

## BEAGLE

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I spent my first eight years in Brooklyn - specifically, Flatbush. During that period, there was no formal religion in my life, but being immersed in Brooklyn I absorbed Jewish culture. The only organized religion I saw was worship of the Brooklyn Dodgers - the Boys of Summer - Duke Snider, Gil Hodges, Carl Furillo, Pee Wee Reese, Roy Campanella and, of course, Jackie Robinson.

In the early fifties, following the trend, my family moved to a Long Island suburb, into what was considered a mixed neighborhood - Jews, Catholics and a sprinkling of Lutherans. My parents decided that in this environment I needed to learn about my heritage, of which they knew nothing having been raised in orphan asylums. I was summarily enrolled in Hebrew school and Sunday school. Hebrew school was a mistake - I have little aptitude for languages, had no interest in them, and resented "wasting" my Tuesdays and Thursday afternoons bicycling to the next town for lessons. I never learned Hebrew; when it came time for the Jewish rites of passage, the Rabbi completely gave up and I memorized transliterations of the prayers. This was perhaps my earliest lesson in hypocrisy.

I was required to attend Friday night and Saturday services - another ritual I resented. My parents opted to not attend the services, reasoning that I was the one being educated and not them. This was probably my second earliest lesson in hypocrisy.

But I enjoyed Sunday school. We read the old Testament and the new, the Koran, and the Book of Mormon; we read them for understanding and for ethical and moral content. Over a two-year period we visited different congregations and took part in every type of religious service imaginable: Orthodox and Conservative Jewish, Pentecostal Christian, Seventh Day Adventist, Mormon, Roman Catholic, Greek and Russian Orthodox, Jehovah's Witnesses, Lutherans, Presbyterian, Islam - you name it, if it existed in the Greater New York area, we went. I received solid lessons in the scriptures and in various groups' interpretations of them.

Growing up, I was not expected to engage in organized sports as there was no future in it; this was before the Jewish Jackie Robinson, Sandy Koufax. My time was to be spent on more intellectual pursuits. Then, as now this created social misfits in school; if you were not in one of the appropriate cliques you were out of it. And being in the "nerd" clique didn't get you many dates. In the summer of 1955 I was sent to Summer Camp - to Bucks Rock Work Camp. Bucks Rock was unique. It was founded by a child-psychologist and wartime-refugee from Austria, Ernst Bulova. Its original purpose, during World War II, was to put middle-class children to work on Connecticut farms, raising food for the Armed Forces. It evolved into an Art and Science paradise for interested teenagers. Compared to more normal summer camps, there was anarchy.

There were only four rules - you had to get up in the morning, you had to go to bed at night, and you had to appear at all meals (not eat - just appear). You didn't have to do anything else. Team sports of any kind were absolutely prohibited before 6:00 PM. Instead of sports there was a panoply of things to taste in the visual and performing arts, the sciences, and the practical arts. Woodworking, printing, ceramics, painting, photography and silver smithing - all taught by professional artists. There was an orchestra conducted by one of Leopold Stokowski's associates. Folk music, well before the folk music revival of the sixties. We listened to and were taught by the likes of Pete Seeger and Woody Guthrie. There was a modern dance troupe taught and choreographed by one of Martha Graham's people, a theater company, science laboratories - and animal and vegetable farms replete with corn, chickens, and pregnant cows and pigs. There was a great-book discussion group; a science discussion group. These were incredible opportunities for an interested teenager. The counselors made great effort to ensure that each camper partook of something, but no one was forced into anything.

It opened the world for me - I was with people in my own age who reveled in artistic and intellectual pursuits. To attend, you had to be interviewed by the owner - the psychologist - to see if you would benefit from the freedom and the programs. Except for some of the owner's patients - he placed them in the camp for therapeutic reasons. Many of those had very real problems: a prime example were Robert and Michael Meeropol - the children of Ethel and Julius Rosenberg. The rest of us were quasi-typical teenagers with a lively interest in the visual and performing arts, music, and science.

During the six or seven years I was there I painted and photographed, threw pots and turned wooden salad bowls, created silver salad spoons and forks, read critically, and outlined and defended mostly untenable positions. (As an aside, it was during this period that I learned to read and enjoy history - which remains an avocation today. I note that I never wanted to be an historian - my image of real historians was that of ill-paid, ink-stained wretches in rumpled clothing, and ragged sweaters, hunched over fading and moldy manuscripts in dark, cold, and drafty archives. I've since learned that this image is quite correct.)

Perhaps the most important thing I learned was to keep an open mind and to not accept a viewpoint because an "authority" said it was correct. I learned to question nearly everything. Those attitudes had me in constant hot water each fall when I returned to high school- except for a very few, I found my high school teachers and administrators to be an ill-humored lot with little tolerance for intellectual disruption.

From high school I went on, eventually earning the necessary letters of marque needed to pursue a career in science - where refusal to accept the gospel in a knee-jerk manner is considered a positive. Over the years I have pursued research in various areas of physics and have established a modest reputation for it.

So there you have it; a scientist, somewhat knowledgeable in religion. My bonofides if you will for the rest of this talk.

On the 27th of December, 1831, after several delays, Her Majesty's Ship Beagle set sail with a crew of 73, heading out from Plymouth under clear skies and a fair wind. The long voyage of the Beagle had begun. Charles Darwin became sea-sick almost immediately. His father had opposed the trip seeing it as one more step down a long path of idle pursuit and dissolution. Worst of all, the journey would get in the way of his view of Charles' proper pursuit: a career in the clergy. His father's refusal was not absolute; if Charles could find one man with common sense who thought it was a good idea, he could go. Darwin obviously found such a person.

On the 2nd of October, 1836, H.M.S. Beagle arrived home after a voyage of four years, nine months, five days. They docked at Falmouth, at night, during a storm. Darwin set off immediately for home. In late May, 1839 a three-volume narrative of the Beagle voyage, Journal of Researches into the Natural History and Geology of the Countries Visited During the Voyage of H.M.S. Beagle, was published. Twenty years later, on November 22nd, 1859, The Origin of Species by Means of Natural Selection: Or, the Preservation of Favored Races in the Struggle for Life was published. Twelve years from then, in early March, 1871, The Descent of Man and Selection in Relation to Sex appeared. With that the world changed and the conflict between science and religion flared up anew, a conflict begun many years before, the most notable instance being the Trial of Galileo in 1633, after he published his text supporting Copernicus' heliocentric universe.

After Darwin published his famous works, there followed a period of debate and discussion in England - with Huxley and others defending it and Wilberforce and company denying it. The stage soon shifted to the United States - the Scopes Monkey Trial in 1925. This was a show-piece trial signed to test whether or not a Tennessee statute that prohibited teaching evolution in public schools was valid. The trial was quite entertaining - but settled nothing, and certainly did not settle the issue of whether or not states, based on the First Amendment, could ban teaching of a theory that violated religious beliefs. That actually did not occur until 1968, when the US Supreme court ruled in *Epperson vs. Arkansas* that such bans contravene the Establishment Clause in the Bill of Rights because their primary purpose is religious. The court used the same reasoning in *Edwards vs. Aguillard* to rule unconstitutional a Louisiana law which required public-school biology teachers to teach so-called "Creation Science" if they also taught evolution - or at least discuss the "evidence" for it. The controversy has now erupted anew - in the form of "Intelligent Design," and attention recently shifted to Ohio as we wrestle with the issues. The religion vs. science conflict will not soon end. I expect legal conflicts will likely arise over physical theories such as the "Big Bang," which also undermine fundamentalist beliefs about creation.

At this point I think it useful to set some definitions:

- A *Creationist* rejects the Theory of Evolution and believes all species were placed here by a divine being. A Creationist accepts micro-evolution – small changes over time - but rejects the idea that any species can evolve into another.

- A *Young-Earth Creationist* believes the earth is about 6000 years old.
- An *Intelligent Designer* rejects the idea that chance and natural law alone can explain the diversity of life, instead arguing that the diversity of life is a direct result of some higher power - who may not be the God of the Bible.
- An *Evolutionist* accepts the Darwinian argument that natural selection and environmental factors explain the diversity of life. An evolutionist may or may not believe that Evolution is the way a divine being has chosen to work.
- A *Theory*. "Theory" has two meanings. One is an hypothesis, perhaps using mathematics, that attempts to explain something, may or may not be right, but needs to be tested. The second is a body of work generally taken to be correct because it has been tested thoroughly. Examples of this latter sort might be "Electrodynamics", "Quantum Mechanics" or "The Special Theory of Relativity." These have been tested over and over again, and laymen know they work because we have televisions and radio's and computers to' prove it.

The Theory of Evolution is in this latter class. A key point of such theories is that they are predictive - that is, they not only explained the facts known at the time of formulation of the theory, but they predicted new things that can be and were tested. The important point here is the oft-used statement by anti-evolutionists, that "Evolution is just a theory" is incorrect. They are using the wrong definition of theory.

Evolution has become the central theory of biological sciences. It explains the millions of fossils. It explains much other evidence about the existence of various life forms, such as the fact that 98% of a chimpanzee's and a human being's DNA is identical. Evolution is not inconsistent with the religious beliefs of most Christians, Jews, and Moslems. Most mainline Protestant denominations and the Catholic Church accept evolution as correct. There is not a single top biologist in the US that does not accept the theory that life evolved from single-celled organisms. There are lots of disputes about evolution - as with almost any theory. Exactly how does the mechanism work - slowly and consistently or suddenly and episodically, for example.

Why is this conflict ongoing? Probably because the theory undermines the view that humans - as a distinct species - have a special place in the universe. It says that the universe is random and chancy. Genesis is much more comforting and believing in the literal word of God gives those believers a modicum of personal peace and joy.

Intelligent Design is the latest manifestation of this argument, one that came to the fore as the bankruptcy of "Creation Science" came to be recognized. Intelligent Design is subtle; perhaps it has implications beyond the simple genesis of life on a minor planet in a small corner of a minor galaxy. Or perhaps, as someone said, it is "nothing more than Creationism dressed in a cheap tuxedo."<sup>1</sup>

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<sup>1</sup> Leonard Krishtalka

Intelligent Design refers to the concept that intelligent beings must be responsible for the origin of the Universe and the diversity of life. The theory is supposed to be based on science and to provide solid empirical proof for the existence of God - or super-intelligent aliens. They do not reject evolution simply because it does not fit their ideas about the Bible. They do present Natural Selection as implying that the Universe could not have been designed or created. This, of course, is nonsense. To state that God lacks the power to create living things by Natural Selection is to assert the unknowable. It is also inconsistent with the belief in an omnipotent creator.

As far as I can tell, Intelligent Design is based on the ideas of three individuals--- Michael Behe, a biochemist from Lehigh University who argues about "irreducible complexity" in Darwin's Black Box, William Dembski, who constructs theories based on conservation of information, and wrote Intelligent Design: the Bridge Between Science and Theology, and Philip Johnson, a Berkeley law professor, now retired.

Intelligent Design was launched by Phillip Johnson with the publication of Darwin on Trial in 1991, after he had a religious conversion that led to his anti-evolution thinking. In 1996 he founded The Center for Renewal of Science and Culture, or CSRC, to provide money for scientists interested in Intelligent Design. That group's mission statement says that their goal is "nothing less than the overthrow of materialism and its damning cultural legacies." Johnson's arguments are not worth repeating; suffice to say that he does not understand the difference between science and metaphysics. His strategy, and the CSRC's strategy, is worth a few words. Called the "Wedge" strategy, it is intended to have Intelligent Design liberate science from "atheistic naturalism," to drive a wedge between science and religion, relying on the fact that most Americans are, to some extent, religious. Intelligent Design differs from its forebearers in that it does a better job of disguising its sectarian intent. The CSRC is well-funded and nationally coordinated. To appeal to a wide range of people, biblical literalism and other such issues associated with Creation Science are hidden. Some educated people, with little background in the relevant science have been taken in, as have some scientists and engineers. Its advocates can't accept the inability of science to deal with supernatural hypotheses, and they see this limitation as a sacrilegious denial of God's work and presence. In need of affirmation, they invent "theistic science" in which the design of the Creator is manifest. The wedge strategy has become clear over the past 8 or so years. Wedge scientists have published no research program or data in any peer-reviewed journal - or elsewhere, for that matter. This absence of Intelligent Design publications in refereed journals is presented as strong evidence for censorship by the science community. Instead of publication, they have a strong public relations campaign, a recruiting campaign, and alliances with conservative Christian groups. The stated goal is to weather their opponents ridicule and scorn, wear them down, and get their viewpoint legislated into public school curricula - grounding education in evangelical religion. When presenting their views before the public, Intelligent designers disguise their religious intent. In academic venues, they avoid any direct reference to an ultimate designer. They portray their ideas as an exercise in detecting design. The presumed censorship of the journals is used to justify their exploitation of public schools and the children in them in order to circumvent established scientific procedures.

The problem is exacerbated by journalists who present controversies where none exist, or present political controversies as scientific controversies to gain readership. This bias towards reporting conflicts, coupled with journalists' inability to evaluate scientific content and an innate unwillingness to do accuracy checks, are among the greatest challenges to public understanding of scientific issues. (The Enquirer's Peter Bronson is a prime example.)

However, rhetoric and theology cannot answer the most important question: is God's interaction with the world empirically detectable. To answer this, Intelligent Designers turn to science and to the most prominent CSRC fellows, Michael Behe and William Dembski.

Behe argues in Darwin's Black Box that an organism's very complexity provides ample evidence for the existence of designer. This is a very old argument, first advanced by William Paley centuries before Darwin, and called the "watchmaker analogy." If we find a pocket watch in a field, we infer that it was produced by a human designer and not by natural processes. Likewise, he argued the natural world contained abundant evidence for an Intelligent Designer.

A scientist uses the expression "black box" for a system whose inner operations are unknown, but whose input and output are known. Behe points out that Darwin thought of cells as black boxes, but we now know they are filled with millions of complicated molecular machines. He argues that such systems are so complex that they could not have been formed naturally - they are, in his words, "irreducibly complex."

A mousetrap is one of Behe's examples of an irreducibly complex system. A mouse trap has a wooden base, a metal hammer to kill the mouse, a spring to power the hammer, a catch that releases the spring, and a metal clasp that holds the hammer back and connects to the catch. You cannot catch a mouse with just the base, then add a spring and catch more, then a holding bar and catch a few more, ever improving it. All the pieces need to be in place to catch any mice.

This Behe calls an irreducibly complex system. It, and biochemical systems of significantly greater complexity, are very unlikely to be produced by many small modifications of prior systems, because a precursor missing any of the parts could not function as a mousetrap. This schematic model expresses his view that a natural process can only select among systems that already work; therefore the existence of these irreducibly complex systems in nature is a challenge to Darwinism: there must have been an Intelligent Designer.

As an example of a biological system, he cites the flagella some bacteria use for motion. It rotates via a molecular motor. A variety of proteins make it work; some act as stators, some as rotors, some hold the motor in place, others are bushings that allow the drive shaft to penetrate the cell membrane, et cetera. Dozens of different proteins make up the motor and the propeller, all are necessary for it to work, and in the absence of

anyone of them, the system fails. Behe goes on to raise the level of the discussion and makes similar arguments about a variety of cellular and sub-cellular molecular systems.

The scientific community has been less than impressed. We may use his own example - the mousetrap - to show why.<sup>2</sup> Behe's contention that every piece of a machine must be in place before anything useful can emerge is simply incorrect. Remove the catch and the metal bar from the mousetrap and you have a perfectly useable tie clip. Remove the spring, and you have a two-piece key chain. The catch makes a good fish-hook, the wooden base a paperweight and one can imagine nutcrackers, paper clips, toothpicks, and clipboards.

The point, long understood by most scientists, but apparently not by Behe and other Intelligent Designers, is that pieces of supposedly "irreducibly complex" mechanisms can have different, but useful, functions away from the mechanism at hand. Evolution can create very complex biochemical systems by copying, modifying, and combining proteins previously used for other functions. Scientific experimentation on the flagella shows how. We can map the proteins that make up the motor and the flagellum and the rest of the parts, we know how they form and what they look like. And we find, for example, that one of the motor's protein groups is used by several variety of bacteria to inject poison into other cells. Work on these proteins has identified exactly the evolutionary path along which they were duplicated, retargeted, and modified for the new purpose. When presented with such evolutionary paths, Behe simply ignores them. The list of such paths is long; working researchers don't see irreducible complexity, they see evolution at work. Behe may believe the complexities of life and the universe represent a world that is completely consistent with a divine being – but that is a philosophical point and not a scientific one.

William Dembski published Intelligent Design: the Bridge between Science and Theology in 1998. His aim was to prove mathematically that the universe - and life could not exist by chance and natural processes alone and therefore must be due to an Intelligent Designer. (I cannot refrain from also mentioning that he has also stated that "the conceptual soundness of a scientific theory cannot be maintained apart from Christ" and that "any view of the sciences that leaves Christ out of the picture must be seen as fundamentally deficient," remarks which certainly show his metaphysical bias and certainly baffle Jewish and Islamic scientists.) Dembski, however, is the only interesting Intelligent Design proponent in that many of his arguments are correct, but these conclusions don't follow from his arguments. I won't attempt to discuss his arguments in detail as they are highly mathematical and out of place in this venue. But I will instead endeavor to show how his errors highlight just how strong the Theory of Evolution is.

Dembski tried to construct a mathematical test that when applied to a complex system would point to supernatural intervention. He tries to detect Intelligent Design in a way that distinguishes design from accident. To do this he searches the data for "*contingency*," "*complexity*," and "*specification*." On the way he creates a very credible information theory argument, much of which is correct.

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<sup>2</sup> "The Flaw in the Mousetrap," K.R. Miller

By *contingency* he means that a system useful for conveying information must allow many possible arrangements and that not all arrangements are evidence of purpose. For example, objects fall, they don't go off in random directions. This is not purposeful but a manifestation of the law of gravity. I can type the nonsense string "dfc6tvk9" as easily as I can type "JoeTomain." Both are possible, but only one conveys information. Similarly, an isolated string of nonsensical DNA is no different in its chemical stability than one that codes for a useful protein. Contingency, then, means that for an information carrying system, which is what DNA is, to be useful, there must exist many possible configurations, not all of which are useful or carry information.

Dembski then demands *complexity* to rule out pure chance. This is because the laws of physics, coupled with randomness, will occasionally produce something that makes sense - a classic example often expressed is that a billion monkeys at a billion typewriters for a billion years will eventually write Hamlet. Dembski points out - correctly - that the longer and more complex a message, the less likely it is that it will occur randomly. In actual fact, it is simple to demonstrate that if one assumes that all the monkeys that ever lived were at word processors, each typing about 5 characters a second, then in the age of the universe the odds of producing Hamlet are 1 in 1054 - *i.e.*, pretty slim and Dembski is again correct.

Finally, Dembski calls for *specification*: this is crucial in order to tell what sort of data is meaningful. If we receive a numerical signal from space and decipher it to reveal the first 200,000 prime numbers, it indicates an intelligent source, whereas a random string of numbers, no matter that the particular sequence is equally as improbable as the string of primes, is just noise. If dealt a bridge hand that is all spades you might suspect a stacked deck - that is, an intelligent dealer. Any random bridge hand, equally as unlikely as the all-spades hand, elicits no such reaction. Further, we must be able to specify meaningful patterns in advance - otherwise, given enough time we can find messages in anything. The specifications must be objectively given, we cannot impose them on events after the fact. Dembski's example: if an archer shoots arrows into a wall and then paints bull's eyes around them, he has imposed a pattern after the fact. If targets are placed in advance and then the archer hits them, we know it was by design.

Dembski argues that these three criteria - contingency, complexity and specification - can be made mathematically rigorous. This is quite correct, and finding design or messages in noise is a very important scientific and engineering issue.

Dembski created a mathematical formalism for his requirements for complexity, and claimed that "specified complexity" detects design and that undirected natural processes, such as evolution, are incapable of generating the specified complexity that exists in biological organisms - *i.e.* that chance and necessity are insufficient and that natural science has to leave room for design.

Dembski's information theory is quite respectable - to a point. The problems begin when he applies it to biology, making the claim that life exhibits the specified

complexity supposed to signify Intelligent Design, and that the search for specified complexity is a rigorous procedure to identify intelligent origin. One rather simple flaw in his argument is that he defines Intelligent Design negatively, as anything that is not due to chance or necessity. But this is rigged, as necessity, chance and design are not mutually exclusive nor do they exhaust all possibilities. In an inversion of science, he claims that the null hypothesis is the thing. But one cannot scientifically detect Intelligent Design by a process of elimination - science requires hard evidence. More is needed and Intelligent Designers attempt to provide it in two ways. One is to fall back on the usual tedious arguments - macro-evolution, the Cambrian explosion, Behe's mousetrap, etc. The other is to extend the information theory argument.

Dembski claims, correctly, that information must be conserved if life is to occur. DNA conveys and conserves information. In addition, he argues that an unintelligent (or random) process that transforms and transmits information cannot add new content. The message string "3:45 PM" can be transformed into "15:45," but no information is added - or lost. It can be rounded to 4:00 PM, but rounding degrades the information. Microsoft Outlook or Lotus Notes might transmit it as "Next meeting is at 3:45 PM." Although useful, it is not new - it is built into the program. Or, the communication channel may be very noisy and it might come out "Christmas party: 3:45 PM". But you couldn't trust that and no meaningful new data has been added. Intelligent Design says that producing information-containing structures like human DNA cannot be done by blind natural processes that do not conserve information.

However, it is simple to show that a connection exists between information theory and thermal physics. Conservation of information is nothing more or less than a restatement of the Second Law of Thermodynamics, wherein changes in entropy – or disorder - are always equal to or greater than zero in a closed system. That is, every natural process always tends to create states of greater disorder. Essentially Dembski's claim comes down to the old Creationist argument that evolution violates the Second Law of Thermodynamics because in a closed system a natural process can only increase the net disorder in the universe, not decrease it. This is correct, but beside the point, since living systems are not closed.

This is a subtle thing, difficult to understand and most Creation Scientists or Intelligent Designers don't understand it. Since most people have problems with it, I will endeavor to create a simple explanation. Let us consider a universe that operates only by Isaac Newton's Laws of Motion (that is no relativity, no quantum mechanics). Newton's laws conserve information at the microscopic level - they are deterministic and they are reversible. This means that if, at any time, we know the position and velocity of every particle in the universe, then we know the position and velocity of every particle in the universe at all future and past times. We might begin with a universe of simple structures but complex structures might appear at some future time. This is not new information but is implicit in the original state. It also does not preclude evolution. It does suggest a clockwork deism where the information existing in the initial state simply unfolds with time, manifesting increasingly complex structures, even some with "specified complexity." How are they created or assembled? Trial and error can certainly do the

job.

This issue is one of the classic problems of physics - how do we understand a macroscopic world that seems to be irreversible, and which does not appear to conserve information, when the dynamics of the microscopic particles making up the world are reversible and do conserve information. The important point is that we never really have a complete description of a system - the approximate knowledge we have becomes obsolete quickly due to dynamical chaos, where the tiniest error grows exponentially. We can only track the statistical properties of systems through macroscopic variables. As an example, consider temperature. Temperature is a measure of the average kinetic energy of the molecules in a body. It is a macroscopic variable that depends on microscopic variables. If we bring two objects at different temperatures into contact and allow them to equilibrate, they will end up at the same temperature. No measurement can recover the original temperature and they will not spontaneously again attain different temperatures. This is a definite loss of information but it doesn't challenge Intelligent Design; indeed it even plays into the Creationist's argument that the Second Law precludes evolution as it shows the tendency of the Universe to tend toward greater disorder. How then can evolutionary processes produce more complex life forms from more primitive ones? The glib answer is that biological systems are not closed, they are open, and the Second Law does not apply. This begs the question. The point is that the very physics that says that order eventually degenerates into disorder, also allows for the emergence of order from disorder. Technically, one would say if a system behaves such that its *maximum possible* disorder - or entropy - increases faster than its actual disorder, it will be driven away from equilibrium, creating space for order from Darwinian process to take hold. This says that Dembski's "contingency" actually means that the more possibilities there are in a system, the more likely it is that there will be a state that is self-replicating and which can mutate and multiply and that chance will bring the system into that state eventually. That is, Dembski's arguments for contingency and complexity are exactly the prescription needed for random events to create ordered systems, all under the laws of ordinary physics. The information-based arguments of Intelligent Design confine the designer to setting the initial conditions - they are too broad to support a critique of evolution. Not to mention a very dubious deistic view.

One must be a little careful here as focusing on microscopic information and deterministic dynamics can give the impressions that complexity is a nuisance created by our imperfect knowledge and the need to resort to statistics. But that is not so - what we know about complex systems is valid under a very wide range of dynamical laws and initial conditions - irreversibility, self-organization and Darwinian selection are not at all sensitive to the underlying microscopic physics, Darwinian Natural Selection is simply a manifestation of Statistical Mechanics, independent of the underlying dynamics. When a wide variety of dynamical laws can generate complex structures, it is quite a leap of faith to conclude there must be an intelligence behind it all. Throw in modern physics and it all gets much worse for Intelligent Design: with General Relativity random boundary conditions are no longer safely tucked away in the past, a black hole is just as much of a source of randomness as the Big Bang. And Quantum Mechanics is notorious for its perverse probabilistic nature.

Intelligent Design is not a scientific theory or an alternate to Natural Selection. The universe would be the same whether or not it was designed by God or a super intelligent alien. It is an empirical theory. Empirical theories describe how the world appears to us; they have no business telling us why it appears that way, or that it must be designed because it is so improbable. In essence, the Intelligent Designers are saying, "I cannot understand how this complex outcome could have arisen so it must be a miracle." Intelligent Design is a pseudo-science because it claims to be scientific but is metaphysical, based on many confusions. It is important to understand that the empirical is not necessarily scientific. That is false, if you mean that empirical means originating in or based on experience. A scientific theory requires prediction of new phenomena. Freud's Oedipus theory is empirical - but not scientific. Creationism is empirical -- but not scientific. But if, by empirical we mean capable of being verified or disproved by observation or experiment, then Intelligent Design is not empirical. One simply cannot create a set of observations that proves an Intelligent Designer exists. Both a Designer Theory and a Natural Law Theory can account for all of nature.

Science of course has its own metaphysical assumptions, the most prominent of which is that the universe follows laws. But the question as to whether the laws are designed is left open. If I answer an empirical question by saying "God or some supernatural being designed it that way" I have left science and entered metaphysics. I note that many scientists have metaphysical beliefs but those beliefs are irrelevant to scientific explanations - science is open to theists and atheists alike.

Finally, I assert that if human beings are capable of discerning design then they are capable of discerning bad design. The lawyers among us sue companies for this all the time. Intelligent Designers refer to the "purposeful arrangement of parts." What if the arrangement is not purposeful? Instead of an Intelligent Designer what if we really have the "All Thumbs Designer?" When Intelligent Designers are confronted with the spine - or the birth canal - or the back of the throat - they retreat into theology, something along the lines of "God can do whatever He wants," or "We're not competent to judge intelligence by God's standards".

Is our design really intelligent? Perhaps the best answer for the gentlemen present at this meeting is the prostate gland.

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