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The Scopes Trial: William J. Bryan's Fight against Eugenics and Racism

by Jerry Bergman, Ph.D.

Eighty-three years ago “the trial of the century,” the now-infamous Scopes evolution trial, occurred in Dayton, Tennessee (Lienesch, 2007). The law was supported by famous Christian attorney William J. Bryan and opposed by famous agnostic attorney Clarence Darrow. At issue in the 1925 trial were certain chapters on evolution and eugenics in a biology text by George W. Hunter, titled *A Civic Biology* (1914), that was mandated by the state of Tennessee and many other states.

For nearly a decade Hunter's book was the most widely-used high school science textbook in the nation. The text was endorsed by many distinguished professors, including those at both Brown and Columbia Universities (Larson, 1997). Tennessee had no problem with the bulk of the text, which covered earth's plants and animals. Then, in March of 1925, the Tennessee legislature passed a law that made it illegal in public schools “to teach any theory that denies the story of the Divine Creation of man as taught in the Bible, and to teach instead that man has descended from a lower order of animals” (Ginger, 1958, p. 3).

The statute was aimed at teaching the evolutionary origins of *human beings* (“the Divine Creation of man”), not the origin of the rest of life. The law was intended to allow parents the right to instruct their children in matters of origins, human nature, and destiny. Because the law did not openly conflict with any section in *A Civic Biology*, which never directly taught human evolu-



tion, the text remained in use throughout the state.

Harvard law professor Alan Dershowitz (1990, p. 2) correctly noted that those actively advocating evolution in 1925 included “racists, militarists, and nationalists,” who used evolution “to push some pretty horrible programs,” including forced sterilization. Those who wanted to prevent the immigration of people judged “unfit” and “inferior,” and of “inferior racial stock” pushed “Jim Crow” laws, rationalizing their agenda on the grounds that blacks were racially inferior (Dershowitz, 1990, p. 2). Dershowitz added that the eugenics movement “took its impetus from Darwin's theory of natural selection,” explaining that German militarism

...drew inspiration from Darwin's survival of the fittest. The anti-immigration movement, which had succeeded in closing American ports of entry to “inferior racial stock,” was grounded in a mistaken belief that certain ethnic groups had evolved more fully than others. The very book — *Hunter's Civic Biology* — from which John T. Scopes taught Darwin's theory of evolution to high school students in Dayton, Tennessee, contained dangerous misapplications of that theory. It explicitly accepted the naturalistic fallacy and repeatedly drew moral instruction from nature. Indeed, its very title, *Civic Biology*, made it clear that biology had direct political implications for civic society.

... continued on p. 2

News release

Controversial Discoveries Being Made by Cedarville Geologist

Cedarville, Ohio — Dr. John Whitmore, associate professor of geology at Cedarville University, recently presented a paper on his Grand Canyon research during the annual meeting of the Geological Society of America (GSA) in Portland, Oregon, October 18-21.

This annual meeting attracts thousands of geologists who converge to share their scientific work with one another. Whitmore has been studying the Coconino Sandstone for about 10 years and is making some controversial discoveries.

The Coconino Sandstone is a rock layer near the top of the Grand Canyon.

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Dr. John Whitmore collects a sample of Coconino Sandstone.

Photo credit:

Scott L. Huck/Cedarville University

Bryan's Fight

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Darwin explained in detail how selection functioned and the importance of war in evolution. He stressed "how all-important, in the never-ceasing wars of savages, fidelity and courage" were to evolution, adding that a nation with superior qualities, those selected by natural selection, would have an evolutionary advantage destroying the weaker races (Darwin, 1871, p. 162). This process of conflict was critical for evolution, and when natural selection that resulted from conflict — such as from war — ceases, evolution also ceases. Hitler and other dictators stressed this point repeatedly in his bible, *Mein Kampf*.

Bryan's concern

A major concern of attorney William J. Bryan was the degradation of humans by evolution and the influence of evolution on war and national conflicts. The Hunter text illustrated Bryan's concern because it was "laced with the racism of the day" (Larson, 1997, p. 23). Its discussion of eugenics included such scarlet passages as the following openly racist claim (Hunter, 1914, p. 196):

At the present time there exist upon the earth five races or varieties of man, each very different from the other ... the highest type of all, the Caucasians, [is] represented by the civilized white inhabitants of Europe and America.

Hunter also wrote that if we can im-

prove domesticated animals by breeding, then "future generations of men and women on the earth" can also "be improved by applying to them the laws of selection." Hunter (1914, p. 261) stressed that this is no small concern because nothing less than the "improvement of the future race" is at stake. Hunter then, under the subheading "Eugenics," which made it clear what type of "improvement" programs he was referring to, applied this idea to humans (1914, p. 261):

When people marry there are certain things that the individual as well as the race should demand. The most important of these is freedom from germ diseases which might be handed down to the offspring. Tuberculosis, that dreaded white plague which is still responsible for almost one seventh of all deaths, epilepsy, and feeble-mindedness are handicaps which it is not only unfair but criminal to hand down to posterity. The science of being well born is called *eugenics*.

When defending his eugenics program, Hunter incorrectly concluded that tuberculosis (TB) is a genetic disease (TB is caused by bacteria pathogens). Furthermore, the main cause of epilepsy and feeble-mindedness is pathogens, trauma, and genetic damage occurring in the womb due to such conditions as genetic non-disjunction, not heredity as Hunter claimed. Hunter (1914, pp. 261-263, emphasis in original) then wrote that research had been completed on many different families in America,

...in which mental and moral defects were present in one or both of the original parents. The "Jukes" family is a notorious example.... In seventy-five years the progeny of the original generation has cost the state of New York over a million and a quarter dollars, besides giving over to the care of prisons and asylums considerably over a hundred feeble-minded, alcoholic, immoral or criminal persons. Another case ... is the "Kallikak" family. This family has been traced to the union of Martin Kallikak, a young soldier of the War of the Revolution, with a feeble-minded girl. She had a feeble-minded son from whom there have been to the present time 480 descendants. Of these 33 were sexually immoral, 24 confirmed drunkards, 3 epileptics, and 143 *feeble-minded*.

Both of the Jukes and Kallikak family studies have now been thoroughly debunked by a reevaluation of the data and cases used to support the studies' original conclusions (Smith, 1985). These studies were the "product of a powerful idea"—Darwinism—and they created "a social myth" that Hunter did much to spread (Smith, 1985, p. 193). The Kallikak family study was translated into German in 1914, and the full text appeared in the German academic journal *Friedrich Mann's Pädagogisches Magazin*. As a result, the Kallikak study had a significant impact in Nazi Germany. One example was the infamous July 14, 1933, sterilization law that began the murder of millions of "inferior" persons

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(Smith, 1985, pp. 161-162). Hunter used the same reasoning that Hitler used to justify his eugenic programs. For example under the subheading “Parasitism and its Cost to Society” Hunter (1914, p. 263) wrote that hundreds of

...families such as those described above exist today, spreading disease, immorality, and crime to all parts of this country. The cost to society of such families is very severe. Just as certain animals or plants become parasitic on other plants or animals, these families have become parasitic on society. They not only do harm to others by corrupting, stealing, or spreading disease, but they are actually protected and cared for by the state out of public money. Largely for them the poorhouse and the asylum exist. They take from society, but they give nothing in return. They are true parasites.

Hunter then quotes the now-notorious American eugenicist Charles Davenport (and the expression that Hitler later made famous: “blood tells”), writing that families which produce brilliant men and women did so because they received *good* inheritance from their ancestors. The text then used an example from Davenport’s *Heredity in Relation to Eugenics*, to illustrate the claim that greatness is due to genes (Hunter, 1914, p. 263). The story is about Elizabeth Tuttle, a woman “of strong will, and of extreme intellectual vigor” who married Richard Edwards, a man “of high repute and great erudition.” This union produced Jonathan Edwards and many influential educators, judges, college presidents, and physicians. (Hunter, 1914, pp. 263-264).

No mention was made of the role social influence and privilege had in the success of this family. Genetics was the only factor given (Smith, 1985). Olasky and Perry (2005, p. 70) wrote that “Hunter’s view of eugenics, widely accepted early in the twentieth century, was a common deduction drawn from and associated with Darwinian theory.” They added (2005, p. 70) that Hunter had first explained Darwinian evolution in five pages, then moved on to the meat of the book, the section on

...“heredity and variation” that included eugenics. This popular connection between natural selection and social engineering would soon fan the flames of opposition to teaching Darwinism, particularly in light of the “remedies” that had “been tried successfully in Europe” on the

eve of World War I, including sterilizing mental patients, criminals, and other genetic “contaminants.”

Hunter openly advocated the infamous solution, negative genetics, to what he was alleging to be the problem, genetically inferior persons. The solution was (Hunter, 1914, pp. 261-263):

If such people were lower animals; we would probably kill them off to prevent them from spreading. Humanity will not allow this, but we do have the remedy of separating the sexes in asylums or other places and in various ways preventing intermarriage and the possibilities of perpetuating such a low and degenerate race.

Many Tennesseans, especially African Americans, objected to the *implications* of the whole evolution doctrine that were made explicit in the very science text required by their state. Even prior to the 1925 Tennessee law, so great was the outcry against these passages in many other states that the publisher, American Book Company, rewrote them (Tennessee used the original 1914 edition until 1926). Even the book, *Civic Biology*, whose title implied eugenics, taught that it was our civic duty to apply eugenics to achieve racial improvement.

The ACLU becomes involved

Soon after the Tennessee “anti-evolution law” was passed, the American Civil Liberties Union (ACLU) began advertising for volunteers to challenge the law in court. The city of Dayton saw this as an opportunity to attract both attention and tourism. The politicians then urged the new young football coach and math teacher, who once substituted for a biology teacher, to claim that he had violated the law during his substitute teaching stint.

Prominent scientists from major universities soon flocked to Dayton to challenge the right of the state to regulate the teaching of human evolution in public schools. A critical point is that these expert witnesses *never once* distanced themselves from the many inflammatory racist passages in *A Civic Biology*. Indeed, some of them were active supporters of the eugenics movement, as was Hunter’s text. Even after the abuses of Darwinian eugenics by the Nazis in the 1930s became common knowledge, some academics approved the eugenic passages in this once-required public high school book.

Among the first persons to awaken to

the racism lurking quite undisguised in these passages had been the most left-leaning Democratic presidential candidate, William Jennings Bryan. Mr. Bryan “stood at the forefront of the most progressive victories in his time: women’s suffrage, the direct election of senators, the graduated income tax,” among others (Gould, 1991, p. 417). His nickname since his first presidential candidacy (1896) was “The Great Commoner,” and Bryan believed his battle against evolution was an extension of both his populist support and his life work (Gould, 1991, p. 419).

A major concern of Bryan was that Darwinism had been used to justify the German war machine and that the survival-of-the-fittest philosophy had been translated into the might-makes-right ethos that had engulfed Germany and threatened to spread to other countries (Gilbert, 1997 p. 31). Bryan, a life-long opponent of solving national problems by war, was fearful that other nations would soon emulate Germany in using “the martial view of Darwinism [that] had been invoked by most German intellectuals and military leaders as a justification for war and future domination” (Gould, 1991, pp. 421-422). Bryan even resigned as Secretary of State in President Wilson’s cabinet in protest of America’s entry into World War I.

Bryan takes on the Scopes case

Even though his health was failing, Bryan took on the arduous Scopes case as an attorney on the basis of several issues, including his opposition to the Darwinian philosophy of survival of the fit, might makes right, and his support of the solid Jeffersonian principle: “To compel a man to furnish contributions of money for the propagation of opinions which he disbelieves, is sinful and tyrannical” (Virginia Act for Establishing Religious Freedom, 1786). In other words, Bryan believed that in a democracy the people had the “right to determine what was taught in their schools” (Gilbert, 1997, p. 31). Bryan pointed out several implications that many professors at that time were drawing from Darwin’s theory.

Among the implications that Bryan opposed was not only eugenics, but also the nihilistic morals of Nietzsche (as elucidated in Darrow’s brief about the University of Chicago in the Leopold-Loeb murder case) and the “moral obligation” of “superior” races, such as the Germans in World War I, to overpower the weak races (e.g., the

Belgians) for the advantage of their future welfare. Bryan had been awakened to this last concern by reading a book by Stanford University biologist Vernon L. Kellogg (1917) that related his conversations with the German General Staff in Belgium in 1914.

The use of Darwinism to defend coercive eugenics that was then being taught in American schools from Hunter's book — and promoted by academia — now seemed repulsive both to most scholars and most Americans. Bryan turned out to be right on this point, while the promoters of eugenics as a corollary of human evolution were embarrassingly wrong. He was right to object to Hunter's text because its interpretation of science was wrong, and evolutionists were wrong to coercively impose their Darwinian eugenics philosophy on public school students. The fact is, Bryan had identified "something deeply troubling" in the Scopes case — and that the "fault does lie partly with scientists and their acolytes" (Gould, 1991, p. 423).

Bryan was also very concerned about the effects of Darwin's racism teachings, such as the following passage from *The Descent of Man*: "With savages, the weak in body or mind are soon eliminated" (Darwin, 1871, p. 168). Bryan (1980, pp. 24-25) made his concerns about the dignity of humankind very clear in the presentation he gave to the court:

Darwin reveals the barbarous sentiment that runs through evolution and dwarfs the moral nature of those who become obsessed with it. ...Darwin speaks with approval of the savage custom of eliminating the weak so that only the strong will survive, and complains that "we civilized men do our utmost to check the process of elimination." How inhuman such a doctrine as this! He [Darwin] thinks it injurious to "build asylums for the imbecile, the maimed and the sick" or to care for the poor. Even the medical men come in for criticism because they "exert their utmost skill to save the life of everyone to the last moment."

Bryan then quoted Wiggam, a best-selling author in 1925, who wrote (quoted in Bryan, 1980, p. 25):

Evolution is a bloody business, but civilization tries to make it a pink tea. Barbarism is the only process by which man has ever organically progressed, and civilization is the only process by which he has ever organ-

ically declined. Civilization is the most dangerous enterprise upon which man ever set out. For when you take man out of the bloody brutal but beneficent hand of natural selection you place him at once in the soft, perfumed, daintily gloved but far more dangerous hand of artificial selection.

These were exactly Bryan's concerns as he documented in his booklet titled the *Last Message* (1980). In short, Bryan was concerned that an increasing number of students were attending high school and, Bryan believed, that "Darwinism made man too much the product of essentially a material Godless process that invited his degradation through eugenics, too much a competitor in a struggle for survival that justified rapacious business relations and war between nations" (Kevles, 2007, p. x).

Conclusions

Bryan's objections to evolution were openly related to Darwin's writings about human rights, dignity, and humanity. Bryan was especially concerned about defending the weak against the assaults of the strong and powerful, a fact that resulted in his being labeled "The Great Commoner." Bryan, as a "political progressive," was very concerned (Larson, 2007, p. 68) about the

...Darwinism survival-of-the-fittest thinking (known as social Darwinism when applied to human society) behind World War 1 militarism and postwar materialism. Of course Bryan also held religious objections to Darwinism and he invoked [Harvard Biology Professor Louis] Agassiz's scientific arguments against it as well—but his fervor on this issue arose from his social concerns. ... With his progressive political instinct of seeking legislative solutions to social problems, Bryan campaigned for restrictions against teaching the Darwinian theory of human evolution in public schools.

When Bryan's role in the Scopes trial is reviewed these many well-documented facts of history are often forgotten or ignored (Gould, 1981; 1987).

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Cedarville Geologist ...continued from page 1

Most geologists believe that it was formed in a wind-blown desert environment. They believe that the formation's large sloping cross beds are the remains of ancient desert sand dunes.

For his research, Whitmore collected samples of this sandstone for microscopic examination of the sand grains. His findings show that the sandstone contains dolomite oolites, small ball-like structures that are only formed in marine settings. Other fea-

tures such as grains of very soft mica are also evident under the microscope.

"We would not expect to see these minerals if this sandstone was formed in a desert," shares Whitmore. "The blowing action of sand would quickly destroy these minerals; however they might survive if carried and deposited by water."

His findings are controversial because the Coconino Sandstone has been interpreted as being formed in a desert, since the first major publications on this sandstone 75 years ago.

Whitmore has been at Cedarville since 1991, and in 2009 began the University's first major in geology. Six of Whitmore's geology students, some of whom are involved with his research, participated in the 2009 GSA annual conference.

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Speaking of Science

Editor's note: Unless otherwise noted, S.O.S. (Speaking of Science) items in this issue are kindly provided by David Coppedge. Opinions expressed herein are his own. Additional commentaries and reviews of news items by David, complete with hyperlinks to cited references, can be seen at: www.creationsafaris.com/crevnews.htm. Unless otherwise noted, emphasis is added in all quotes.

Flying Fossils Found

A population of insects called "living fossils" has been located in Australia. These tiny insects, called ancient greenling damselflies, have no living relatives. Their closest relatives disappeared from the fossil record 250 to 300 million years ago in the geological column, according to *The Age*¹ and *Heidelberg Leader*.² The wingspan of the insects is only 22mm and they are camouflaged, so it was difficult to detect them. A scientist involved in the discovery said, "There are a lot of unanswered questions."

A big entry in the class of impossible-to-believe claims of evolution is the notion that an animal went extinct in the age of dinosaurs but still is found alive today, hundreds of millions of years later. If this were the only case it would be enough to cause serious doubts about the consensus age of the earth and Darwinian evolution, but there are many living fossils [see *Creation Matters* 3(2):1-3, 1998 and 12(6):10, 2007].

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Rockefeller University and Harvard Medical School that found two essential proteins that act like "molecular tailors" that can snip out an error and sew it back up with the correct molecules. These proteins, FANCD1 and FANCD2, repair inter-strand crosslinks, "one of the most lethal types of DNA damage." This problem "occurs when the two strands of the double helix are linked together, blocking replication and transcription." Each of your cells is likely to get 10 alarm calls a day for inter-strand crosslinks.

What do the proteins do to fix it? They link together and join other members of the repair pathway. The scientists found that FANCD1 and FANCD2 are intimately involved in the excision and insertion steps.

This one repair operation requires 13 protein parts. "If any one of the 13 proteins in this pathway is damaged, the result is Fanconi anemia, a blood disorder that leads to bone marrow failure and leukemia, among other cancers, as well as many physiological defects," the article said. The original paper put it, "Our results show that multiple steps of the essential S-phase ICL repair mechanism fail when the Fanconi anemia pathway is compromised." Neither the paper nor the press release said anything about how this tightly-integrated system might have evolved.

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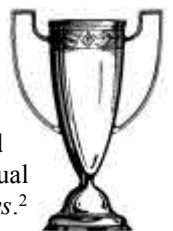
DNA Repair Requires Teamwork

As if the genetic code itself were not incredible enough, researchers have been finding systems that repair it. There are numerous pathways the cell can embark on to fix DNA errors. Two key players were recently described in more detail in the journal *Science*.¹

A damaged genetic code is worse than a book with typos. Broken or mismatched DNA strands can lead to serious diseases and even death. It is essential that DNA damage be recognized and repaired quickly. *ScienceDaily*² reported results by a team at

Arctic Tern Maintains World Record Title

The arctic tern makes a marathoner look like a wimp. This little bird has been confirmed as the migratory bird with the longest route, flying annually from pole to pole. A team of international scientists obtained the results by using an implanted geolocator on several birds, and tracking their actual path. The story is told by *PhysOrg*¹ and the *BBC News*.²



... continued on p. 7

...without excuse!

by Timothy R. Stout

THE TESTIMONY OF SUCCINATE DEHYDROGENASE

like *succinate dehydrogenase* (pronounced suck SIN ate dee hi DROJ in aze). Despite its intimidating name to a non-biochemist, it has a wonderful message. If you are a creationist, you should like it, too. You see, there is no rational explanation for its existence apart from God's decision to design it and use it.

Succinate dehydrogenase (SD) is an enzyme. It is extremely ubiquitous. Almost all living organisms use it, including all of the various kinds of plants, animals, fungi, and aerobic bacteria. Beyond this, many anaerobic bacteria also use it. Yet, it is one of the most complex enzymes in existence. It is comprised of over 1,100 amino acids. Whether it is being used by a bacterium, an apricot tree, or a man makes no difference. In every place that it appears, over 1,100 amino acids are used to make it.

There are 20 amino acid possibilities for each of these 1,100-plus amino acids. In an enzyme, the choice of amino acids at some locations is not very critical, while at others there is no freedom of choice possible—changing only one amino acid at a critical location can render an enzyme completely ineffective. Suppose one allows 2 possible choices at each of the amino acid locations of SD, a reasonable generalized approximation. If one then goes through the calculations, the odds against getting succinate dehydrogenase in a single step are approximately 10^{1100} (see endnote). Considering that there are only an estimated 10^{80} atoms in the known, observable universe,¹ even evolutionists will acknowledge that these odds are much, much too large for SD to have appeared in a single step.

However, evolutionists typically claim that single-step selection is not necessary. Forming a new enzyme only necessitates “small genetic changes”² from an existing enzyme already in use, provided that that change has a selection advantage over its predecessor. Thus, an enzyme series could start with a sequence totally unrelated to that of SD, have a much smaller size than SD, and gradually be transformed into SD. All that is necessary is for each step in the path to have a selection advantage over its predecessor. The accumulated effect of these small steps will be adequate to produce a functional enzyme.

The obvious question to ask regarding



Succinate Dehydrogenase.

Image from

http://en.wikipedia.org/wiki/File:Succinate_Dehydrogenase.jpg

their proposed step-by-step process is, “What is required to provide such a selection advantage for the hundreds upon hundreds of steps required?” Remember, in an evolutionary process, if any step in the sequence does not have a selection advantage over the preceding step, then natural selection will select away from the step, not towards it. Only one disadvantageous step would be adequate to destroy an entire sequence.

The challenge, then, is to realize a selective advantage for each of the intermediate steps. These intermediate steps are for enzymes that function neither as the original enzyme nor as SD.

However, enzymes typically do not have “stand-alone” functions. They work as members of a team of enzymes, with each member of the group being a specialist in the overall task of the team. For instance, SD provides a step in the Krebs cycle, also known as the citric acid cycle, which has the overall function of transforming the energy contained in sugars and fats into a form that a cell can conveniently use.

The new, intermediate enzymes along

a path to SD are in an awkward situation. They are not yet ready to function in the Krebs cycle, yet they have left behind their initial function. So, the reality is that each step of the process is going to require its own entirely new group of cooperating enzymes to perform some yet undefined function. If one thinks about it, this means that *each* step along the way requires the sudden appearance of a team of new enzymes able to work with the intermediate and give it a selection advantage. Then, after they are no longer needed as intermediate, they suddenly disappear. This process would be more cumbersome than simply jumping to SD in a single step.

What we know of science teaches us that there is no mechanism for an enzyme such as SD to appear through natural processes. It had to come from a source outside of natural processes. Hence, succinate dehydrogenase provides one more piece of evidence demonstrating that physical life came from a living, creator God and that a person is without excuse who will not see it.

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Endnote: The genetic code codes for 20 possible amino acid choices. If a logarithmic average of 2 of these choices is viable for each location, then the probability of getting a viable choice in a single step is one in 20 divided by 2, which equals 10. This probability is multiplied by itself for each amino acid in the sequence, 1,100 times. Thus, the probability of getting a workable sequence of amino acids in a single step capable of functioning as SD is approximately equal to 10 multiplied by itself 1,100 times, i.e., $1 \times 10^{1,100}$.

“Albatrosses, godwits, and sooty shearwaters all undertake epic journeys,” the BBC said, “But none can quite match the Arctic tern’s colossal trip.” They found that half the birds flew along South America on the way down, and others followed the coast of Africa, but all returned northward the same way.

The team was surprised to find the birds following an S-curve home when flying north. They figured that it allows the birds to conserve energy when flying over the trackless Atlantic Ocean by riding the prevailing winds. The detour, even though thousands of miles longer, is actually more energy efficient.

The round trip is about 70,000 kilometers (43,000 miles). An average arctic tern, weighing only 3.5 ounces, will fly “the equivalent of three trips to the moon and back over its lifetime.”

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To Advance Technology, Make Like Nature

Scientists and engineers continue to find the most elegant solutions to practical problems by looking at plants and animals. Here are a few of the recent examples.

1. **Wet computing:** Cells and brains do a superior job of complex processing, so why are our current computers singing how dry I am? Not for much longer. *ScienceDaily*¹ reported that “A new kind of information processing technology **inspired by chemical processes in living systems** is being developed by researchers at the University of Southampton.” What they have so far is “very crude” but they are working toward developing a “liquid brain” just like our brains. Dr. Klaus-Peter Zauner at the University’s School of Electronics and Computer Science said, “People realise now that **the best information processes we have are in our heads** and as we are increasingly finding that **silicon has its limitations** in terms of information processing, we need to explore other approaches, which is exactly what we are doing here.” Makes you wonder why IBM didn’t follow that inspiration early on. Think of the other benefits: “Our system will copy some key features of neuronal pathways in the brain and will be capable of excitation, self-repair and self-assembly,” said fellow researcher Dr. Maurits de Planque.

The *BBC News*² also reported on this story. Dr. Zauner told them, “**Every neuron is like a molecular computer; ours is a very crude abstraction of what neurons do.**” The planned chemical computers will also have another characteristically human trait: lipids, or fat.

2. **Slime mold highways:** What would a slimy mold have to teach humans? *NewScientist*³ reported two specialists in “unconventional computing” believe they can provide alternative methods for road planning. After watching a slime mold in a petri dish find the best path to nutrients on a map of England, comprised of oat flakes, Jeff Jones of the University of the West of England in Bristol said, “This shows how a single-celled creature without any nervous system — and thus intelligence in

the classical sense — can provide an efficient solution to a routing problem.”

3. **Make like a leaf:** Leaves are like incredibly-efficient solar panels, so why not imitate them? *NewScientist*⁴ reported that a team in China is building artificial leaves that can imitate photosynthesis. “By **mimicking the machinery plants use** to do this, it is possible to create a miniature hydrogen factory,” one of the researchers at Shanghai Jiao Tong University said. “Using sunlight to split water molecules and form hydrogen fuel is one of the most promising tactics for kicking our carbon habit.”

Their new approach is closer to the plants’ technique. They are trying to “**mimic photosynthesis by copying the elaborate architectures of green leaves**” themselves. To do this, they are actually building on dried leaves and using them as templates. “The leaf retained features such as the **lens-like cells at its surface, which catch light coming from any angle, and veins that help guide light deeper into the leaf.**” This strategy is making the artificial structures more efficient: twice as good at absorption and three times better at hydrogen production, the team claimed.

They realize this is just a “good beginning,” the article ended. “**Complex structures found in leaves should be utilised further for enhancement in light harvesting.**”

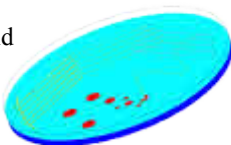
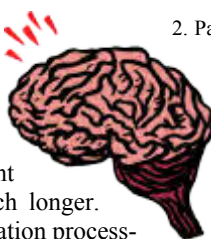
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Tiktaalik Demoted to Has-Been

The highly-publicized tetrapod missing link or “fish-a-pod” that made headlines in 2006 has been dethroned by new findings in Poland. Trackways said to be 18 million years older than *Tiktaalik*, showing digits and alternating steps, were announced today in *Nature*.¹ The authors said, “They force a **radical reassessment** of the timing, ecology and environmental setting of the **fish-tetrapod transition**, as well as the **completeness of the body fossil record.**”

Here is a sample of the revolutionary talk being reported:

- “These results **force us to reconsider our whole picture of the transition from fish to land animals**” said co-discoverer Per Ahlberg in *ScienceDaily*.²
- The finding “**could lead to significant shifts in our knowledge of the timing and ecological setting of early tetrapod evolution.**” — Ted Daeschler in *National Geographic News*.³
- “The team says the find means that **land vertebrates appeared millions of years earlier than previously supposed....** the Zachelmie Quarry tetrapods **break the neat**



and simple timeline.” (*BBC News*⁴).

- “The fish-tetrapod transition was thus seemingly quite well documented.... Now, however, Niedzwiedzki *et al* lob a grenade into that picture.” — Janvier and Clement, commenting on the find in *Nature*.⁵
- “It blows the whole story out of the water, so to speak.” — Jenny Clack (Harvard), in *PhysOrg*.⁶
- “We didn’t know they existed at this point, and we would not have expected to have found them in this environment.” — Per Ahlberg, co-discoverer, in *Live Science*.⁷

No body fossils were found. This means that inferences about the trackmakers will be limited. Readers should therefore take caution at the artist reconstructions in some articles, such as *National Geographic*, that try to give the animals a fish-like appearance. *PhysOrg* noted, “Although she acknowledged their importance, Clack warned against drawing conclusions exclusively on small marks left by animals on the bottom of a muddy surface hundreds of millions of years ago [mya].” The tracks are dated 397 mya, whereas *Tiktaalik* was dated around 380 mya. The scientists inferred that the trackmakers were sizeable — about 2 meters long. Since no tail drag prints are seen, the animals must have had limbs strong enough to hold their bodies above ground (see illustrations in the *BBC News*).

Another bombshell is that this may not be the only grenade to be lobbed into the picture. The discoverers noted with interest that trackways from Glenisla dated late Silurian (418–422 mya), thought to be those of arthropods, may actually be vertebrate tetrapod tracks as well.⁸ And the new Polish trackways open the door to more finds like it. “Obviously the hunt is on,” Ahlberg said, for more trackways and body fossils from that period and the locale’s presumed intertidal environment. Janvier and Clement said,

Niedzwiedzki and colleagues’ apparently **anachronistic Eifelian [397–391 mya] tetrapod trackways** will thus **shake up thinking about tetrapod origins**. They show that the first tetrapods thrived in the sea, trampling the mud of coral-reef lagoons; this is **at odds with the long-held view** that river deltas and lakes were the necessary environments for the transition from water to land **during vertebrate evolution**. And in guiding the search for a gradual timing of the fin-limb transition during the Middle Devonian, they are **likely to trigger a burst of field investigations** into potential tetrapodomorph fish sites of Emsian [497–397 mya] **or earlier age**.

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Molecular Machines Use Moving Parts

Research papers into the processes of molecular machines continue to reveal moving parts: “fingers” that open and close, ratchets that lock into place, and feet that move along tracks. Here are a few samples from the voluminous literature that continues to pour from biophysics labs.

1. **DNA Polymerase I**: Scientific papers tend to be reserved in their language, but the authors of a paper in *Structure*¹ couldn’t help themselves: “DNA polymerases are **spectacular molecular machines** that can **accurately copy genetic material** with **error rates on the order of 1 in 10⁵ bases** incorporated, **not including the contributions of proofreading exonucleases**.” Their paper went into detail on how the “fingers” and “thumb” of the machine open and close in precise sequence as the machine moves along the DNA strand base by base. Part of the machine rotates 50° as the machine translocates along the DNA. These machines copy millions of base pairs of DNA every cell division so that each daughter cell gets an accurate copy. The research was done on a bacterium that lives in hot springs.

Pata and Jaeger, who reviewed the paper by Golosov *et al* in *Structure*,² included a diagram showing the “conformational changes” that DNA polymerase I undergoes in its action along the DNA strand. “After more than **fifty years of research**, the DNA polymerases **responsible for copying the genetic material** are some of the most well characterized enzymes in all of biology,” they said. “Although the polymerases are divided into several different families, they all share a common two metal-ion catalytic mechanism, and most of them are described as **having fingers, palm, and thumb domains**: the palm contains metal-binding catalytic residues, the thumb contacts DNA duplex, and the fingers form one side of the pocket surrounding the nascent base pair.” Three phases occur during each step along the DNA chain: the fingers open, the machine moves one base pair as it rotates, then the base in the “palm” is placed into the “pre-insertion site,” while another moving part prevents further movement till the operation is completed. Then the process repeats — millions of times per operation.

A paper in *PNAS*³ on DNA Polymerase I noted that “The **remarkable fidelity** of most DNA polymerases depends on a **series of early steps** in the reaction pathway which **allow the selection of the correct nucleotide substrate**, while **excluding all incorrect ones**, before the enzyme is committed to the chemical step of nucleotide incorporation.” Their paper also discussed numerous conformational changes in the operation — some that precede the emplacement of the nucleotide at each step. They described how the fingers-closing step forms “a snug binding pocket around the nascent base pair.” They discussed at length how the machine prevents mismatched bases at several stages of the operation. None of the authors of these three papers used the word *evolution*.

2. **Virus replicator**: Language of moving parts abounds in an article in *PNAS* about the machinery a virus uses to replicate itself.⁴ This little helicase called NS3h undergoes three successive conformational changes as it ratchets along the DNA. Words found in the paper suggesting moving parts include: stretched spring, torsion, rotation, bending, propel, motion, unwinding, gating, cycle, kinetic steps, motor domains, structural transitions, and ratchet-type unidirectional translocation. This particular machine works in a virus that causes hepatitis C. It is part of superfamily SF2 of this kind of machine. Regarding evolution, the authors only said, “structural comparison of the representative SF1 and SF2 members reveals explicit differ-

ences in catalyzing nucleotide hydrolysis and motion (Figs. S6 and S7), reflecting **the fact that these helicases have evolved to adopt divergent mechanisms** and act in different biological processes.”

3. **Torsion springs and lever arms:** There’s a molecular machine that detects stretching force when a load is applied. The keywords for a paper in *PNAS*⁵ about one of the myosins include kinetics, torsional motions, lever arm, force-sensitive transition, and more. “Myosin-IIs are **molecular motors** that link cellular membranes to the actin cytoskeleton, where they play roles in **mechano-signal transduction** and membrane trafficking,” the paper begins. “Some myosin-IIs are proposed to act as **force sensors, dynamically modulating their motile properties in response to changes in tension.**” Why do cells need force sensors? “Tension sensing by myosin motors is **important for numerous cellular processes**, including **control of force and energy utilization in contracting muscles, transport of cellular cargos**, detection of auditory stimuli, and control of cell shape.” The authors found that *alternative splicing* of the gene produces isoforms of the motor with lever arms of different lengths, with varying response to force. This “**increases the range of force sensitivities of the proteins translated from the myo1b gene.**” and it “**tunes the mechanical properties of myo1b for diverse mechanical challenges**, while **maintaining** the protein’s basal **kinetic and cargo-binding properties.**”

How did these myosin machines arise? They just evolved. “Myosins **have evolved different tension sensitivities tuned for these diverse cellular tasks**,” the authors said. That’s all they had to say about evolution.

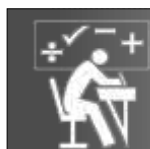
4. **Ribosome dynamics:** When transfer-RNAs and messenger-RNAs traverse the ribosome protein-assembly factory with their amino-acid cargos and genetic data readouts, respectively, they undergo several motions as they are transported along. Researchers writing in *PNAS* said,⁶ “Spontaneous formation of the unlocked state of the ribosome is a **multistep process.**” Their paper described how the L1 stalks of the ribosome bend, rotate and uncouple — undergoing at least four distinct stalk positions while each tRNA ratchets through the assembly tunnel. At one stage, for instance, “the L1 stalk domain closes and the 30S subunit undergoes a counterclockwise, ratchet-like rotation”

with respect to another domain of the factory. This is not simple. “Subunit ratcheting is a **complex set of motions that entails the remodeling of numerous bridging contacts** found at the subunit interface that are involved in substrate positioning,” they said.

Since the discovery of molecular machines, biochemistry has transformed into biophysics. The kind of chemistry we learned in school is inadequate for understanding the machinery of the cell. Interactions between molecules are not simply matters of matching electrons with protons. Instead, large structural molecules form machines with moving parts. These parts experience the same kinds of forces and motions that we experience at the macro level: stretching, bending, leverage, spring tension, ratcheting, rotation and translocation. The same units of force and energy are appropriate for both — except at vastly different levels.

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Math Matters

by
Don DeYoung, Ph.D.



What Are Irrational Numbers?

Irrational numbers cannot be written as a simple fraction of two other numbers. For example, 7/11 is rational but π (pi) is not. An equivalent definition is that irrational numbers have an endless string of decimals with no repeating or recurrent pattern. The fraction 7/11 equals 0.636363..., but π is non-repeating (3.1415926535...).

There have been many unsuccessful attempts to find a large fraction which exactly equals π , therefore showing that this constant is a rational number. However, computers have evaluated π to a trillion places with no repetition of the decimal pattern. This expression of π , at 2000 characters per page, would fill 500 million pages. Several

fractions give a close approximation to π . The vertical lines show where the following values differ from π :

$$\frac{22}{7} = 3.14\overline{285714}$$

$$\frac{355}{113} = 3.141592\overline{92}$$

The discovery of irrational numbers such as π was disturbing to Greek mathematicians. Pythagorean philosophy taught that nature consisted of whole numbers only, in direct conflict with irrationals. Initially there were efforts to hide the “logical scandal” of irrational numbers from public knowledge. Irrationals represented some cosmic imperfection or error that should be

π

suppressed since they were considered to be inferior to whole numbers. There is a legend that the mathematician Hippasus was banished from the Pythagorean community for disclosing to outsiders the existence of such numbers. A tomb was erected for him as though he were dead (Eves, 1980, p. 53).

Today, irrational numbers are a rich area of interest and application. Entire books are written on the intriguing properties of π . Mathematics is the language of creation, including the irrational numbers.

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Editor's note: Dr. Danny Faulkner serves as guest respondent to this issue's featured question. You may submit your question to Dr. Jean Lightner at jean@creationresearch.org. It will not be possible to provide an answer for each question, but she will choose those which have a broad appeal and lend themselves to relatively short answers.

Q Once, long ago, I saw in *Astronomy* magazine an interesting article titled "Why is the Night Sky Black?" It was interesting and if I remember correctly it posited that an infinite universe would have a bright sky since at any point there would be a star sooner or later at some distance. I have often been intrigued with the idea and wondered if it could be interesting from a creationist point of view.

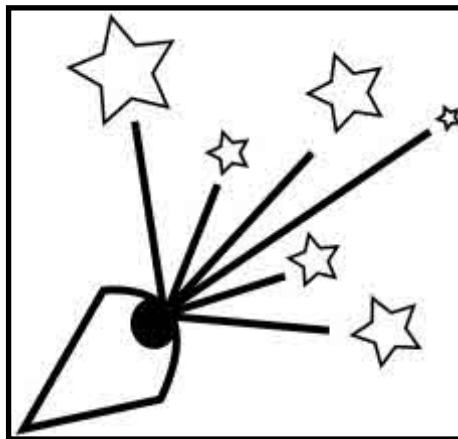
A This normally is named "Olbers' Paradox" after Heinrich Wilhelm Matthäus Olbers (1758–1840). Olbers wrote about this as early as 1823, but there were others prior to him who discussed the issue as well. There are four assumptions required for Olbers' Paradox. They are:

1. Stars have some average size and brightness.
2. Stars are uniformly distributed throughout the universe.
3. The universe is eternal.
4. The universe is infinite.

We can work through these assumptions. The apparent brightness of a star diminishes with the inverse square of the distance. This is due to the fact that the angular size of a star (how much of the sky that appears to be taken up by a star) decreases with the inverse square of the distance. If stars are uniformly distributed throughout the universe, then with increasing distance the number of stars increases with the square of the distance. These two effects cancel, so that wherever we look, our view is blocked by an increasing amount of stellar surfaces with ever increasing distance.

If the universe is eternal, then light from stars has been traveling toward us in every direction forever. If the universe is infinite, then the number of stars also is infinite. Thus, in every direction that we look, our view is totally blocked by stellar surfaces. Therefore, if the sun's temperature is the approximate stellar temperature, then the entire night sky ought to be as bright as the sun's surface. The night sky is profoundly dark, so this is a huge discrepancy.

These four assumptions were widely believed at the time of Olbers, but not so today. Let us examine the assumptions. We now know that there is a tremendous range in stellar



Olbers' Paradox.

*Permission granted under the terms of the GNU Free Documentation License.
<http://en.wikipedia.org/wiki/File:Eye-stars.svg>*

size and brightness (and correspondingly, temperature). However, with a large enough sample size, this assumption is not a bad approximation. The relatively rare, bright stars are balanced out by the very numerous but faint stars. This is borne out by the surface brightness of galaxies. Relatively nearby galaxies, such as the Andromeda galaxy, overall are bright, but they can be amazingly disappointing when seen through even large telescopes, because the surface brightness of nearby galaxies is no greater than very distant galaxies.

This brings us to the second assumption, that stars are uniformly distributed in space. Stars tend to clump together into structures that we call galaxies, so locally stars are not uniformly distributed at all. However, over large distances (that large sample size again), the galaxies, and hence the stars that they contain, tend to smooth out. So the first two assumptions, though incorrect, do not have a large bearing upon the outcome. The real outcome comes from the final assumptions, that the universe is eternal and infinite.

The eternity of the universe goes back at least to the ancient Greeks, who could not envision a naturalistic beginning of the universe. The Greek gods were not transcendent, nor were they capable of fiat creation. This left the ancient Greeks with the only other possibility: that the universe was eternal. Once Sir Isaac Newton devised his law of universal gravity, people realized that if the universe were eternal, all the matter in the universe would end up in a large heap at the center of the universe. With an eternal universe, there would have been more than ample time for this to already have happened, but it obviously had not happened.

Without rejecting Newtonian gravity, there were only two ways out of this dilemma. Either the universe was not eternal (which is what the Bible teaches), or the universe was infinite. In an infinite universe, there is no center about which matter could fall, so one is left with a static universe. Sadly, instead of taking Genesis 1:1 at its word, most people assumed that the universe was infinite. Thus, Olbers' Paradox remained a mystery for more than a century.

Modern physics gave us a new theory of gravity, general relativity. One of the differences between Newtonian gravity and general relativity is that even with an eternal universe, general relativity will cause all matter to collapse. That is, there is no static universe, for we would expect that the universe is either expanding or contracting. This led to the discovery of the expansion of the universe by Edwin Hubble in 1928.

This discovery eventually paved the way for the big bang cosmogony, though the big bang is not the only possibility within a general relativity theory. The big bang cosmogony posits that the universe began in an instant in the past, currently thought to be 13.71 billion years ago. The consequence is that the universe has not been around for an eternity, and so there has not been sufficient time for light from all corners of the universe to have reached the earth. Therefore, our view is not mostly blocked by stellar surfaces in every direction, and Olbers' Paradox is not a problem.

This is how evolutionary astronomers explain Olbers' Paradox, that the assumption that the universe is eternal is not correct. How do recent creationists explain Olbers' Paradox? Amazingly, in a very similar way. Of course, we don't believe that the universe is billions of years old. However, neither do we believe that the universe is eternal. And, like evolutionary astronomers, we don't know if the universe is infinite, but that is irrelevant if the universe is not eternal. Regardless of which mechanism one uses to explain the light travel time problem (how light from all portions of the universe could have gotten here if the universe is young), our view of the night sky is not entirely blocked by stellar surfaces no matter which direction we look.

For more discussion of Olbers' Paradox and much more about cosmology, see my book, *Universe by Design*, available from the Creation Research Society.

Ancestor of *T. rex*?

by Andrew V. Ste. Marie

R*aptorex kriegsteini* is the name of the recently discovered, alleged missing link on the way to the fearsome *Tyrannosaurus rex*.¹ It is supposed to be a missing link between the so-called basal (primitive) tyrannosauriids (such as *Guanlong*, *Dilong*, and *Xiongguanlong*) and the large tyrannosaurids (such as *Albertosaurus*, *Daspletosaurus*, and *Tyrannosaurus*). It was very similar to the larger and much more famous *Tyrannosaurus*, sharing features such as the large head (the two even had similar, but not identical, skull shapes), small forearms, huge back legs, and large olfactory bulbs. *Raptorex*, which was described recently in the journal *Science*, also shares with *T. rex* “a proportionately large skull, incisiform premaxillary teeth, expanded jaw-closing musculature, diminutive forelimbs, and hindlimbs with cursorial proportions.”² Despite the similarities, *Raptorex* is miniscule compared to its 40-foot-long look-alike — it was only about 9 feet long and probably weighed only 150 pounds.³

The missing link claims are backed up by the supposed age of the fossil (125 million years old — 60 million years older than *T. rex* is alleged to be). Paul Sereno said

It’s as close to the proverbial missing link on a lineage as we might ever get for *T. rex*...From the teeth to the enlarged jaw muscles, the enlarged head, the small forelimbs, the lanky, running, long hind-limbs with the compressed foot for hunting prey: we see this all, to our great surprise, in an animal that is basically the body weight of a human or 1/90th the size that ultimately this lineage would reach in *T. rex* at the end of the Cretaceous.¹

Sereno also said *Raptorex* shows that the body design of tyrannosaurs evolved at “basically our bodyweight. And that’s pretty staggering, because there’s no other example that I can think of where an animal has been so finely designed at about 100th the size that it would eventually become.”³

But are the missing link claims justified? The claims really rest only on the age of the fossil, since *Raptorex* and *Tyrannosaurus* are very similar and there is little, if any, morphologic justification for the idea that they are anything other than members of the same created kind.⁴ Most creationists are probably familiar with the many problems inherent in the dating of rocks and fossils, but this fossil cannot even be dated!

BBC News reported that “researchers say

that fragments of sand and sediment on the skeleton indicate that it came from an area of northeastern China rich in fossils. It was dug up illicitly and spirited out of the country and ultimately sold.”¹ AIG’s *News to Note* points out the implications of this fact:

The team’s claim that *Raptorex kriegsteini* is a missing link rests entirely on the sediment-based dating of the fossil — which was done indirectly because the fossil’s original finders and specific origin are unknown.⁵

Basically, the fossil is *presumed* to be a missing link based on the *presumed* age of the rocks where it is *presumed* to have originated. Would you want to base your faith on that kind of reasoning? The question can legitimately be asked, why can’t the fossil just be interpreted as a small individual of the tyrannosaur kind, or a small kind of tyrannosaur? It isn’t necessarily a missing link, although it may be a new species or even genus.

If this fossil is accepted by evolutionists as the tyrannosaur missing link, it would actually be somewhat different from what they would have hoped to find as a *T. rex* ancestor. *BBC News* says that “the team believes that the new fossil completely overturns accepted opinion on the evolution of tyrannosaurs.”¹ Evolutionists had believed that the distinctive body shape of *Tyrannosaurus* had evolved as a consequence of its large size, not before it. Stephen Brusatte (American Museum of Natural History), coauthor of the scientific description, said that “*Raptorex*, the new species, really throws a wrench into this observed pattern.” He went on to say that

Here we have an animal that’s 1/90th or 1/100th of the size of *T. rex*, about my size, but with all the signature features — the big head, the strong muscles, the tiny little arms — that were thought to be necessary adaptations for a large body predator....So really we can say that these features did not evolve as a consequence of large body size but rather that they evolved as an efficient set of predatory weapons in an animal that was just 1/100th of the size of *T. rex* and that lived 60 million years before *T. rex*.¹

Brusatte concluded that “In short, much of what we thought we know about tyrannosaur evolution turns out to be either simplistic or out-and-out wrong.”¹ This is not a surprise to those who trust what God says in His Word over what fallible men think! Henry Morris

expressed it well when he wrote “[d]iscoveries of science are constantly sending the evolutionists back to the drawing board, while the case for biblical creationism is strengthened with most discoveries.”⁶

Raptorex did not have any fossilized feathers, but this didn’t keep the research team from making the all-too familiar claim that they believe the animal “would have had similar feathers to an ostrich.”¹ Such speculation is useless, especially since all or at least most of the previously announced claims of dinosaurs with feathers have turned out to be mistaken.

Raptorex is not a missing link, but is probably just a variety of tyrannosaur. Evolutionists need to realize that *Tyrannosaurus*, and all the other tyrannosaurs, were created by God on the Sixth day of the Creation Week and their fossils were buried in the year-long Genesis Flood. The data are consistent with this interpretation of Earth history!

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All by Design

by Jonathan C. O'Quinn, D.P.M., M.S.

The Bear Necessities

The Bible teaches that God created all living things according to kinds. We may safely assume that God has provided living things with the skills and abilities each needs to survive. Let us look at the black bear with this in mind.

During the typical hibernation season, many physiologic processes decrease dramatically in the black bear, which neither eats nor drinks during this time, but uses fat as the primary source of energy. Reduced muscle activity and prolonged starvation during hibernation should cause severe muscle atrophy and subsequent loss of strength. Oddly enough, no significant loss of lean body mass occurs in the bear during hibernation, excepting lactating females, which experience a modest 4–10% loss of muscle protein.

It turns out that at the molecular level, a number of specific genes coding for enzymes used in protein synthesis in skeletal



muscle and liver tissue are highly over-expressed during hibernation. There is simultaneous down-regulation of some genes that promote protein breakdown, while the breakdown of some type-I collagen in connective tissues provides essential amino acids for protein synthesis. This allows

black bears to reduce muscle atrophy over prolonged periods of immobility and starvation during hibernation, allowing them to emerge from hibernation in the spring quite vigorous and strong, ready to resume their normal activity.

The simple and amazing fact is that this process occurs automatically, without the black bear's having to think about it. Logically, a biological system so complicated, so perfect and self-regulating, cannot have developed in stages or by chance.

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Figure caption:
Black bear.

Photo (WO1927-28) by Mike Bender, courtesy of U.S. Fish and Wildlife Service.