreducibly complex in this sense, Behe refers to a mousetrap. This mice catching device has several parts, including a wooden platform, a spring with extended ends, a hammer, holding bar and catch. If one of these parts is missing, the trap won’t catch any mice: *all* of the parts have to be in place at the same time, if it is to catch mice. Just a few of the parts simply won’t do the job. The removal of any one of the parts causes the mousetrap to cease functioning. Therefore it is an irreducibly complex system.

Behe’s main contention is that as biology has progressed with dazzling speed in the past half-century, many systems in the cell have been discovered which, like a mousetrap, are irreducibly complex. He supports this claim by giving detailed and technical descriptions of various such systems. Let me quote Behe’s own summary description of the bacterial flagellum:

‘The flagellum is quite literally an outboard motor that some bacteria use to swim. It is a rotary device that, like a boat’s motor, turns a propeller to push against liquid, moving the bacterium forward in the process. It consists of a number of parts, including a long tail that acts as a propeller, the hook region that attaches the propeller to the drive shaft, the motor that uses a flow of acid from the outside of the bacterium to the inside to power the turning, a stator that keeps the structure stationary in the plane of the membrane while the propeller turns, and bushing material to allow the drive shaft to poke up through the bacterial membrane. In the absence of the hook, or the motor, or the propeller, or the drive shaft or most of the forty different types of proteins that genetic studies have shown to be necessary for the activity or construction of the flagellum, one doesn’t get a flagellum that spins half as fast as it used to, or a quarter as fast. Either the flagellum doesn’t work, or it doesn’t even get constructed in the cell. Like a mousetrap, the flagellum is irreducibly complex’.<sup>15</sup>

So far, this is only description. But this description serves as the basis for the point that it is very difficult to envision how the flagellum could have developed by ‘numerous, successive, slight modifications’. To see difficulty, just try to envision a trail through space time such that it begins with a very simple system that, through chance events that are responsible for very small phenotypic changes all of which confer evolutionary advantages to the emerging systems, and that ends with something as complex as the flagellum! Behe’s point with respect to irreducibly complex systems such as the flagellum, then, is that it is very hard, if not impossible, to see how they can be explained by invoking natural selection that operates on random mutation. The reason for this is that the stages that supposedly precede the stage where the entire complex system is in place, are such that they could not have possibly survived the selective pressures—which Darwinian theory tells they must, for the only changes that it allows are very small ones.<sup>16</sup>

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<sup>14</sup> Michael Behe, *Darwin’s Black Box: The Biochemical Challenge to Evolution*, New York, 1996, 39.

<sup>15</sup> Michael Behe, ‘The Modern Intelligent Design Hypothesis’, in: Neil A. Manson (ed.), *God and Design. The Teleological Argument and Modern Science*, London, 2003, 280.

<sup>16</sup> Sometimes Behe seems to suggest that irreducibly complex systems defy Darwinian explanation by *definition*, as when he says ‘An irreducibly complex system cannot be produced directly by slight, successive modification of a precursor system, since any precursor to an irreducibly complex system is by definition nonfunctional’, ‘Molecular Machines’, in Robert Pennock (ed.), *Intelligent Design Creationism and its Critics*, 247.

Behe doesn't just claim that it is hard, or impossible, to envision an evolutionary scenario leading up to, for instance, the flagellum. He also claims that nowhere in the scientific literature a serious and detailed model for how the flagellum might have arisen in a Darwinian manner has ever been proposed, let alone that experiments have been conducted to test such a model. Therefore, the flagellum seems to meet the criterion of being a serious counterexample to Darwin's theory!

The flagellum, as well as other irreducibly complex systems, therefore require an alternative explanation. Behe's own proposal is that such systems be explained by 'intelligent design'. This proposal contains a positive and a negative part. The negative part is that such systems are *not* designed by the laws of nature, nor by chance and necessity, i.e. not by non-intelligent agents. The positive part is that such systems are *planned* by a designer with intelligence who knew what the systems would look like when they were completed. In order to forestall misunderstanding of Behe's position, I should like to emphasize that in *Darwin's Black Box* Behe argues that the flagellum, as well as the other examples he gives of irreducible complex systems, exhibit design regardless of whether they were produced by natural (albeit non-Darwinian) means or by supernatural agent intervention at some point in the past.

Not being a biochemist myself, I am not properly positioned to evaluate Behe's ideas and proposals. But I do think that I am in a position to make some cautionary remarks. First, Behe's case for the claim that irreducible complex systems have not been and cannot be explained in Darwinian fashion is a straightforward scientific claim that nowhere rests on religious premises. Behe's claim is a claim to the effect that there are certain phenomena that a certain theory cannot explain, and this is certainly not a sort of claim that is foreign to scientific debates. Behe's claim is, of course, controversial but this can't be a reason to discard it out of hand. After all, many new scientific ideas were once controversial. Furthermore, Behe hasn't just thrown out untried ideas but he carefully made a case for his claim. His claim is founded on recent findings in biochemistry concerning the molecular basis of life—a claim that is up for discussion. I should add that a number of critics have tried to refute Behe's claim. But also that Behe responded to many if not most of them in a manner that gives both bystanders and experts in the field the impression that Behe is on to something.<sup>17</sup>

Second, Behe's proposed alternative explanation in terms of intelligent design, should also be taken as a proposal *within the bounds of science*. And like all scientific theories, there may eventually be very good reasons to discard it. Not everybody, however, will grant that 'intelligent design' is a concept that can legitimately be used in a scientific theory. As a matter of fact, many intellectuals take it for granted that 'intelligent design' can not be used in scientific theorizing. It is impossible to discuss this matter in any depth. Two remarks must suffice. (i) In everyday contexts we habitually engage in design explanations all the time. 'Why is that book on my desk?' I ask; and the explanation may be 'because Jane wants you to read it'. 'Why isn't John at the meeting?', you may ask; I explain it is because John wants to sabotage the negotiations. But if we engage in design explanations all the time, why should we stop doing that once we enter the halls of science? (ii) There isn't such a thing as 'the essence of science' that somehow rules that design explanations are always out of order. In fact, science is an evolving practice and concepts and ideas that once seemed illegitimate may later become acceptable.<sup>18</sup>

Third, Behe's argument is an argument for the conclusion that irreducible complex systems are designed, it is not an argument for the conclusion that a benevolent God exists.

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<sup>17</sup> For an overview of criticisms I can do no better than refer to Behe's webpage, where they are all listed. That page also contains a number of responses to his critics.

<sup>18</sup> That science has no essential nature I have argued in my book *Toeval en ontwerp in de wereld*, 51 ff. A most helpful discussion of arguments for the impermissibility of design explanations in science is Del Ratzsch, *Nature, Design, and Science. The Status of Design in Natural Science*, New York, 2001, 105-47.

Behe argues for design, but the question as to the identity of the designer is left open. There are various possible candidates to fit that role, e.g. the God that Christians believe in, angels, Plato's demiurg, some mystical force, space aliens, or some utterly unknown intelligent being. But Behe's scientific argument isn't committed to any of these—for it is compatible with the existence of any of them. This feature of Behe's argument sets it apart from the design arguments of William Paley who argued for the conclusion that design is due to a benevolent God.<sup>19</sup>

Finally, Behe claims that intelligent design is a good explanation for a number of biochemical systems. He emphatically doesn't propose intelligent design as an explanation for everything. As a matter of fact, Behe acknowledges that evolutionary biologists have recognized a number of factors that might have affected the development of life: common descent, natural selection, migration, population size, founder effects, genetic drift, gene flow, linkage, and more. The claim that some biochemical systems were designed by an intelligent agent doesn't mean that any of the other factors aren't operative, common, or important.<sup>20</sup>

#### 4. A fine-tuned cosmos

Another area of discussion where design ideas have been newly introduced is cosmology. For a long time such ideas were virtually absent in that field of study. So what happened? The main thing is that the scientific view of the cosmos has drastically changed over the last few decades. Ever since the 19<sup>th</sup> century the cosmos was considered to be an amorphous affair consisting of matter in motion. Recent cosmology however has showed that our cosmos hangs in a delicate balance, that it is "fine tuned" so as to be a friendly abode for life. The idea is that our cosmos could easily have been radically different from the way it actually is, and that if it had only been slightly different, there would have been no life. These facts suggest, or so it is argued, that the fine tuning of the cosmos is due to design. In this section I will give an impression of various ideas that go into this line of thinking.

The last twenty years a number of books have appeared in which it is argued that even slight changes changes in any of the so-called 'cosmological constants' would produce a dramatically different cosmos, one that is unsuitable for life of any conceivable type. Some of the more important and influential ones are John Barrow and Frank Tipler's *The Anthropic Cosmological Principle*<sup>21</sup>, John Leslie's *Universes*<sup>22</sup>, Paul Davies' *The Accidental Universe*<sup>23</sup>, Paul Davies' *The Cosmic Blueprint*<sup>24</sup>, and Gilles Cohen-Tannoudji's *Universal Constants in Physics*<sup>25</sup>. Among the cosmological constants are the so-called 'Universal Constants': Boltzmann's constant, Planck's constant, the Speed of Light, and the Gravitational Constant. Among the cosmological constants are furthermore the so-called 'Fine Structure Constants': the Gravitation fine structure constant, the Fine structure constant of weak interaction, the Electromagnetic fine structure constant, and the Fine structure constant of strong interaction. The cosmological constants finally include the masses of the elementary particles, such as the mass of the proton, electron, and neutron and the unit charge for the electron or proton. All the cosmological constants have a certain value, for instance, the value

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<sup>19</sup> It should be noted that some authors who offer design arguments are unlike Behe in that they hold that such arguments don't commit one to the existence of a designer. E.g. Morris, and Ronald Meester, "Ontwerp een wetenschappelijk begrip?", *Radix* 2004.

<sup>20</sup> Behe, 'Molecular Machines: Experimental Support for the Design Inference' in: Robert T. Pennock (ed.), *Intelligent Design Creationism and its Critics*, Cambridge (MA), 2001, 255.

<sup>21</sup> Oxford, 1988.

<sup>22</sup> New York, 1989.

<sup>23</sup> Cambridge, 1982.

<sup>24</sup> Portsmouth, 1988.

<sup>25</sup> New York, 1993.

of the Gravitational Constant  $G = 6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$ . If the cosmos is to be life-permitting, so these authors argue, there needs to be a very precise balancing of the nuclear strong force and the electromagnetic force. This balancing is required if there is to be the abundance of carbon in nature that is needed for the development of life. So there is this ‘cosmic coincidence’ that the values of the strong force and the electromagnetic force are such that carbon-based life is possible. And these authors argue that there are many more of such coincidences.

To facilitate thinking about these matters (at least for a non-physicist) it may be helpful to think of the cosmos as the product of a machine designed to produce cosmosi.<sup>26</sup> The machine has, let’s say, some twenty or thirty dials on it. The overall features of the cosmos are the result of the ways the dials were set when the cosmos was produced. Had the dials been set in other positions, a different type of cosmos would have emerged from the machine. The lesson that the authors I have mentioned teach is that many statements of the following form are true:

- the pointer on dial 18 is set at 0.0054321; if it had not been set at some value between 0.0054320 and 0.0054322, there would be no carbon atoms, and hence no life.
- the pointer on dial 23 is set at 5.113445 and the pointer on dial 5 is set at 5.113449; if the values of these dials had been exactly equal, there would have been no matter, but only radiation; if the two readings had differed by more than .000006, all stars would be of a type that would burn out before multicellular organisms could evolve on their planets.

When it is said that our cosmos is fine-tuned, what is meant is twofold. First, that the dials on the machine that produced our life containing cosmos were set between quite strict parameters. And second, that only a vanishingly small proportion of the ways the dials could be set would make the machine produce a cosmos that is life-permitting.

This fancyful way of thinking inevitably leads up to the question ‘why were the dials set right for life?’, ‘why is our cosmos one of the few possible cosmosi that is a friendly abode to life?’ In response to this question, a number of people have framed an answer in terms of design. The dials were set right for life, they say, because some rational agent designed it that way.

This answer, of course, has met with considerable resistance, nor is it the only possible answer. An alternative, and most popular, answer is that it is sheer accident, pure luck that the dials were set right for life. After all, so the reasoning goes, if the machine has dials, the dials have to be set *some* way, and any particular way is as likely (or better, since the probabilities are very small, as *unlikely*) as any other; hence, there is nothing particularly remarkable about the setting that resulted in the current cosmos, nothing that needs what I call ‘a special explanation’. For, to say it again, given that the dials have to be set in *some* way, the setting for the current cosmos is as unlikely as any other setting.

As friends of the design explanation of the fine-tuning have pointed out, however, this reasoning should convince nobody. What is wrong with it, can be brought out by reference to what Leslie has called ‘the principle of the merchand’s thumb’. There is a story behind the principle. It is about a merchand who displays an expensive silk robe to a potential buyer. The robe has a hole in it, but the merchand consistently keeps it covered with his left thumb. When he is accused of dishonestly concealing the hole from the buyer, he and his defenders point out that everyone’s left thumb has to be *somewhere* and that the merchand’s left thumb being right above the hole is as likely (or as unlikely) as its being at any other place. There is therefore, they say, nothing remarkable about its being above the hole, it doesn’t need any

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<sup>26</sup> This way of putting the issue is due to Peter van Inwagen, *Metaphysics*, Boulder, 1993, 130.

special explanation. But, of course, no one should accept this piece of reasoning. What the story suggests is that there is a principle to the following effect:

*Principle of the Merchants Thumb:* if we can think of a ‘special’ explanation of a certain fact that would be a very good explanation, then it is wrong to discard that explanation simply because no such special explanations are available for otherwise similar facts.

The chance explanation of the settings of the machine’s dials violates this principle and should therefore not be accepted.

Yet another explanation of the settings of the dials is that, somehow, these settings are *the only possible* settings, that, contrary to what was suggested, the various cosmological constants could not possibly have other values. Those values would then, somehow, be necessary. In response to this, however, the friends of design have pointed out that at the moment there is no reason at all to suppose that the values *are* necessary.

Given what was just said, some friends of design reason as follows: ‘If the setting of cosmic dials cannot be explained by reference to (natural) necessity, nor by reference to chance, then, by elimination, only one possibility is left, viz. that the setting is intentionally designed by a rational agent’. Those who reason thus<sup>27</sup>, may, but need not, make use of William Dembski’s ‘explanatory filter’ that tells us that if we want to explain some phenomenon, we should first of all see if it can be explained in the sense that it fits a general pattern; if it cannot be thus explained, we should conclude that the phenomenon is due to chance, unless the probability that the phenomenon occurs is so small, that it must be explained by reference to design.<sup>28</sup>

To round off this section, I will make some comments. First, the argument advanced by the friends of design has been countered by the ‘multiple worlds’ hypothesis, the hypothesis that there are, or have been, very many cosmoses. According to this hypothesis the cosmic machine has produced not just one cosmos but a real plethora of them. On this hypothesis, it is vastly less improbable that our cosmos is a friendly abode to life than on the hypothesis that there is, and has been, only one. This is so for the very same reason as that it is less probable that one will throw snake eyes in one throw, than it is that one will throw snake eyes in one hundred throws. But if the many cosmoses hypothesis is true, then ‘chance’ is a very good explanation of our cosmos’ being life-permitting; *that* explanation doesn’t violate the Principle of the Merchant’s Thumb. So, if the many cosmoses hypothesis is true, then there is no rationale for a design inference.

The cogency of this argument depends, of course, on the likelihood of the hypothesis. Some think it is a rather plausible hypothesis, others find it badly *ad hoc*, advanced only so as to be able to escape the otherwise inescapable design inference. This is not the place to enter this discussion, but it seems clear that discussion is needed here.

Second, the friends of design as I have depicted them, argued for a design explanation of the setting of the cosmic dials by means of an elimination argument. Since this setting cannot be explained by reference to some (natural) regularity, nor by chance, what is left is the design explanation. This way of arguing for design, however, is rather problematic. For, as was argued in section 2, design and chance do not necessarily exclude one another. Furthermore a rather strong case could be made for the claim that (natural) regularity and design do not necessarily exclude one another. But if that is true, then any argument for design that works by eliminating both regularity and chance, will give unwanted results!

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<sup>27</sup> William Lane Craig, ‘Design and the Anthropic Fine-Tuning of the Universe’, in Neil A. Manson (ed.), *God and Design*, London, 2003, 161-175.

<sup>28</sup> William Dembski, *The Design Inference*, Cambridge, 1998, 36-66.

The task of this paper was to indicate where and how ideas about design have recently resurfaced in discussion about nature. They resurged in philosophy, biochemistry and in current cosmology. Philosophers have argued that claims to the effect that something is designed cannot be countered by showing that the coming about of that something involves chance. Michael Behe argued that irreducible complex biochemical systems defy Darwinian explanations and that the best alternative explanation is in terms of design. Finally, a number of cosmologists have argued that our cosmos is fine-tuned and that this requires an explanation in terms of design.

It would be a gross overstatement to say that ideas about design in nature have become acceptable to the average scientist. Many of them are hostile to the very suggestion. But that hostility, it seems to me, stems not so much from scientific findings as it does from preconceived opinions about what science is, and about the impermissibility of design explanations. These opinions are, most of the times at least, philosophical opinions—and about such opinions, I fear, a true consensus is unavailable. Or, to put the same point in a more positive vein, about such opinion a genuine, albeit not irrational dissensus, is possible.