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## In this month's issue:



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# Behe's black box

**By John Blanton**

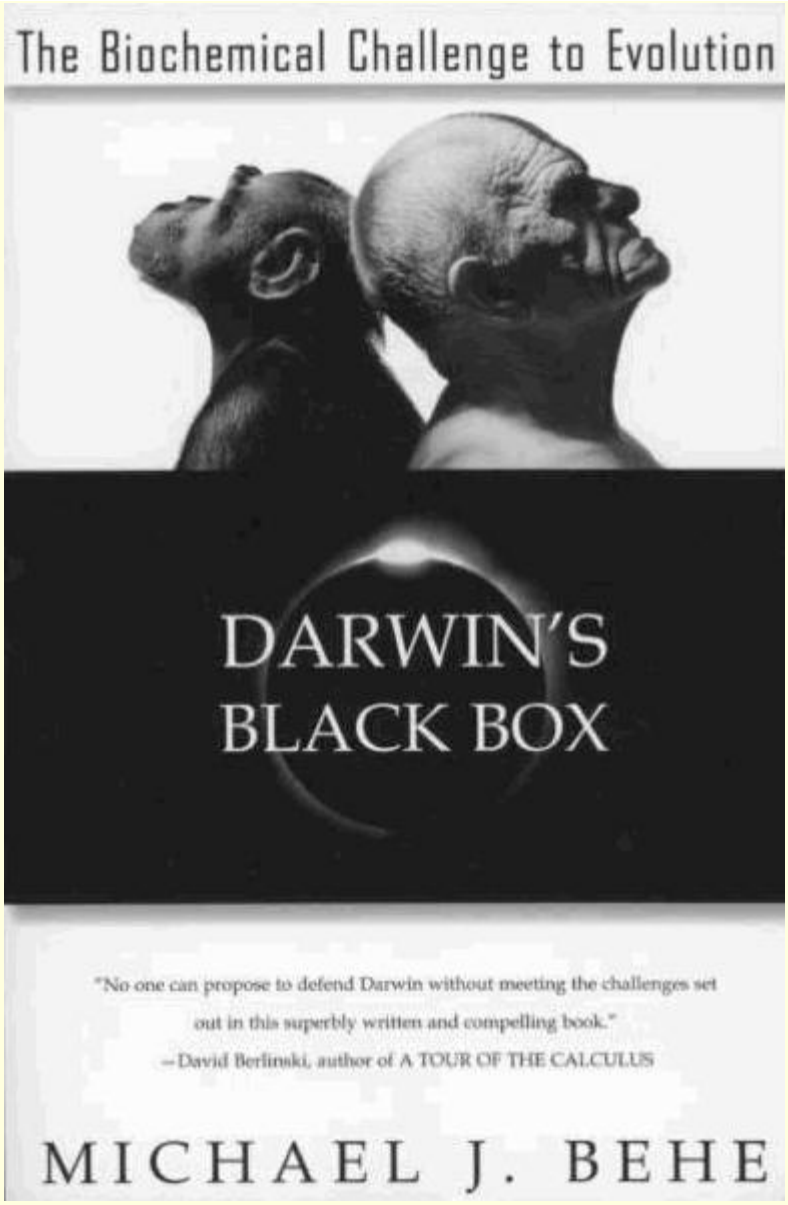
Darwin really got it right according to Michael J. Behe. We and our animal friends and all the plants, too, are descended from a common ancestor. Furthermore, it all happened by strictly natural processes, and Darwin's theory of natural selection is the most reasonable explanation.

Natural selection explains why whales have vestigial leg bones that they don't need but that their hoofed ancestors did. It explains why analyses of protein sequences reveals a molecular family tree that stretches down through the ages and reflects the branching of the family of life.

Deeper down, it explains how the complex molecular chemistry of life came into being.

**Uh, not so fast there, says Dr. Behe.**

Michael Behe is Professor of Biochemistry at Lehigh University, and he feels competent to rule on the feasibility of Darwinism on his home turf. In his book Darwin's Black Box professor Behe argues that the story of natural selection ends here.[1]




**Cover of the recent paperback edition**

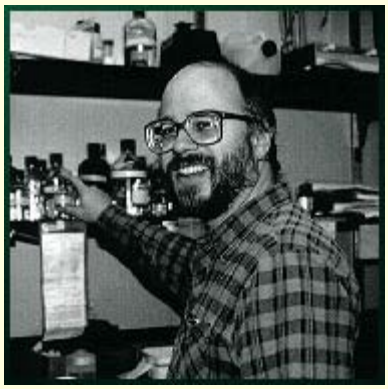
Chemical processes that control such diverse life functions as blood clotting and disease immunity are exceedingly complex. Additionally, such processes are constructed like a house of cards in such a way that one missing card would bring down the whole business. Behe calls such systems "irreducibly complex."

The point is this: Evolution makes new machines (e.g., animals) from existing ones by allowing small genetic changes to creep in due to accidents of nature during reproduction. Natural selection locks these changes into the population by ensuring they tend to predominate in succeeding generations.

For a new feature to develop, it must be based on what was previously a successful form. Not only that, but the prior form must have been competitive in its population or it would not have been there in the first place. This is where irreducible complexity comes in. A multi-story house of cards cannot be built one card at a time.

That's what Behe claims for a number of biochemical processes he cites in his book. A large number of cards had to be added in just the right places and all at the same time. In genetics, this is equivalent to a significant number of fortunate mutations occurring at the same time, something that geneticists generally agree is not likely to happen. Behe says this is what happened. And it was not natural!
Something else is working here besides natural selection he says. Somebody has tweaked the experiment in just the right way to produce the complex chemistry that supports microbes, elephants and marvelous creatures like us. This

something is intelligent design. He leaves it as an exercise for the reader to figure out just who's been doing the designing.



**Michael Behe (photo from Dr. Behe's Web site)**

At this point Behe departs considerably from his scientific colleagues. In response a huge cry has gone up in the scientific community—part of the conspiracy of scientific orthodoxy if you listen to some sources. They take Behe to task on several points. I will cover just two:

**1. The good doctor has given up the search much too soon.**

In his book Behe cites some hard problems in molecular evolution that defy scientific explanation. As evidence, he notes the feeble and unsuccessful attempts to solve them. For example:

> Another paper that gamely tries to account for a piece of the immune system is entitled "Evolution of the Complement System." Like the paper discussed above, it is very short and is a commentary article—in other words, not a research article. The authors make some imaginative guesses about what might come first and second, but inevitably they join Russell Doolittle in proposing unexplained proteins that are "unleashed" and "spring forth"…. No quantitative calculations appear in the paper. Nor does an acknowledgment that gene duplications would not immediately make a new protein. Nor does any worry about a lack of controls to regulate the pathway. But then, it would be hard to fit these concerns in the four paragraphs of the paper that deal with molecular mechanisms.[2]

His book contains a number of similar statements that reinforce his idea that mainstream science cannot (or will not) tackle the problem of irreducible complexity. His many critics are not willing to accommodate him in this matter.

In his Web site on the subject Donald C. Lindsay has posted an extensive rebuttal to Behe. He is among those who seem to believe Behe gave up a few yards short of the goal post. He writes:

> His examples—cilia, clotting, the immune system and the bombardier beetle have failed to impress experts on these specific topics.
>
> Behe doesn't seem to be up to date. Although he implies on page 114 that he is expert at computer searches for scientific articles, he somehow managed to not find pretty well the entire literature on biochemical evolution. I personally own a textbook entitled Molecular Evolution, despite his claim that no such book exists.
>
> Behe also doesn't seem to be aware of the basic way that the history of a molecule can be studied: namely, by examining its variation across a set of living species. If the tree of descent (phylogeny) of the creatures is known from other data, then it is sometimes possible to deduce a great deal. He dismisses this on page 175, apparently in total ignorance of the successes of the method.
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> Behe argues that many biochemical systems would cease to function if various crucial elements were

> missing. However, there are many examples[3] of biochemical systems that continued to function when put to just such a test. As that article says,
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> "It is a hallmark characteristic of evolved biochemical systems that there are typically multiple causal routes to a given functional end, and where one route fails, another can take over."
>
> In particular, Behe spent Chapter 4 saying that the clotting cascade couldn't be reduced. But there are lab mice from which we have removed several parts of the clotting cascade, and they seem quite normal. Behe did not mention any of these experimental results, presumably because he didn't know about them.[4]

In a subsequent e-mail Lindsay has added:

> I currently have plans to upgrade the Behe material modestly. I have Xeroxes I haven't read yet about the evolution of the immune system, and I have supporting material to the point that duplication mutations can cause new genes. (Nature 10 Dec 98 396:522 "A plastic genome").

Others have expressed concern with Behe's lack of diligence. David W. Ussery is Associate Research Professor for the Center for Biological Sequence Analysis, Institute of Biotechnology, The Technical University of Denmark.[5] Discussing Behe's treatment of the biochemistry associated with cilia he remarks:

> This brings me to another simple statement that is easy to check—that "only two articles even attempt to suggest a model for the evolution of the cilium that takes into account real mechanical considerations" (page 68). A quick PubMed search — http://www.ncbi.nlm.nih.gov/PubMed/ — (all the PubMed searches were done in July, 1998—here I just typed in "cilia" and "evolution"), revealed 107 articles, many of which discuss exactly the types of mechanisms Behe claims are missing from the literature. The interested reader with Web access is certainly encouraged to try this little experiment for themselves—how many articles can you find about the evolution of flagella? According to Darwin's Black Box, "Even though we are told that all biology must be seen through the lens of evolution, no scientist has ever published a model to account for the gradual evolution of this extraordinary molecular machine." (page 72, emphasis his) I found 125 articles, several of which DO discuss and give models for gradual evolution of flagella, with titles such as "The flagella apparatus of spermatozoa in fish. Ultrastructure and evolution".
>
> So my point in all of this is that Behe hasn't done his homework. His main points of the chapter are: 1.) the complexity of the flagella, as evidenced by 2.) the large number of proteins involved in the cilia and flagella, (240 of which are required for a functional flagella), and 3.) the absence of scientific literature on the subject. I am certainly willing to concede the first point (that cilia and flagella are complicated), but not the latter two points (e.g., this represents "irreducible complexity"). In particular, in the last point it is in fact more his IMPRESSION of the lack of papers in the scientific literature. It is important to keep this in mind when reading the final section of the book.[6]

**2. Relying on magical tweaks is bad science.**

Robert Pennock has written a comprehensive critique of the new creationists and particularly intelligent design. He is a philosopher of science, and his book Tower of Babel outlines some of the consequences of invoking miracles in science.[7] He reminds the creationists that the supernatural includes more than religious miracles—it includes the occult. Creationists (of the religious variety) might hope for miracles, but they would get witchcraft, as well.

He also points out the problems of trying to drag God into the world of science:

> We need to recognize that the wishful belief in the possibility of human control of divine and occult powers actually contradicts the idea of the supernatural in a profound manner, for by definition the supernatural is beyond the reach of we mere creatures of the natural world. If the supernatural could be controlled by the natural then it would cease to be "super." If we can control the natural world it is only because the world is governed by physical laws that must be "obeyed" even when we are pulling the strings, whereas the very

> idea of the supernatural is that it stands above natural laws and thus outside the possibility of our control. If God were really under our control in any sense then He could certainly not be said to be omnipotent and probably would not be thought very godly.[8]

Given concerns about Behe's lack of scholarship, it does not appear that his book will make much of an impact on the course of science. So, who is his audience? Who does buy into his arguments? Glad you asked.

Following up on the Kansas Board of Education's action on evolution last summer, there was an intense exchange in the newspaper letters columns. Terry Leatherwood of Irving, Texas, took offense at someone's attack on creationists and submitted his thoughts to The Dallas Morning News. After giving high praise to Philip Johnson's books, Darwin on Trial and Reason in the Balance, he went on to say:

> Perhaps a reading of Darwin's Black Box by Michael J. Behe, molecular biologist and not a Christian, would shed some light. Dr. Behe states in his book that what he calls "irreducibly complex systems" (the eye, cilia, bacterial flagellum, bombardier beetles, blood clotting and others) cannot have arisen through Darwinian natural selection, because they cannot function properly without all their component parts intact, and that without all their parts working they don't do anything useful. Dr. Behe concludes that life as we know it must have had some intelligent design behind it.[9]

A little knowledge, it would appear, can be a wonderful thing. I was struck by the remark that Behe is not a Christian, because I had not considered the possibility before. Without any real knowledge of his private life, I had based my presumptions on statements in his book and links in his Web page, which included a Catholic home school and the Eternal Word Television Network Web page.[10]

Professor Behe has staked out a considerable amount of territory in his book. His study, he asserts, has demonstrated that the chemical processes of life are the result of design by a higher intelligence. The appearance of this work in a scientific journal would be a news event of the first class. Professional reputations are built on top of publications. Successfully challenging the evolution of biochemical processes would be worth at least a Nobel Prize. Publishing a hash of half-baked ideas would have the opposite effect. I have not heard whether Dr. Behe has submitted any of this material for publication in scientific journals.

In *DBB* Behe states more than once that science should give up the ghost of Darwinism and accept the obvious fact of design. Apparently this is not about to happen. Scientists on a weekly basis are solving the kinds of problems Behe claims to be intractable. While the creationists appear to want to plant a flag and declare victory, serious researchers are moving the ball.

In the three years since the publication of *DBB* a lot of ink has been spilled, and television and radio operators have sold millions of dollars in air time. Much more material is out there for those interested in following up on the controversy, but there is not room to give it full coverage here. The following URLs provide links to some additional sources:

http://bostonreview.mit.edu/BR22.1/coyne.html
http://biomed.brown.edu/Faculty/M/Miller/Behe.html
http://www.amsci.org/amsci/bookshelf/Leads97/Darwin97-09.html
http://uts.cc.utexas.edu/~pennock/Pennock-SupNatExpl.html
http://uts.cc.utexas.edu/~pennock/
http://pennock.tcnj.edu/

**References**

1. Michael J. Behe, *Darwin's Black Box*, Simon and Schuster. (1996)

2. Ibid. p. 137.

3. Redundant Complexity: A Critical Analysis of Intelligent Design in *Biochemistry*, Niall Shanks, Karl H. Joplin,

*Philosophy of Science*, 66 (June 1999), pp. 268-298 (Reference in the original with the following URL: http://www.etsu.edu/philos/faculty/niall/complexi.htm)

4. Donald C. Lindsay at http://www.best.com/~dlindsay/creation/behe.html.

5. http://www.cbs.dtu.dk/dave/index.html

6. David W. Ussery at http://www.cbs.dtu.dk/dave/Behe.html

7. Robert T. Pennock, *Tower of Babel*, MIT press. (1999, second printing)

8. Ibid. p. 291.

9. *The Dallas Morning News*, August 17, 1999.

10. http://www.setonhome.org/new.htm and http://www.ewtn.com/

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# What's new

*[Robert Park publishes the What's New column at http://www.aps.org/WN/index.html. Following are some clippings of interest.]*

**Polygraph: Senate calls on NIH to examine polygraph validity**. — A Sense of the Senate resolution attached to the Labor, HHS Appropriations Bill calls on NIH to investigate the validity of the polygraph as a screening tool. A 1983 study by the Office of Technology Assessment found little evidence to support such applications. A letter from Senator Jeff Bingaman (D-NM) to NIH Director Harold Varmus notes that polygraphy is based on theories of psychophysiological phenomena that are "within the technical expertise of the NIH." NIH is asked to initiate and support a study by the National Academy of Sciences updating the 1983 OTA study. Meanwhile, DOE Secretary Bill Richardson, feeling the heat from the labs, has scaled back the testing plan from some 5,000 weapons scientists to about 1,000 people in sensitive jobs.

However, if the polygraph doesn't work, no one should be tested.

**Cellular phones: 20/20 revives the brain cancer controversy**. — It began in 1993 when a Florida man brought suit against cellular phone companies after his wife died of brain cancer. "She talked on the thing all the time and held it against her head," he said on Larry King Live (WN 29 Jan 93). That was the extent of the evidence and a federal judge threw out the claim two years later (WN 26 May 95). Wednesday night, ABC News 20/20, in what Diane Sawyer called "the report everyone will be talking about," asked its own experts. They were familiar to anyone who followed the power-line controversy. The editor of Microwave News, Louis Slesin, was repeatedly referred to as "Dr. Slesin." Doctor of what? Reached by phone this morning, he would not say. However, WN has confirmed that Slesin's Ph.D. is in "Urban Studies and Planning." We don't know if "everyone is talking about" the 20/20 report, but Nokia, a major cell phone maker mentioned on the program, went up 8 points on the NY Stock Exchange.

**Free energy: Martin Fleischmann speaks on cold fusion at NRL**. — The term of choice these days is "chemically assisted nuclear reactions," but the co-discoverer of whatever it is was having none of that; his seminar was titled Cold Fusion: Past Present and Future. He acknowledges that after ten years of research the effect is still plagued by irreproducibility, but if he has any doubts about the source of "excess heat," it didn't show. At one point, as if speaking to himself, he reflected that "sometimes I think we've made no advance since 1990. Certainly, not since 1994." Sure we have; for one thing, Steven Jones at Brigham Young, who also claimed back then to see cold fusion, albeit at barely detectable levels, is now working on a simple solar cooker for people in Third World countries to use instead of open fires.

On the minus side, we find that the Entropy Systems, Inc. ad in Physics Today, for a machine that runs off ambient heat (WN 24 Sep 99), was also carried by Applied Physics Letters.

**Creationism: teaching standards in New Mexico are evolving**. — In 1996, the New Mexico State School Board was taken over by religious fundamentalists, who voted to remove "evolution" from the state's teaching standards. The legislature later voted to put evolution back in after a debate in which a creationist senator brought a stuffed ape to the floor. As has happened in other states, people began paying attention to school board elections. The result was that last week, alarmed by events in Kansas (WN 17 Sep 99), the new school board amended the standards to prevent religious alternatives from creeping in. For example, "Discuss evidence for and against evolution," was replaced with "Discuss the various mechanisms proposed to interpret evolution."

Meanwhile, Kentucky replaced the emotionally loaded "evolution" with "change over time." Hmmm. It's sort of like replacing "cold fusion" with "chemically assisted nuclear reactions" isn't it?

*Helene Grossman contributes to WHAT'S NEW.*

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