

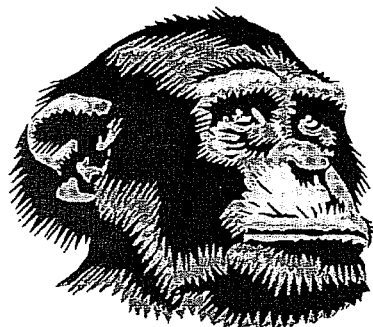
# BASIS

## BAY AREA SKEPTICS INFORMATION SHEET

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### The Publication of the Bay Area Skeptics

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#### Meetings

All meetings, unless otherwise noted, will be held at the Claremont Branch of the Berkeley Public Library at 7:15 PM on the date indicated. As always, admission is free. Students are especially welcome, and we encourage teachers to bring their classes to BAS events to encourage critical thinking. The Claremont Branch of the Berkeley Public Library is located at the corner of Ashby and Benvenue in south Berkeley.

Opinions expressed by members or guests of Bay Area Skeptics are those of the individual authors or speakers and do not necessarily represent those of the organization.

For the latest information on upcoming events and meetings, please check our web site at:

**[www.BASkeptics.org](http://www.BASkeptics.org)**

All current information as well as information about past events is located there.

#### Advisers

- Yves Barbero  
*Computer Consultant*
- William J. Bennetta  
*Scientific Consultant*
- Dean Edell, M.D.  
*ABC Medical Reporter*
- Andrew Fraknoi, Ph.D.  
*Astronomical Society of the Pacific*
- Donald Goldsmith  
*Astronomer and Attorney*
- Earl Hautala  
*Research Chemist*
- Mark Hodes  
*Educational Consultant*
- Alexander Jason  
*Investigative Consultant*
- Lawrence S. Lerner, Ph.D.  
*CalState University, Long Beach*
- John E. McCosker, Ph.D.  
*Director, Steinhart Aquarium*
- Kit Moser  
*Science Writer*
- Richard J. Ofshe, Ph.D.  
*University of California, Berkeley*
- Kevin Padian, Ph.D.  
*University of California, Berkeley*
- James Randi  
*Magician, Author, Lecturer*
- Francis Rigney, M.D.  
*Pacific Presbyterian Medical Center*
- Wallace I. Sampson, M.D.  
*Stanford University*
- Terry Sandbek, Ph.D.  
*Clinical Psychologist*
- Eugenie C. Scott, Ph.D.  
*Anthropologist*
- Robert Sheaffer  
*Author, UFO Expert*

Wells also contends that changes in frequency of dark and light ladybugs - unpalatable to birds - invalidates the bird predation hypothesis for peppered moths. Yet it is known that different selective pressures exist for ladybugs and peppered moths; lepidopterists do not claim that one selective argument has to fit all examples of color change in insects. And in fact, researchers have documented pollution associated color changes such as that shown for *B. betularia* in England in other moth species in North America, and on the continent of Europe. What is called "industrial melanism" is well documented among insects, and researchers are in agreement that natural selection is the only biological mechanism strong enough to produce it. Bird predation is thought to be an important selective agent, though it may not be the only component. Wells attacks the peppered moth example in textbooks because he wants to reduce student confidence in natural selection, and thereby reduce confidence in evolution. When the actual facts are known, it is clear that he is making a weak argument based on selective citation of literature.

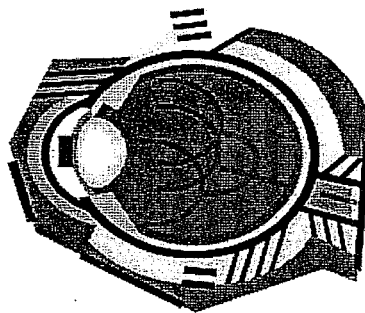
It is clear from Wells' treatment of the "icons" that his interest is not to improve textbooks, but rather to get teachers to undermine evolution. Rewriting textbooks to criticize evolution lacks pedagogical purpose: evolution is not considered a weak theory by scientists, and students are miseducated if they are taught that it is. At NCSE (The National Center for Science Education) we have heard from teachers who have

dropped the peppered moth example from their curriculum because they have heard that it was no longer good science - based on Jonathan Wells' *Icons of Evolution!* Nothing could be farther from the truth: the peppered moth case is a clear and understandable example of natural selection, and has a place in the biology curriculum. And teachers would be well-advised to view Jonathan Wells' scholarship with great caution. Wells' discussions are rife with inaccuracies and out-of-date information. This makes Icons of Evolution of little value to educators, but certainly useful for those with a certain political and religious agenda.

#### References cited:

Wells, Jonathan. 2000. *Icons of Evolution: Science or Myth?* Washington, DC: Regnery.

*Alan Gishlick is a Postdoctoral Scholar at the National Center for Science Education.*



#### Behe's Blunder: Irreducible Complexity and Change of Function

By Nicholas J. Matzke

Intelligent Design Creationists (IDCs) place great importance on Michael Behe's concept of "irreducible complexity" (see Scott, this issue). Creationists widely claim that irreducible

complexity is "proof" that Darwinian evolution is inadequate to explain complex biological systems, and therefore they must have been specially created by an "intelligence" - God, to every major IDC. Yet Darwin himself provided a strong counter to the argument that irreducible complexity implies intelligent design. Behe, and IDCs in general, have committed a huge blunder by failing to come to grips with Darwin's principle of "change of function."

In his 1996 book *Darwin's Black Box*, Behe begins by recounting the debate over the origin of the complex vertebrate eye. In 1802, clergyman William Paley compared the eye (with its lens and numerous other useful features) to the telescope, and argued that such structural complexity could not form "by chance" (natural causes), but required a Creator. Darwin famously addressed this example in his *Origin of Species*, contending instead that his mechanism of natural selection could in fact explain a complex structure like the eye through massive, but gradual, improvement of function, starting with a simple ancestral patch of light-sensitive cells. Behe more-or-less concedes that the vertebrate camera eye could evolve in this fashion. At this point, most people would give up and conclude that if Darwin was right about something as amazing as the eye then probably no biological system would present a barrier to evolution. Behe perseveres, however. He notes that in the sub-microscopic world of biochemistry, which Darwin knew nothing about, we find numerous examples of systems

that require multiple parts in order to function. He calls these systems "irreducibly complex." Behe points to various "molecular machines," biochemical systems such as the vision cascade, blood-clotting, the immune system, the eukaryotic cilium, and the bacterial flagellum. Each of these systems is made up of combinations of specific proteins that cooperate to perform a function: for example, the flagellum is used by bacteria to swim. In each case, it can be experimentally shown that most (usually not all) of the proteins that make up these systems are required for successful function, and the loss of one of these required parts results in loss of function. Unlike the eye, Behe concludes, for these systems, intermediate systems would be non-functional, and therefore Darwin's theory breaks down. Functional systems would only be accessible if created all at once, via Intelligent Design.

Unfortunately, Behe's entire line of argument is undercut by a factor that Darwin emphasized in the very section, "Organs of extreme perfection and complication," that contains Darwin's discussion of the eye. Right after the eye discussion, Darwin makes his second major point: *change of function* is of equal importance to improvement of function in understanding the evolution of complex systems. He spends five pages discussing change of function (Darwin's discussion of the eye and improvement of function takes only four), writing, "In considering transitions of organs, it is so important to bear in mind the probability of conversion from

one function to another.." and discusses several examples. Furthermore, after the *Origin* was written, Darwin further emphasized change of function in his next book on the complex, trap-like adaptations of orchid flowers.

There are many examples of change of function in evolution, the vertebrate forelimb being a familiar example. The same basic structure found in your hand has evolved into specialized structures – several independent times in each case—for walking (horse and cow hooves), flying (pterodactyl, bird, and bat wings), and swimming (plesiosaur, whale, and seal flippers). In one particularly remarkable series, the forelimb has been converted from a fish fin, to a reptile foot, to the grasping claw of a predatory dinosaur, to a flying bird wing, and back to a swimming flipper – I speak, of course, of your well-dressed relative, the penguin. Such examples are found essentially wherever one looks in biology. Ernst Mayr once wrote that cataloguing these examples "would mean listing a good portion of all animal structures." Sadly, Behe and his fans ignored all of this, even though the importance of change of function has been repeatedly emphasized by major evolutionary biologists, including Mayr, Maynard Smith, Futuyma, and Gould – all in prominent sources published before Behe wrote his book.

Although there are numerous other cracks in the irreducible complexity argument, functional change is the gaping hole. If systems can change function, then a system "missing" some of the parts "required" for function

A can instead start out performing function B, gradually increasing in complexity while improving function B. Then, a relatively small change to the complex system can add function A, and an "irreducibly complex" system results. Once the new function is established, further improvements to the new function will add even more complexity.

How can we test the Darwinian model? The change-of-function model predicts that complex systems will be patched together from simpler systems with alternative functions that are useful in themselves. For a test case, consider the mascot of the IDC movement: the bacterial flagellum. The flagellum is a long filament that sticks out of a bacterium and is rotated by a motor at the base, producing movement. The whole system uses about 50 kinds of proteins. The IDCs trumpet the flagellum wherever they go: surely, they say, it is wildly improbable that such a structure could form all at once. Since they failed to appreciate Darwin's point about change of function, they never bothered to look for homologous systems with functions different from those of the flagellum. ("Homologous" proteins descended from the same ancestral protein. Proteins are made up of a sequence of amino acids that fold up into a specific, complicated three-dimensional structure, and detailed similarities in sequence and structure indicate that two proteins are homologous).

I recently did a search through the scientific literature to see what homologies scientists had discovered for the bacterial

flagellum. Briefly, it turns out that the 51 flagellar proteins can be assigned to nonessential signaling systems (11), duplications of other flagellar proteins (12), secretion systems (10 definite, 8 probable), ion channel (2), and regulation (2), leaving only a few proteins with currently unknown homologies (and some of these are not strictly required components). This leads to a rather simple hypothesis for the evolutionary origin of the flagellum: The flagellum began as a secretion system with a filament attached (bacteria have many such systems). The key change of function was the accidental binding of an ion channel that caused the filament to rotate. Then a long series of improvements increased rotation, specialized the filament, and attached a sensory system. There are of course many details that I have more thoroughly considered elsewhere (see references); but the basic scheme seems obvious.

Remember that the bacterial flagellum is the IDCs' absolutely favorite example of an irreducibly complex molecular machine. They put it on the cover of their books and videos. But it fell rather quickly once someone took a serious look at the evidence. It's true that machine-like systems with multiple required parts exist, but this fact is just not the evolution-killer that the IDCs think it is. Once again, special creation has failed, because the alleged gaps collapsed when the evidence came in. None of this would have surprised Darwin, who wrote in his 1862 book about the machine-like contraptions of orchid flowers,

"[T]hroughout nature almost every part of each living being has probably served, in a slightly modified condition, for diverse purposes, and has acted in the living machinery of many ancient and distinct specific forms."

#### References:

*Note:* For examples of evolutionary biologists emphasizing functional change, see: [http://www.evowiki.org/wiki.phtml?title=Citations of cooption](http://www.evowiki.org/wiki.phtml?title=Citations%20of%20cooption)

Darwin, Charles (1859). *On the Origin of Species*. London, John Murray, 1859.

Darwin, Charles (1862). *On the various contrivances by which British and foreign orchids are fertilized by insects*. London, John Murray.

Behe, Michael (1996). *Darwin's Black Box*. Simon & Schuster, New York.

Mayr, Ernst (1976). "The Emergence of Evolutionary Novelties." *Evolution and the Diversity of Life: Selected Essays*. Harvard University Press, Cambridge, Mass., pp. 88-113.

Matzke, Nicholas (2003). "Evolution in (Brownian) space: a model for the origin of the bacterial flagellum." Online at: [http://www.talkdesign.org/faqs/flagellum\\_background.html](http://www.talkdesign.org/faqs/flagellum_background.html)

Paley, William (1802). *Natural Theology; or, Evidences of the Existence and Attributes of the Deity*. J. Faulder, London.

#### Additional Information On Intelligent Design

Three other websites are recommended for additional information on intelligent design. The *Skeptical Creationism* website has information, essays, rebuttals, links and book reviews on the topic of evolution versus creationism. It can be found at:

[www.freeinquiry.com/skeptic/creationism](http://www.freeinquiry.com/skeptic/creationism).

The *Talk Origins Archive* is also a good source of information. It includes journal articles, book reviews and essays. It is located at: [www.talkorigins.org](http://www.talkorigins.org).

A large amount of additional information can be found at the web site of the *National Center for Science Education* at [www.ncseweb.org](http://www.ncseweb.org)



#### Intelligent Design Creationism

Excerpted and modified from chapter 6 of *Evolution and Creationism: An Introduction*, Greenwood Press; June, 2004. (This book is available at <http://tinyurl.com/25tcf>.)  
by Eugenie C. Scott  
Executive Director, The National Center for Science Education

In 1987, the Supreme Court decision *Edwards v. Aguillard* struck down a Louisiana law requiring "equal time" for creationism and evolution. Creationism is a religious idea, said the Court, and the First Amendment prohibits government from promoting religion. Antievolution strategies subsequently were developed that avoided the use of any form of the words "creation," "creator," or "creationism." In effect, proponents shifted their strategy from proposing to balance evolution with creation science to proposing to balance evolution with the teaching of