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SCIENCE NEWS

THE WEEKLY NEWSMAGAZINE O

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how strep A evades detection

breaking down more plastics

shake, rattle, and rome

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brain power

EXERCISE GIVES A BOOST

THE WEEKLY NEWSMAGAZINE OF SCIENCE

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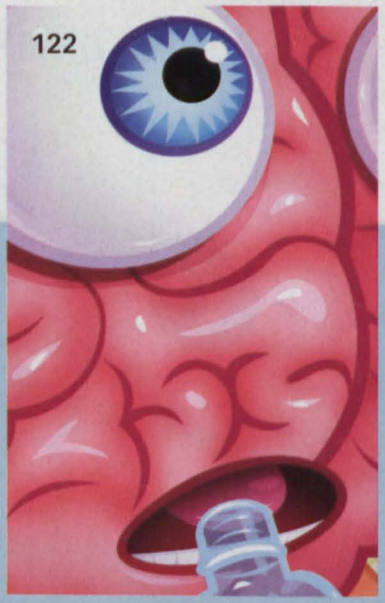

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Cover Just as physical exercise primes the body, researchers are finding that it also primes the mind. Exercise prompts brain cells to multiply, strengthens their connections, and boosts their resilience against damage and disease. (Dean MacAdam)
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SCIENCE NEWS
This Week

Degrading a Defense

Bacteria use enzyme to escape trap

Like a cloak of invisibility, an enzyme released by strep A bacteria lets them slip away from the body's staunchest defenders, a new study shows. The discovery could lead to a new weapon against virulent diseases.

White blood cells called neutrophils have a two-pronged defense against bacteria: They can swallow and destroy them or they can release neutrophil extracellular traps (NETs). The fibrous NETs are made up of DNA and toxic compounds that can catch and kill pathogenic microbes.

But some bacteria nimbly evade NETs, says Victor Nizet of the University of California, San Diego. One possible explanation has been that those bacteria produce an enzyme that degrades the traps.

Disease-producing bacteria seem to make more of an enzyme called DNase than benign microbes do, Nizet says. "There's been speculation for a long time that DNases could be virulent," he says.

Group A streptococcus bacteria can cause diseases ranging from throat infections to scarlet fever to flesh-eating disease, and they're highly resistant to the neutrophils' traps.

To test whether it is DNase that helps strep A bacteria escape NETs, the researchers created a mutant strain of the bacteria that lacked the gene that encodes for DNase. Without the gene, the bacteria didn't degrade the NETs and were quickly killed by cultured neutrophils.

The team also inserted the DNase gene into benign bacteria that normally lack the enzyme. In laboratory tests, the altered microbes evaded the NETs with ease. "This showed that manipulating this one bacterial-virulence factor has a big effect on the disease-causing potential of bacteria," Nizet says.

In the same study, the researchers injected a chemical DNase inhibitor into one hind leg of each of four mice infected with flesh-eating strep disease and injected a placebo into the other hind leg. In placebo-treated limbs, where the bacteria were "running rampant," Nizet says, there were no fibrous NETs. In all the inhibitor-treated limbs, however, the scientists saw abundant NETs. In lesions there, no bacteria remained and no ulcers developed, says Nizet. He and his team report the results in the Feb. 21 *Current Biology*.

The paper "clearly shows" that strep A makes an enzyme that can destroy NETs, says microbiologist Arturo Zychlinsky of the Max Planck Institute for Infection Biology in Berlin. "It's extremely interesting." In the Feb. 21 *Current Biology*, Zychlinsky describes a similar enzyme secreted by pneumococcus bacteria.

Nizet says that his team's discovery could guide a new approach to fighting disease, although researchers will first need to find ways to target only pathogenic DNases. Rather than killing the bacteria with antibiotics, and thereby encouraging them to evolve resistance, he says, "we're basically allowing the immune system to do its job." —C. GRAMLING

QUOTE

"**Manipulating this one factor has a big effect on the disease-causing potential of bacteria.**"
VICTOR NIZET, University of California, San Diego

Rome at Risk

Seismic shaking could be long and destructive

If a large earthquake struck Rome, ground motions could rock the city for up to a minute, a new simulation suggests. Strong shaking for that surprisingly long interval would threaten many of the city's aging landmarks.

Earthquakes that shake Rome and gradually degrade its ancient structures typically originate in one of two places: the Alban Hills region, about 25 kilometers southeast of the city, or the Central Apennines, a mountain range about 90 km to the east. At least 20 large quakes have shaken the city in the past 2,000 years. The most recent, estimated at magnitude 7.0, occurred in 1915, says Kim B. Olsen, a geophysicist at San Diego State University. However, none of the region's seismic instruments had yet been installed, so detailed analyses of ground motions generated by major quakes in the area haven't been possible.

Rome covers the floodplain of the Tiber River. Because the sediments supporting the city haven't yet solidified into rock, strong and sustained ground motions can cause the soil to shift, settle, and even liquefy and flow, says Olsen. Data gathered from more than 1,000 boreholes drilled in and around the city indicate that the soil and silt beneath the city is about 50 meters thick. Below that lies a thin layer of gravel over bedrock.

Olsen and his colleagues used the borehole data to construct a first-of-its-kind, three-dimensional computer model of the geology of Rome and its environs. Then, they subjected the model to simulations of two earthquakes typical of past large quakes in the region—a magnitude 5.3 quake centered in the Alban Hills and a

ROMAN SHAKEDOWN The sediment underlying Rome makes ancient landmarks, including the Colosseum, especially vulnerable to large earthquakes that originate nearby.

magnitude 7.0 temblor originating in the Central Apennines.

The greatest ground motions caused by the simulated quakes appeared along the edges of the floodplain, where seismic waves traveling through the sediment bounced off the rocky edges of the river valley and reinforced each other.

Olsen notes that parts of central Rome that experienced large ground motions during the simulations were locations that had been heavily damaged in actual quakes.

What surprised team members was that the virtual quake originating in the Central Apennines shook Rome for as long as a minute, he notes. Seismic vibrations in the sediments under the city echoed back and forth through the basin, extending the quake's duration. The researchers report their results in the February *Bulletin of the Seismological Society of America*.

Simulations such as these could enable scientists to determine which of Rome's ancient buildings are most at risk of collapse during a major quake, says Kirk Martini, a structural engineer at the University of Virginia in Charlottesville. Preservationists could then focus their costly and time-consuming efforts on seismically retrofitting the most vulnerable historical sites. —S. PERKINS

Big Woman with a Distant Past

Stone Age gal embodies humanity's cold shifts

A 260,000-year-old partial skeleton excavated in northwestern China 22 years ago represents our largest known female ancestor, according to a new analysis of the individual's extensive remains.

This ancient woman puts a modern twist on Stone Age human evolution, say Karen R. Rosenberg of the University of Delaware in Newark, Lü Zuné of Peking University in Beijing, and Chris B. Ruff of Johns Hopkins University School of Medicine in Baltimore. The fossil individual's large size and the apparent adaptation of her body to cold conditions are "consistent with the idea that patterns of human anatomical variation that we see today have deep evolutionary roots," Rosenberg asserts.

Although the woman belonged to the *Homo* genus, her species is uncertain. Now known as the Jinniushan specimen, she stood roughly 5 feet, 5-½ inches tall and tipped the scales at 173 pounds, the three anthropologists estimate. The only Stone Age *Homo* woman known to have approached that size weighed an estimated 163 pounds. Her partial skeleton came from a 100,000-year-old Neandertal site in France.

The Jinniushan specimen's size reflects her membership in a population that, as an adaptation for retaining heat in a cold climate, evolved large, broad bodies with short limbs, a shape similar to that of near-polar populations today, the scientists propose in an upcoming *Proceedings of the National Academy of Sciences*.

LARGE LADY **A new analysis of a partial Stone Age skeleton, including this skull, identifies it as coming from the biggest known female among human ancestors.**

The large estimated brain size of the Chinese fossil supports a current theory of mid–Stone Age brain expansion in *Homo* species, the researchers say. Earlier analyses of other fossils' skulls and lower-body bones—not including multiple bones from single individuals—had indicated that, between 1 million and 200,000 years ago, the *Homo* lineage peaked in body size and displayed considerable brain growth relative to body size.

Bones of the Jinniushan specimen include a skull with many upper-jaw teeth, six vertebrae, two left ribs, a left-forearm bone, and the left half of the pelvis.

Pelvic shape and proportions are those of a female, the researchers conclude. Some researchers had previously dubbed this ancient individual a male solely on the basis of its large, thick-boned skull.

Three other partial-fossil individuals found in high-latitude, mid–Stone Age sites—two Neandertals and one of another *Homo* species—had wide torsos and short limbs, although to a lesser extent than the Jinniushan specimen did, Rosenberg says.

The Chinese skeleton's age estimate derives from measurements of radioactive material that accumulated in animal teeth found in the same sediment.

The new findings reinforce previous fossil analyses suggesting that mid–Stone Age human ancestors evolved cold-adapted bodies at lower latitudes and in warmer climates than modern people did, remarks anthropologist Erik Trinkaus of Washington University in St. Louis.

In his view, that's because mid–Stone Age folk had less effective ways to protect themselves from the cold than people did after about 60,000 years ago. At that time, campfires gave way to stone-lined hearths. The nature of mid–Stone Age clothing and shelter is unknown, Trinkaus adds. —B. BOWER

Birth Deterrent

Stress hormone cited in early miscarriages

High concentrations of a stress hormone in newly pregnant women might make them more likely to have miscarriages, a new study finds.

Roughly 30 to 50 percent of pregnancies end in miscarriage, says biologist Pablo A. Nepomnaschy of the National Institute of Environmental Health Sciences in Research Triangle Park, N.C. That number is imprecise because many miscarriages occur within days of conception, before a woman knows that she is pregnant. Miscarriage is a natural process that evicts defective embryos that are unlikely to survive, Nepomnaschy says, but the high rate suggests that other factors also play a role.

A few previous studies examined the relationship between miscarriage and stress, but their results were inconsistent. Nepomnaschy focused on extremely early pregnancies in healthy women and measured a biochemical indicator of stress.

In high-stress circumstances—for example, energy deficit, infection, injury, or social conflict—the body's adrenal gland produces more of the hormone cortisol. To test whether cortisol concentrations are associated with miscarriage, Nepomnaschy enlisted 61 married women in rural Guatemala who weren't using birth control. Over a year, each woman collected a urine sample every other morning right after she woke up. Nepomnaschy and scientists at the University of Michigan in Ann Arbor used these samples to assess each woman's pregnancy status and cortisol concentration.

There were 22 pregnancies during the study. In 9 of 10 pregnancies in which a woman's cortisol concentrations had jumped above her personal average during the first 3 weeks of gestation, a miscarriage

resulted. Of the 12 pregnant women whose cortisol concentrations stayed at or below average during these first few weeks, only 4 miscarried, Nepomnaschy and his colleagues report in an upcoming *Proceedings of the National Academy of Sciences*.

The miscarriages in the study occurred an average of 2 weeks after conception. "These findings are eye-opening, suggesting that elevated cortisol levels in early pregnancy [pose] a nearly complete threat to the pregnancy continuing," says endocrinologist David H. Abbott of the University of Wisconsin–Madison. However, he says, it's not clear whether outside stressors or some biologic process intrinsic to early pregnancy in certain women caused the increase in cortisol.

He notes that some research suggests that cortisol can suppress progesterone, a hormone essential to a successful pregnancy.

Petra Arck, a physician at Charité, an institute at the University of Medicine in Berlin, says that the study complements her observations that stress can adversely affect pregnancy. That earlier work, however, concentrated on women later in their first trimester and determined stress on the basis of the women's self-reports rather than on cortisol measurements.

"Although looking at slightly different time points during pregnancy, we both came to the same conclusion," Arck says. High stress during pregnancy disrupts normal endocrine functioning and interferes with fetal survival, she proposes.

Nepomnaschy agrees that maternal stress remains the simplest explanation for his results. He briefly interviewed the women in his study three times a week. He's still analyzing those interviews, which might reveal whether outside stressors brought on the higher cortisol concentrations, he says. —N. SEPPA

Easy Answers

Quantum computer gives results without running

Physicists have long known that quantum computers have the potential to race through calculations trillions of times as fast as ordinary computers do. Now, it seems that those machines may not have to calculate at all to deliver answers.

That seemingly absurd possibility, which was advanced as a theory several years ago, has now received experimental verification. What's more, although previous calculations indicated that such an approach would work only half the time at best, the new study suggests that it could become completely reliable.

Onur Hosten and his colleagues at the University of Illinois at Urbana-Champaign present their findings in the Feb. 23 *Nature*.

"This is a beautiful experiment. It verifies ... one of the strangest aspects of the nature of physical reality that is presented to us by quantum theory," comments theorist Richard Jozsa of the University of Bristol in England, who dreamed up the scenario in 1998.

Built so far only in laboratories and on a limited scale, quantum computers exploit the quantum-mechanical properties of tiny objects, such as photons and ions, to perform calculations (*SN: 1/7/06, p. 5*). Such properties include being in a so-called superposition, where an entity simultaneously exists in two or more states that seem mutually exclusive.

For the new experiment, the Illinois team, led by Paul G. Kwiat, built a rudimentary quantum computer from optical components such as mirrors and beam splitters. The researchers first mark one of four locations in a miniature database. When triggered by an incoming red photon with certain traits, the computer searches for the marked location and checks for a match between the location indicated by the photon and that target (*SN: 6/3/00, p. 356*).

When there's a match, the computer

Busy Little Recyclers

Chemical process, microbial metabolism transform trash-bound plastics

A two-step approach that converts a common plastic into a biodegradable polymer could cut the number of packing peanuts and Styrofoam cups that end up in landfills, researchers suggest.

In 2003, U.S. manufacturers produced more than 2 million tons of polystyrene to make such items as food packaging, packing materials, and furniture. Nearly all of this plastic was discarded, according to the Environmental Protection Agency. There is little demand for recycled polystyrene because it's of lower quality than the polystyrene made directly from petroleum components, notes Kevin E. O'Connor of the University College Dublin.

Last year, O'Connor's group reported that the bacterium *Pseudomonas putida* CA-3 could metabolize pure styrene, the precursor of polystyrene, and convert it into polyhydroxyalkanoate (PHA), a biodegradable polymer that can be made into good-quality plastic. While other members of this microbe family turn sugars and other plant-based materials into PHA, converting styrene is rare, says O'Connor.

In an upcoming *Environmental Science & Technology*, O'Connor and his colleagues describe adding a chemical step to the microbial process, thereby changing polystyrene into PHA.

First, they heated the polystyrene to 520°C in a closed reactor, which broke down the polymer chains and produced styrene oil containing a few other chemical compounds.

The researchers then cooled the liquid and added it to *P. putida* CA-3 growing in the lab. O'Connor says that he was not sure whether the microbes would tolerate the impure styrene, but "they grew well. You can take your dirty oil and just feed it to the bacteria rather than having to clean it up."

As in their previous work, the researchers induced the bacteria to turn styrene into PHA by limiting the microbes' supply of nitrogen, which they need to make amino acids. Under such conditions, which don't support growth, some bacteria go dormant, says O'Connor, but others react by storing carbon as a polymer that will be useful if more-favorable conditions return.

After 48 hours of fermentation, the bacteria had produced 1.6 grams of medium-chain-length PHA from 16 g of styrene oil, the researchers report. This biodegradable polymer, with repeating units of 6 to 14 carbons, could be used to make paints or medical devices.

"We recognize that it's a nice concept, but it needs to be improved to make it more economical," O'Connor says. The researchers are now investigating ways to improve the 10 percent styrene-to-PHA conversion rate.

Stephen McCarthy of the University of Massachusetts at Lowell agrees that the approach is not practical at this stage but adds that it "could be of value in the future."

However, he notes that rather than making biodegradable materials from petrochemical plastics, it would be better to use only biodegradable plastics in the first place. They can be made from renewable resources such as farm crops. "That's going to help us to wean ourselves off of fossil fuels more than this particular approach," says McCarthy. —A. CUNNINGHAM

emits a red photon with specific traits. If there's no match, the outgoing photon has different characteristics.

The team incorporated the computer into a larger setup that included a beam splitter upstream to provide a path around the computer. Given its quantum nature, a trigger photon simultaneously enters and doesn't enter the computer. "This puts the quantum computer in a superposition of running and not running," Hosten explains.

Downstream photodetectors then record light signals in the various paths, which indicate whether the photon went into the computer and what its target location was. When such measurements are taken, however, the computer can no longer maintain its multiple states and the superposition collapses, leaving evidence that the computer ran or didn't run.

Indeed, the detectors indicated about a third of the time that, with no photon going into the computer, and thus no search, the computer had yielded the correct answer to the question: Was there a mismatch between the incoming photon and the chosen database location?

Kwiat's team also presents new theoretical calculations showing a way to boost the computer's accuracy to nearly 100 percent and to specifically identify the selected location rather than determining whether there was a mismatch.

Charles H. Bennett of the IBM Thomas J. Watson Research Center in Yorktown Heights, N.Y., praises the new work for "exploring the places where quantum prediction seems most at odds with common sense." —P. WEISS

Hunger for Knowledge

Appetite hormone may stimulate memory

A hormone that's been tied to hunger may also play a pivotal role in creating and retrieving memories, according to a study in mice. These findings could spur new strategies for improving learning and memory in people.

When the stomach is empty, its lining cells secrete a hormone called ghrelin. Previous studies have shown that ghrelin migrates through the bloodstream and into the brain, where it stimulates receptors on nerve cells in the hypothalamus. This structure, found at the base of the brain, subsequently triggers appetite.

Researchers have also found ghrelin receptors scattered throughout the brain beyond the hypothalamus. "The question was, 'What is ghrelin doing in the rest of the brain, if anything?'" says Tamas Horvath, a neuroscientist at Yale University School of Medicine.

QUOTE

"What is ghrelin doing in the rest of the brain, if anything?"
TAMAS HORVATH, Yale University School of Medicine

Horvath and his team focused their attention on ghrelin's role in the hippocampus, a brain area involved in learning and memory and that's littered with ghrelin receptors. The scientists started by injecting some normal mice with extra ghrelin and others with an equal amount of saline over the course of several days. When they examined the animals' brains, they found that hippocampal cells in those mice that had received ghrelin had about a quarter more dendritic spines, which are specialized nerve cell connections associated with learning.

The scientists found a similar scenario when they compared normal mice with mice genetically altered so that they didn't make any ghrelin. The ghrelin-deficient animals had about 25 percent fewer dendritic spines than normal mice did.

To see whether these anatomical differences could affect learning and memory, Horvath's team compared ghrelin and saline-injected mice in a variety of memory-retention tasks, such as recalling where treats were hidden in a maze or remembering sections in another maze that delivered a mild shock to the animals' feet. Mice treated with ghrelin learned these locations significantly faster than the saline-treated animals did.

The researchers compared how normal mice and mice lacking the gene to make ghrelin reacted when an old toy in their cages was swapped for a new one. Normal mice spent several extra minutes investigating the new toy, which researchers take as an indication that an animal remembers a missing object. However, the ghrelin-deficient mice didn't spend any more time with the new toy than with other toys in their cages. When the researchers injected these mice with ghrelin, they investigated new toys as much as normal mice did.

The researchers report their findings in an upcoming *Nature Neuroscience*.

The results make sense in the context of evolution, says Mark Mattson, a neuroscientist at the National Institute on Aging's Intramural Research Program in Baltimore. Previous studies by his lab and others have shown that hunger increases an animal's brain activity. "It makes sense that hungry animals need to enhance their learning and memory so, for example, they can remember where a food source is and return to it," he says. —C. BROWNLEE

Eyeing a Saturn storm

The Cassini spacecraft recently photographed the most powerful storm (white swirl) ever observed on Saturn. The tempest is located in Storm Alley, a region of the planet's southern hemisphere where strong disturbances have frequently occurred. From north to south, the storm spans 3,500 kilometers, about the distance from Salt Lake City to New York. Because most storms on Saturn lie below the clouds, only the strongest upwellings can be seen. The storm erupted on Saturn's night side, so the orbiting craft had to rely on the tiny amount of sunlight reflected off Saturn's icy rings to record the disturbance. Cassini first detected signs of the storm on Jan. 23, when the craft recorded radio noise generated by lightning deep within Saturn's atmosphere. Amateur astronomers using small, Earth-based telescopes took the first visible-light portraits. NASA released this Cassini image, taken Jan. 27, on Feb. 14. The storm intensified on Feb. 19. —R. COWEN.

Science Mall shopping

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Deluxe Dinosaur Panorama Poster

The Deluxe Dinosaur Panorama poster - A colossal wall poster that embodies the elegance and power of dinosaurs. Painted by Haruo Takino. Size: 64.375"L X 22.75"H and comes laminated. Order #JPT-dinopan cost: $38.00

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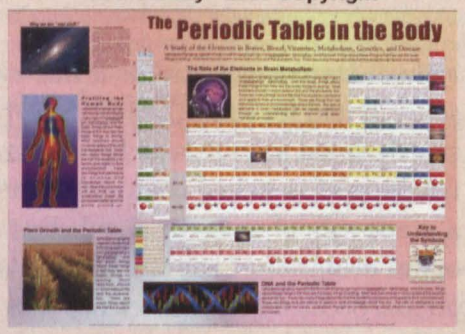
Both puzzles are based on the deluxe poster shown above, right.

The Periodic Table NEW! in the Body - 2006 Copyright



The Periodic Table in the Body - poster discusses each of the elements on the Periodic Table in relation to how the body uses them. It helps us understand how the elements are used by bones, blood, metabolism, genetics, and disease. Also, there are five sections to this periodic table poster. One section examines why we are indeed "star stuff" and our chemical ties to the universe; others profile the chemical makeup of the human body, plant growth, DNA, and the role of the elements in brain metabolism. Full color, laminated, 28"W X 38"H poster, Copyright 2006... #JPT-4191.... Cost $28.95

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Periodic Table in Earth & Sky

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Mayan Altar Leg Bookend

This is an exceptionally impressive reproduction inspired by a limestone carving from Piedras Negras, Guatemala, 790 A.D. This reproduction of the west leg of Altar 4 is one of four with symbols of rain and clouds. This leg probably represents one of the four "chacs," the serpent spirits that bring rains and wind from the four directions. The modern Maya still offer food and drink to the four "chacs" at planting time. Comes with information. Order #JPTmayan12, Cost: $69.95, #JPT-mayan 2, Two for $130

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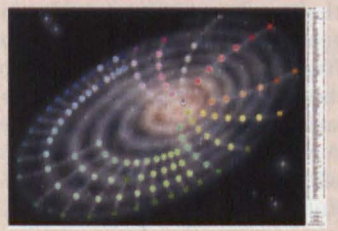
Chemical Galaxy: *A New Vision of the Periodic Table of the Elements*



Chemical Galaxy poster is a new creation in the world of periodic table charts. Developed by Philip Stewart, Oxford University, this table was created in a spiral design. It uses a starry pathway to link the elements and to express the astronomical reach of chemistry. Copyright 2006, Size: 26"H X 38"W Laminated, info sheet provided. Order#JPT-2221, Cost $28.95

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EVOLUTION IN ACTION

The trials and tribulations of intelligent design

BY SID PERKINS

Irony of ironies, creationism has evolved. In a sense, it had to: In 1987, the U.S. Supreme Court struck down a Louisiana law that required the teaching of so-called creation science whenever a grade school or high school class covered the theory of evolution. That law was declared unconstitutional because creation science—the notion that the Bible's version of the creation of the universe could be verified scientifically—was intended to advance a particular religion.

Since that landmark decision, called *Edwards v. Aguillard*, creationism has morphed into a philosophy dubbed intelligent design. That viewpoint holds, among other things, that organisms are too structurally and biochemically complex to have arisen only in accordance with natural forces. Intelligent design doesn't identify who or what created the universe, Earth, and the creatures that live on it.

After more than a decade of making inroads to classrooms across the country, the intelligent-design philosophy recently suffered a setback in its first test in federal court. Last December, Judge John E. Jones III of the United States District Court for the Middle District of Pennsylvania ruled that intelligent design couldn't be taught in the Dover (Pa.) Area School District because it "cannot uncouple itself from its creationist, and thus religious, antecedents."

That loss won't be appealed to the Supreme Court, however, in large part because eight of the members of the school board that had supported the teaching of intelligent design were swept out of office in an election last November. But that doesn't mean that the debate is over. Skirmishes between proponents of intelligent design and pro-evolutionists are taking place across the country in arenas ranging from meetings of local school boards to state legislatures. Points of contention extend from specific curricula and textbooks to the definition of science itself.

FAVORITE TARGET Evolution is the biological process by which populations of organisms acquire new, advantageous traits, pass them on to subsequent generations, and sometimes create new species. Even though most biologists today consider Darwinian evolution so sound that they regard it as the unifying concept of their field, a large fraction of the U.S. population apparently doesn't buy into the theory. In polls, about 40 percent maintain that living things have existed in their present forms since the beginning of time.

The theory of evolution has inspired opposition since it was first proposed by Charles Darwin in the late 1850s. Resistance to the concept has manifested itself in four waves, says Mark Terry, a science teacher at the Northwest School in Seattle, who spoke to the Society of Vertebrate Paleontology in Mesa, Ariz., last October. The original wave of opposition was voiced by scholars in the 1860s. The second wave peaked in the 1920s with the Scopes trial (*SN: 12/24&31/05, p. 408*). A third push for creation science lost steam after the *Edwards v. Aguillard* decision in 1987.

> This textbook contains material on evolution. Evolution is a theory, not a fact, regarding the origin of living things. This material should be approached with an open mind, studied carefully, and critically considered.
>
> ***Approved by***
> ***Cobb County Board of Education***
> ***Thursday, March 28, 2002***

Since the fourth and current wave, intelligent design, took hold in the early 1990s, its proponents have become increasingly vigorous, Terry says. Their strategy is to encourage—or force—schools to cast doubt on evolution and then offer intelligent design as an alternate theory of biological origins. Many proponents of intelligent design use the rallying cry, "Teach the controversy."

From 2001 through 2003, anti-evolution activity was reported in 40 states, says Jay B. Labov, an adviser for education and communications for the National Academies of Science in Washington, D.C. Those flare-ups included legislation proposed in 14 states, proposals to state boards of education in 14 states, and action by local school boards in 35 states, he said last December at the fall meeting of the American Geophysical Union in San Francisco.

The tactics of such proposals, as well as of those put forward more recently, are varied. Some strategies favor the teaching of intelligent design. In New York, for example, a bill introduced into the state assembly in 2005 would require that students in public schools in grades from kindergarten through 12 receive instruction in both intelligent design and evolution. The proposal, which is still being considered, would also oblige local school boards to train teachers "to ensure that all aspects of the theories, along with any supporting data, are fully examined."

Other proposals—either directly or indirectly—fling darts at evolution. A bill introduced into the state legislature in Missouri in 2004 would have required that teachers "help students to understand the full range of scientific views that exist" when "controversial" topics such as evolution are taught. Another provision in the bill would have permitted teachers to present alternate views to evolution, even if they weren't part of the official curriculum. That bill died in May 2004 when the legislative session ended.

In Cobb County, Ga., the school board 4 years ago placed stickers inside biology texts reading, "This textbook contains material on evolution. Evolution is a theory, not a fact, regarding the origin of living things." Parents successfully sued in U.S. District Court to have those stickers removed, but the school board quickly appealed to the 11th U.S. Circuit Court of Appeals in Atlanta. The three-judge panel that heard the appeal last December hasn't yet rendered a verdict.

Another antievolution tactic is the verbal equivalent of the Cobb County sticker. It would have teachers read a disclaimer to students before any lessons that include discussion of evolution. Such a requirement sparked last autumn's lawsuit by the American Civil Liberties Union and a group of 11 parents against the school board in Dover, Pa.

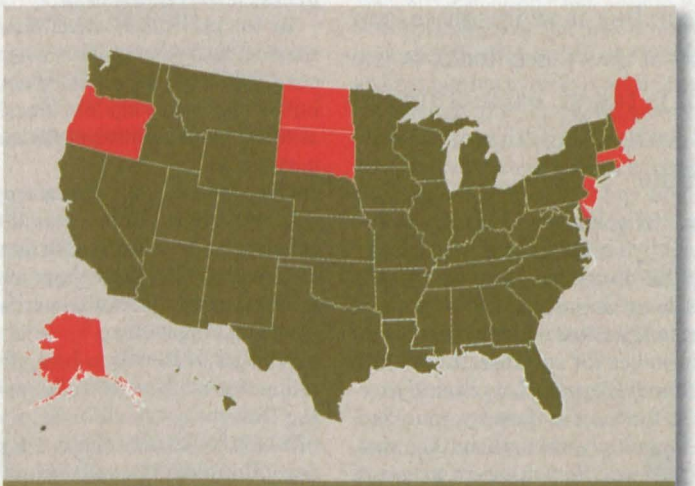
That trial, *Tammy Kitzmiller et al. v. Dover Area School District*, lasted about 6 weeks. The judge gave the proponents of intelligent design time not only to argue details of the case but also to defend their philosophy. Those who opposed the teaching of intelligent design also had plenty of time for rebuttal, says Robert T. Pennock, a philosopher and biologist at Michigan State University in East Lansing and an expert witness in the case against intelligent design.

In what Pennock terms "a thorough and sweeping decision," Judge Jones' 139-page ruling declared that intelligent design is religious and isn't science and that it is therefore unconstitutional for anyone to teach intelligent design as an alternative to evolution in a public school science classroom.

Some of the most damning evidence presented at the trial included early drafts and the final version of *Of Pandas and People* (1993, Davis and Kenyon, Foundation for Thought & Ethics), a high school textbook that espouses the intelligent-design philosophy. Hundreds of references to "creationism" and "creator" found in those early drafts were replaced with "intelligent design" and "intelligent designer" in the published version of the book.

Because the *Kitzmiller* ruling won't be appealed to the Supreme Court, its judicial precedent is binding only for the court district that contains Dover. Nevertheless, the ruling is influential because judges in other jurisdictions can refer to it when deciding similar cases, says Pennock.

Repercussions of the Kitzmiller decision quickly reached beyond the courts. In January, after being sued by a group of parents, a California school district canceled its plans for a month-long philosophy class that espoused intelligent design. Just last week, the Ohio Board of Education voted 11-4 to remove the requirement that high school biology classes "critically analyze" the theory of evolution. Board members and other people opposing that requirement argued that it could open the door to the discussion of intelligent design, thereby inviting lawsuits.



SWEEPING THE NATION — Since 2001, anti-evolution activity—including proposed bills in state legislatures and debates in state and local boards of education—has taken place in at least 41 states (depicted in green).

MAP RESOURCES/E. ROELL

MATTER OF DEFINITION

Judge Jones isn't the only person to decide that intelligent design doesn't fit the definition of science. Some folks within the intelligent design movement would like to change that definition to accommodate their view.

Hence the debate last May before the Kansas State Board of Education. There, proponents of intelligent design proposed changing the definition of science from "seeking natural explanations for what we observe around us"—the current definition in the state's science standards—to "continuing investigation that uses observation, hypothesis testing, measurement, experimentation, logical argument and theory building to lead to more adequate explanations of natural phenomena."

While that might seem to be just a more comprehensive definition of science, separation of the word *natural* from *explanations* opens the door to supernatural explanations, says Eugenie C. Scott, director of the National Center for Science Education in Oakland, Calif.

Science restricts itself to looking for natural causes to explain observable phenomena, she notes. While researchers can control environmental conditions such as temperature, humidity, and the concentrations of various chemicals when they conduct their experiments, there's no way to consistently include or exclude the potential influence of an unseen, willful, and omnipotent being. "You can't put God in a test tube," says Scott.

"There's a mythology that scientists reject intelligent design because it's a religious view," she says. "That's not true. They reject it because it's bad science."

WHAT'S NEXT?

Although the federal court system has weighed in on intelligent design's presence in the classroom and several state efforts to push the philosophy have stalled, efforts to advance it have by no means ended. Lawmakers in at least seven states are now or soon will be considering legislation that either directly or indirectly pertains to the teaching of evolution. The current proposals are less likely than earlier ones to specifically mention intelligent design.

For example, a proposal being considered by the Missouri legislature would require public school science teachers in grades 6 through 12 to "support the truthful identity of scientific information." The topic of evolution gets special attention: "... if a theory or hypothesis of biological origins is taught, a critical analysis of such theory or hypothesis shall be taught in a substantive amount."

Likewise, in Indiana, proposed legislation would prevent the state board of education from adopting a textbook if the book knowingly "contains information, descriptions, conclusions, or pictures that are false." Rep. Bruce A. Borders, the state representative who introduced the bill, singled out evolution and its "lies" as targets of the bill. Such a proposal shifts the forum of debate into textbook-adoption committees, often a mix of scientists, teachers, parents, and other concerned citizens. In such a forum, arguments about the worthiness of specific scientific facts and theories could be driven by political agendas and could rage endlessly.

The language contained in most of these proposals are a deliberate move away from mention of intelligent design and other philosophies that depend on a creator, says the National Center for Science Education's Scott. That "adaptive shift," she notes, most likely came in response to the Kitzmiller decision's finding that intelligent design can't constitutionally enter a public classroom.

Scott speculates that future alternatives to evolution won't use the words *creation* or *design* but will perhaps promote views that include "sudden emergence" or "abrupt appearance" of species.

Just as the *Edwards v. Aguillard* decision of 1987 squelched creation science, the *Kitzmiller* decision will exert a strong selective pressure on intelligent design, Scott predicts. Stay tuned. ■

BUFF AND BRAINY

Exercising the body can benefit the mind

BY CHRISTEN BROWNLEE

This is part one of a two-part series on lifestyle and brain fitness.

Anyone who frequents the local gym has probably noticed a cyclical pattern to attendance. Workout kings and queens exercise religiously throughout the year, but as swimsuit season approaches, a rash of new faces flocks to the facility. Every treadmill is taken, each elliptical machine is engaged, and without fail, there's a waiting line for a weight machine.

While exercise may be the path to looking great in a two-piece, everyone knows that it's also healthy for the body. It strengthens the heart and lungs, shores up thinning bones, and wards off a host of evils, including diabetes, heart disease, and stroke.

But what these newly inaugurated gym rats probably don't know is that besides buffing up their bodies for summer, they're also buffing up their brains. New research suggests that physical exercise encourages healthy brains to function at their optimum levels. Fitness prompts nerve cells to multiply, strengthens their connections, and protects them from harm. Benefits seem to extend to brains and nerves that are diseased or damaged. These findings could suggest new treatments for people with Alzheimer's disease, Parkinson's disease, and spinal cord injuries.

SWEATING TO THE OLDIES The cliché about a healthy mind residing in a healthy body has ancient roots. The famous quote of the same meaning, "*mens sana in corpore sano*," came from the Roman writer Juvenal in the early 100s A.D. And a century earlier, the philosopher Seneca was prescribing exercise as a way to achieve both physical and mental health.

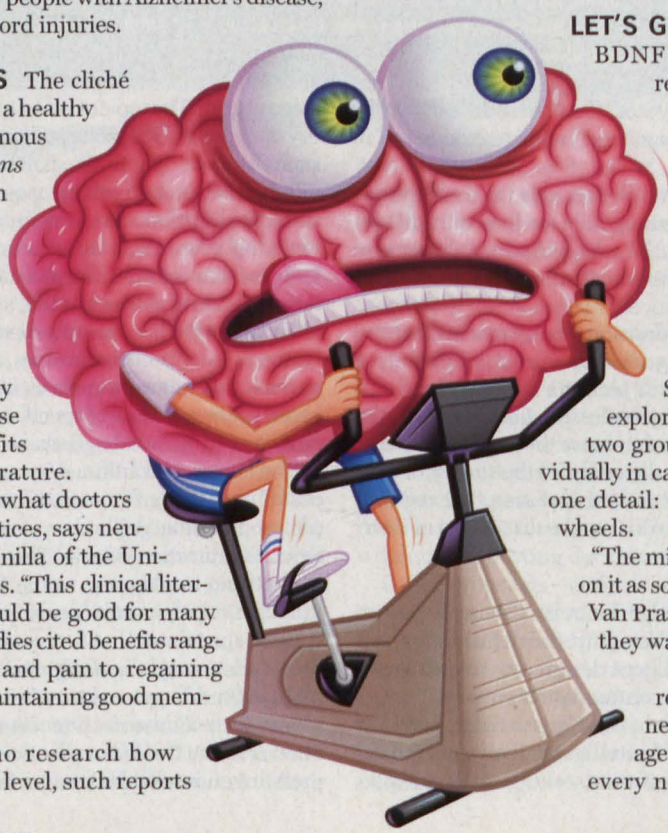
But it wasn't until the early 1950s that reports that exercise conveys neurological benefits appeared in the scientific literature. These articles usually described what doctors had witnessed in their own practices, says neurobiologist Fernando Gómez-Pinilla of the University of California, Los Angeles. "This clinical literature described that exercise could be good for many different things," he says. The studies cited benefits ranging from alleviating depression and pain to regaining mobility in paralyzed limbs to maintaining good memory in old age.

However, for scientists who research how nerve cells work at a molecular level, such reports raise a bevy of questions. Gómez-Pinilla and other neurobiologists have aimed to fill this information gap by working with lab animals such as mice and rats—creatures that can be easily manipulated to sort out each one of an experiment's variables and that, unlike people, can be dissected in the end to get an insider's view of the brain.

By the mid-1990s, researchers began to get answers. Preliminary studies indicated that when lab animals exercise, their nerve cells release chemicals called neurotrophic factors. These proteins buffer nerve cells against illness or injury, prompt them to grow and multiply, and strengthen each neuron's connection with other nerve cells.

Out of the variety of neurotrophic factors released during exercise, however, scientists found that one in particular stood out: brain-derived neurotrophic factor, or BDNF. This protein seems to act as a ringleader, both prompting brain benefits on its own and triggering a cascade of other neural health–promoting chemicals to spring into action.

"I think of BDNF as brain fertilizer. It's thrilling to see what it does to cells in culture," says Carl Cotman, a neuroscientist at the University of California, Irvine. Sprinkling a dilute solution of BDNF onto neurons in a lab dish makes the cells "grow like crazy," he adds. The cells sprout branches prolifically and extend them rapidly.



LET'S GET PHYSICAL Knowing what BDNF can do to neurons in the lab, researchers wondered whether the BDNF that exercising animals produce has similar effects on neurons in their brains. If so, could these physical effects translate into behavioral ones, making the animals learn quicker and better?

In 1999, Fred H. Gage of the Salk Institute in La Jolla, Calif., and his colleagues, including Salk's Henriette Van Praag, began exploring these questions. They studied two groups of healthy mice housed individually in cages that were identical except for one detail: One group of mice had running wheels.

"The mice just love [the wheel]. They run on it as soon as you put it in their cages," says Van Praag. "If you let them run as much as they want, they run all night long."

Over the next several weeks, the researchers kept track as the runners voluntarily racked up an average of 4 to 5 kilometers on their wheels every night. The scientists then tested

whether the groups differed in how quickly each mouse solved a popular learning test known as the Morris water maze.

Although both groups of mice swam at about the same speed, Gage and his colleagues noticed that the runners learned the location of a platform hidden under the maze's opaque water significantly sooner than their less-fit counterparts did.

Dissections showed that the runners had about twice as many new brain neurons as the sedentary mice did. When the researchers tested individual neurons isolated from both groups, they discovered that neurons taken from the runners showed greater signs of strengthened connections and cellular learning.

> "Locomotion played a very important role in evolution. Exercise had a direct action on brain regions related to cognition."
>
> — FERNANDO GÓMEZ-PINILLA, UNIVERSITY OF CALIFORNIA, LOS ANGELES

In a related study published in 2004, Gage's team teased out the molecular factors responsible for the behavioral effects that come with exercise. The researchers provided a group of rats with running wheels and compared them with rats without access to the wheels. On average, the runners voluntarily racked up an astounding 48 km per day over the next several weeks.

When they dissected the rats' brains, Gage's team found changes similar to those that they'd seen in the previous study's mice: The runners had more new neurons and stronger connectivity, which is evidence of learning, than did the rats that didn't have running wheels. After examining the messenger RNA of both groups, an indicator of gene expression, the researchers found that the running rats had consistently higher activity in the gene that codes for BDNF than the nonrunners did.

Gómez-Pinilla and his colleagues added more evidence that BDNF is a primary source for the behavioral benefits of exercise. Like Gage's group, Gómez-Pinilla's team worked with rats that were either sedentary or had access to a running wheel. After a week, some members of each group began receiving daily injections of a drug that blocked the action of BDNF. The rest of the animals were injected daily for several days with a chemical called cytochrome-C, which isn't known to cause any physical or behavioral effects.

The researchers then tested all the animals on the Morris water maze. While runners receiving cytochrome-C excelled at the test, runners that received the chemical that blocked BDNF performed only as well as the sedentary mice did. Performance by the nonrunners was about the same, regardless of which injection they received. "If we block the action of BDNF, we block learning and memory," concludes Gómez-Pinilla.

KEEP ON MOVING With mounting evidence of what exercise and its associated BDNF can do for healthy animals, researchers speculated that a similar mechanism could benefit animals and people stricken with neurological disease or injury. For example, in the April 27, 2005 *Journal of Neuroscience*, Cotman and his colleagues suggested that exercise could slow the progression of Alzheimer's disease.

In the study, Cotman's team worked with mice that were genetically predisposed to develop an Alzheimer's-like disease. When they're a few weeks old—that's young adulthood in mice—the rodents' brains start accumulating a protein known as beta-amyloid. In the brains of people with Alzheimer's, this protein surges to form thick plaques that are one of the hallmarks of the disease.

As in other exercise-related studies, Cotman housed Alzheimer's-prone mice individually in cages, some of which were equipped with running wheels. At the start of the experiment, the animals were around 1 month old. Alzheimer's-like symptoms "had barely started by then," says Cotman.

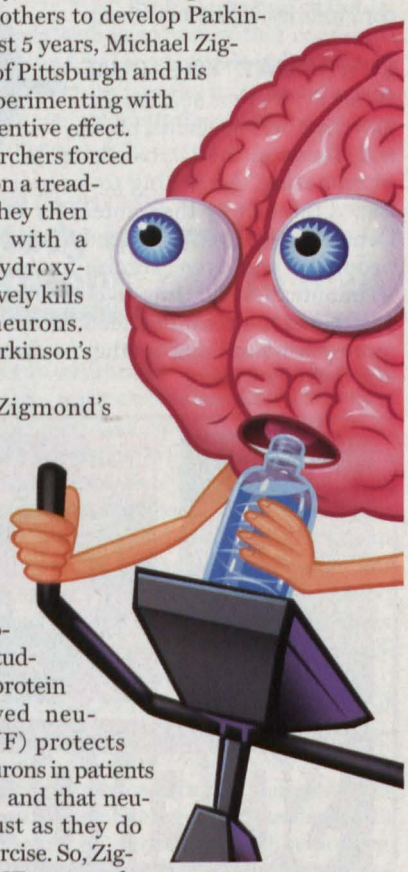
After 5 months, the researchers tested the animals in the Morris water maze. As in the earlier studies, the exercisers fared significantly better on that memory test than the sedimentary mice did.

However, in the "really exciting" part of the study, says Cotman, he and his colleagues dissected the animals' brains at 6 months of age to measure the beta-amyloid. They were surprised to find about half as much accumulation of the substance in the runners as in the nonrunners.

Cotman says that his team hasn't figured out how exercise reduces the buildup of amyloid-beta. But regardless of the mechanism, he notes that his results suggest that physical activity could eventually fight early Alzheimer's disease.

Exercise also shows promise in preventing Parkinson's-like symptoms from developing in animal models of that disease.

Surveys of lifestyle and health have suggested that people who exercise moderately, such as walking an hour each day, are less likely than others to develop Parkinson's disease. For the past 5 years, Michael Zigmond of the University of Pittsburgh and his colleagues have been experimenting with rats to explain this preventive effect.



In one study, the researchers forced healthy rats to exercise on a treadmill daily for a week. They then injected the animals with a chemical called 6-hydroxydopamine, which selectively kills dopamine-producing neurons. These cells also die in Parkinson's disease patients.

After several days, Zigmond's team examined the animals' brains. Compared with rats that received 6-hydroxydopamine but hadn't worked out on the treadmill, the exercisers lost fewer dopamine-producing neurons. Earlier studies had suggested that a protein called glial cell–derived neurotrophic factor (GDNF) protects dopamine-producing neurons in patients with Parkinson's disease and that neurons produce GDNF, just as they do BDNF, in response to exercise. So, Zigmond proposes that GDNF protected brain cells in the rats that exercised. He described his team's findings at the Society for Neuroscience meeting in October 2005 in Washington, D.C.

Researchers are also exploring physical activity as a way to treat neurological injuries, such as spinal cord damage. Although physical therapists have long helped patients regain some function by moving individual limbs affected by neurological damage, they have typically considered a patient with paralysis from the waist or neck down too damaged to rehabilitate.

"When you're told to go home and sit in a chair, your body doesn't get the feedback that comes from physical activity," says John MacDonald, director of the International Center for Spinal Cord Injury at the Kennedy Krieger Institute in Baltimore. He developed exercise programs for Christopher Reeve as part of the late actor's therapy after his paralysis.

Without the neurotrophic factors produced in response to

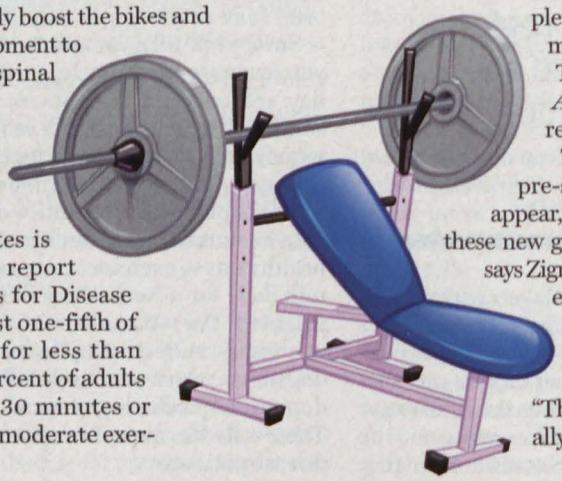
DEAN MACADAM

physical activity, MacDonald hypothesizes, the nervous system fails to establish connections between damaged neurons and grow new ones.

To alleviate this problem, MacDonald and his colleagues came up with a way for people with extensive paralysis to exercise. The researchers started with exercise bikes that had been equipped with electrodes that stimulate a patient's muscles to pedal. Heavy versions of these electrical-stimulation bikes had been used in physical therapy years ago, but their expense and inconvenience had made them fall out of favor. MacDonald worked with the bikes' manufacturer to design models light enough for patients to use at home.

In a recent study, 24 people who had been paralyzed for an average of 5 years used the special bikes three times a week. Another 24 participants only stretched. After 2 years, 40 percent of the exercisers had regained some motor function, compared with only 4 percent of the other patients.

More research could eventually boost the bikes and similar assisted-movement equipment to become standard therapy for spinal cord injuries, says MacDonald.



LONG MAY YOU RUN

While evidence is soaring for exercise's brain benefits, physical fitness in the United States is plummeting. According to a report issued recently by the Centers for Disease Control and Prevention, almost one-fifth of people 18 and over exercise for less than 10 minutes a week. Only 46 percent of adults performed the recommended 30 minutes or more of brisk walking or other moderate exercise 5 days a week.

Whereas public health experts worry about the effects of a sedentary lifestyle on rates of heart disease, diabetes, and other health problems, Gómez-Pinilla is concerned that a lack of physical exercise could also foretell a wave of decreasing brain health for the United States.

"Locomotion played a very important role in evolution. Animals had to move to find food and run away from predators. Exercise had a direct action on brain regions related to cognition," he says. "Normally, when two functions evolve in this way, you can't separate them."

But it's never too late to pick up an exercise program, according to psychologist David Albeck of the University of Colorado at Denver. Sedentary middle-aged and elderly rats placed on a walking program showed improvements in learning and memory, compared with sedentary rats of the same age, Albeck's team reported at the 2005 Society for Neuroscience meeting.

Furthermore, memory tests given to 1,740 people over 65 during a 6-year project have linked moderate exercise to reduced risk of dementia. These results were published in the Jan. 17 *Annals of Internal Medicine* by a Seattle research team.

That's yet another piece of good news for the pre-swimsuit season rush of exercisers that will appear, like clockwork, at gyms across the country. For these new gym rats, starting to exercise is a smart move, says Zigmond, but the smartest move will be to stick with exercising for years to come.

"If somebody were to stop me in the street and ask me what to do, I wouldn't have any problem telling them to exercise," he says. "There are lots of reasons to exercise, and virtually no reason not to." ■

Next week, part 2: Diet and the brain.

DEAN MACADAM

OF NOTE

ENVIRONMENT

Finding dirty diesels

Diesel-fueled vehicles have gained notoriety for their oily carbon emissions. However, there's wide variability in how much of this soot any car emits. A new Dutch study finds that just 5 percent of cars—mostly diesel-fueled vehicles—account for 43 percent of tailpipe-soot releases.

Andy Kurniawan and Andreas Schmidt-Ott of Delft University of Technology analyzed soot emissions from more than 1,250 cars by using a device set up on the shoulder of the road. As long as cars were spaced at least 8 seconds apart, the device could suck in and determine a single vehicle's exhaust. In an upcoming *Environmental Science & Technology*, the researchers describe how the device works. By irradiating the carbon particles with ultraviolet light, the device imparts a positive electric charge to them. It then measures the charge to quantify the soot, Schmidt-Ott explains.

Policy makers looking to reduce pollution may get the biggest bang for the buck by focusing on cars badly in need of a tune-up, Schmidt-Ott maintains. The chemical engineer recommends that municipalities begin scouting for "superpolluters," with devices such as the one that his group used. —J.R.

BIOLOGY

Transplant reroutes cells from sperm to eggs

Fish cells destined to become sperm can morph into eggs when transplanted into larvae, a new study shows.

Some fish species can switch from male to female either spontaneously or when treated with steroids. This knowledge led Goro Yoshizaki of the Tokyo University of Marine Science and Technology and his colleagues to wonder whether the gonads of male fish contain cells that might become either eggs or sperm.

From rainbow trout carrying a gene that makes their tissues glow green, Yoshizaki's team removed cells, called spermatogonia, that normally give rise to sperm. The researchers then transplanted these cells into fish larvae so immature that their gender wasn't yet known.

As the larvae matured into adult fish, the scientists found glowing green sperm, produced from the donor fishes' spermatogonia, in males. However, they also found glowing green eggs in females. When Yoshizaki and his colleagues fertilized these eggs with sperm from normal rainbow trout, they developed into healthy, fertile fish, the team reports in the Feb. 21 *Proceedings of the National Academy of Sciences*.

GENDER BENDER These rainbow trout were conceived from eggs that started as immature sperm.

Yoshizaki says that he and his colleagues don't yet know whether spermatogonia can become eggs in animals other than fish. However, his lab has done spermatogonia transplants between fish species, producing trout eggs and sperm in salmon. He suggests that scientists could use the technique to turn small fish species easily kept in captivity, such as mackerels, into brood fish for large, hard-to-keep species such as overfished bluefin tuna. —C.B.

CHEMISTRY

Membrane purifies gas

Researchers have synthesized a membrane that may purify hydrogen more efficiently than conventional chemical methods do.

The chemical reactions that produce hydrogen, used widely by the chemical industry, leave the gas contaminated with carbon dioxide, water, and hydrogen sulfide. Depending on the application, these impurities must be partially or completely removed, says Benny D. Freeman of the University of Texas at Austin.

Using membranes for hydrogen purification could require less energy than conventional methods do, Freeman says. Available membranes pass hydrogen into low-pressure chambers, leaving behind the contaminants. However, industry typically needs the gas at high pressures. The cost to recompress the gas has kept membranes from competing with conventional methods, he says.

Freeman and his colleagues devised a membrane that is permeable to the contaminating gases instead. The researchers used a polymer with chemical groups that attract the contaminants more strongly than they attract hydrogen. For example, this affinity increased carbon dioxide's permeability relative to hydrogen but wasn't so strong that it impeded the contaminant's movement through the membrane, says Freeman.

The researchers placed the membrane between two chambers at different pressures. They then fed the high-pressure side with a mixture of hydrogen and carbon dioxide at temperatures that match those used in other purification methods. At −20°C and 17 atmospheres of pressure, the membrane was 30 times as permeable to carbon dioxide as it was to hydrogen, the researchers report in the Feb. 3 *Science*. The hydrogen largely remained in the high-pressure chamber, while the carbon dioxide migrated into the low-pressure chamber.

Tests with gas streams that contained water and hydrogen sulfide indicated that the membrane was also more permeable to those contaminants than to hydrogen, says Freeman. —A.C.

HEALTH PHYSICS

Study upgrades protons' risk to DNA

Proton radiation—beams of hydrogen nuclei—causes worse breaks in DNA than researchers had expected, a study finds.

This radiation "will not be good for astronauts," says Betsy M. Sutherland of Brookhaven National Laboratory in Upton, N.Y. NASA funded her work to evaluate risks to travelers in space, where they will encounter proton radiation from the sun and exploding stars. The new findings, however, support the use of protons' cell-killing capability in cancer therapy.

Radiation can induce cancer or cause cell death by ripping DNA with a blast of energy. Because radiation sources vary greatly in their energy-release profiles, biologists rank them by their linear energy transfer (LET).

High-LET radiation, such as ionized iron particles, releases copious energy as it passes through cells. Often, it cleaves both strands of a DNA molecule, creating damage that cells find almost impossible to repair. In contrast, low-LET radiation, such as X rays, unloads little DNA-damaging energy as it zips through a cell. If an X-ray photon hits DNA, it typically cuts only a single DNA strand, a break that a cell can often repair.

Protons have a low LET, so scientists expected them to behave as X rays do in their DNA-damaging capability, notes Sutherland. "But they didn't," the radiation biologist says. "Their damage looked more like that of [heavy] charged particles, even though their LETs were wildly different."

OF NOTE

She and Megumi Hada extracted DNA from cells and irradiated it with different types of photon sources and charged particles. In the February *Radiation Research*, they report that protons create large numbers of predominantly double-strand DNA breaks. —J.R.

ENVIRONMENT

Species-aid budget looks fishy

State and federal governments spent $1.4 billion on programs in 2004 to conserve 1,260 of the nation's threatened and endangered species. One-third of those funds went to protecting fish, according to a U.S. Fish and Wildlife Service analysis, released last month.

The 219-page report states that nearly $800 million went for programs to conserve individual species. Nine of the top 10 expenditures—or $273.8 million—went for fish, including four Chinook salmon populations and two steelhead trout communities. Other animals in the top 10 species-by-species expenditures were the Steller sea lion, coho salmon, bull trout, sockeye salmon, red-cockaded woodpecker, pallid sturgeon, chum salmon, and right whale.

At $474.8 million, fish expenditures were roughly four times as great as the amount spent to protect birds or mammals and many more times as large as the amount spent for groups such as flowering species, insects, and the nation's vanishing amphibians.

Almost $560 million went for support services, such as law enforcement and coordination of conservation programs. Another $60 million paid for new land acquisitions critical to preserving the habitat of endangered species. —J.R.

ASTRONOMY

Tiny planet orbits faraway star

Taking advantage of some gravitational sleight of hand, astronomers have found indirect evidence of the smallest planet known to exist beyond our solar system.

Just five times as heavy as Earth, the planet circles a red dwarf, a low-mass star. The planet orbits three times farther from its star than Earth does from the sun. Taking into account the planet's size and orbit, researchers estimate that the planet's surface temperature is 220°C, similar to that of Pluto.

Red dwarfs are the most common stars in the Milky Way. The new discovery therefore suggests that planets with masses such as Earth's may not be rare, says Kailash Sahu of the Space Telescope Science Institute in Baltimore. He and his colleagues report their finding in the Jan. 26 *Nature*.

ALMOST EARTH Researchers recently detected the smallest planet known to exist outside of our solar system. The newly found body is shown with its parent star in this artist's sketch.

To detect the planet, which lies about 20,000 light-years from earth astronomers relied on one of the stranger properties of gravity: It acts as a magnifying lens. When one star briefly passes in front of another, the foreground star amplifies the light of the background star. If the foreground star happens to have a planetary companion, researchers will see brightening over a longer period of time.

The team found that the brightening lasted about 12 hours longer than it would have if the foreground star had had no partner. The astronomers deduced that the passing red dwarf has a small planet orbiting it.

Researchers will have to wait for another chance alignment between stars to learn more about the planet. —R.C.

BEHAVIOR

Smart shoppers use unconscious tactics

Consumers make better decisions about major purchases if they heed the power of their unconscious minds, say psychologist Ap Dijksterhuis of the University of Amsterdam and his colleagues.

Conscious thinking enables a person to follow precise rules using small amounts of information, the researchers say. Unconscious thinking, or deliberation without directing one's attention to the choice at hand, permits detection of critical patterns in a mass of information, Dijksterhuis' team asserts in the Feb. 17 *Science*.

In one experiment, 80 college students read information about four made-up cars. Each car was described by 4 or 12 attributes, including whether it handled well and got good gas mileage. One car had mainly positive attributes, one had mainly negative ones, and two had even numbers of both.

When grappling with 12 attributes per automobile, students who were given 4 minutes to think about the cars and make a choice frequently didn't choose the best vehicle and immediately afterward said they were dissatisfied with the decision. Students who first spent 4 minutes completing the distracting task of solving anagrams usually chose the best cars and felt satisfied with the decision.

When volunteers had to consider only four attributes for each car, however conscious thinking proved slightly superior to unconscious deliberation.

Another experiment focused on 27 people making major purchases at a furniture store and 27 others buying inexpensive items at a department store. Those who reported having thought only a little about specific furniture to buy before shopping were much happier with their choices a few weeks later than were those who said that they had thought a lot about what to buy before shopping.

The reverse characterized the department store customers. —B.B.

BIOMEDICINE

Saw palmetto flunks prostate exam

An herbal supplement used by 2.5 million men in the United States has failed to outperform a dummy capsule when taken for urinary problems.

Some men treat themselves for enlarged prostate glands by taking saw palmetto extract, which is derived from the berries of the North American scrub palm (*Serenoa repens*). The condition, called benign prostatic hyperplasia (BPH), squeezes the urethra, making urination difficult and frequent. Symptoms include a need to get up at night to urinate.

Several earlier studies showed that although saw palmetto didn't shrink the prostate, it eased urinary symptoms somewhat. In one study, it relieved symptoms as well as did the drug finasteride, which doctors prescribe for BHP under the brand names Propecia and Proscar.

But in the Feb. 9 *New England Journal of Medicine*, scientists report that 112 men with BPH who took two capsules of saw palmetto extract daily for a year still had symptoms similar to those reported by 113 men with BPH who took inert capsules. The men weren't told the contents of their capsules during the trial.

The active ingredient in saw palmetto is unknown, and preparations vary in content. That makes it hard to know whether these new results apply to all saw palmetto supplements, says study coauthor Stephen Bent, an internist at the Veterans Affairs Medical Center in San Francisco.

Nevertheless, the new study "tips the scale back toward uncertainty" about saw palmetto, he says. —N.S.

Books

A selection of new and notable books of scientific interest

AMAZING LEONARDO DA VINCI INVENTIONS YOU CAN BUILD YOURSELF

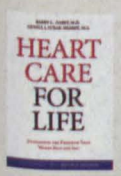
MAXINE ANDERSON

Leonardo da Vinci, painter of the "Mona Lisa" and "The Last Supper," was a great artist, but he was also a great inventor. Famous are his sketches for curious flying machines. Less so are his designs for such things as shoes that could walk on water and the first monkey wrench. This educational guide gives children age 9 and up hands-on experience, using materials found readily around the house, with some of Leonardo's inventions. Anderson provides an introduction to the Italian Renaissance as well as a brief biography of Leonardo and a time line chronicling his achievements. Then, the author details Leonardo's various inventions, including the master's sketches. She then provides easy-to-follow instructions for creating one's own version of the invention. ***Nomad Press VT, 2006, 144 p., b&w illus., paperback, $14.95.***

HEART CARE FOR LIFE: Developing the Program That Works Best for You

BARRY L. ZARET AND GENELL J. SUBAK-SHARPE

Millions of people in the United States annually experience heart disease, from high blood pressure to heart attack, stroke, and sudden cardiac death. Addressing these problems, which typically develop over a lifetime, involves both lifestyle changes and medical interventions. Zaret, a cardiologist at Yale University School of Medicine, and coauthor Subak-Sharpe, a medical writer, explain the need for individualized treatments for people with heart diseases. The authors review risk factors for heart disease, including age, race, ethnic background, obesity, diabetes, and high cholesterol. They recommend various lifestyle changes for the prevention of heart disease, including regular exercise, dieting, stress reduction, and smoking cessation. Heart patients can find detailed descriptions here of the medical treatments they're likely to undergo for their particular conditions. That information includes recent advances in heart disease treatment targeted to elderly people, women, athletes, and adults with congenital heart conditions. ***Yale, 2006, 304 p., hardcover, $26.00.***



THE ORACLE: The Lost Secrets and Hidden Message of Ancient Delphi

WILLIAM J. BROAD

The Oracle of Delphi was a real figure in Greek history, bestowing advice and prophecy to multitudes of men on matters as diverse as marriage and war. Both Socrates and Plato sought her counsel. The oracle was not just one person but a series of priestesses who passed on their secret knowledge from woman to woman and whose power and influence were unprecedented in misogynistic Greek society. The mysteries surrounding the oracle's influence have fascinated archaeologists and historians for centuries. Broad, a writer for the New York Times, examines the scientific research and theories behind the oracle's legend. For instance, he probes the eyewitness account by Plutarch of the oracle entering a vapor-induced trance before making her prophetic statements. Did the ancient temple of Delphi lie atop some sort of gas-filled chasm? Though excavations by French researchers in the 1950s seemed to debunk this claim, subsequent findings gave it new credence. Broad follows geologists to the flanks of Mount Parnassus in search of a gas vent and describes an astonishing find: a fault similar to the one in ancient descriptions of the temple at Delphi. ***Penguin, 2006, 336 p., b&w photos and illus., hardcover, $25.95.***

HOW FAT WORKS

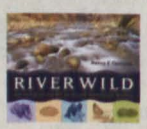
PHILIP A. WOOD

The obesity epidemic striking industrialized nations has led to a renewed research focus on the physiological causes and effects of excess fat in the body. Scientists are striving to understand how fat is metabolized and how excess fat leads to diseases such as diabetes. Wood, a metabolic geneticist at the University of Alabama at Birmingham, outlines his and others' recent findings on such topics. Much of that research uses mice engineered to lack certain genes that control the buildup of fat. Using these animal models of obesity, scientists have learned much about how cells both store fat and secrete hormones that regulate a person's appetite and activity levels. Wood describes how discoveries in these areas are explaining disorders of metabolism, cholesterol processing, and insulin activity. The book explores the merits of various dietary approaches, exercise, and lipid-lowering drugs. ***Harvard, 2006, 272 p., b&w illus., hardcover, $35.00.***

RIVER WILD: An Activity Guide to North American Rivers

NANCY F. CASTALDO

This engaging guide to rivers helps children understand the importance of these waterways to both wildlife and people. Rivers such as the Hudson, Rio Grande, and Mississippi have played important roles in American history, explains Castaldo, a former environmental educator. She starts, however, with the basics, instructing her young readers about water evaporation, precipitation, and flow. The first project in the book is to "create your own river" out of rocks, sand, and a pitcher of water. Interspersed with activities are descriptions of at least 25 North American rivers. For most of these, a simple table lists length, watershed size, major tributaries, and cities served. River animals are a focus of the book, which includes features on beavers, the American alligator, and the many species of birds that rivers are home to. Castaldo provides instructions for 30 games, activities, and experiments that relate to rivers, such as how to pan for gold, make a rain gauge, and hunt for fossils. ***Chicago Review Press, 2006, 144 p., b&w illus. and photos, paperback, $14.95.***



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LETTERS

A squirt could hurt

The fine piece about invasive sea squirts ("Squirt Alert," *SN: 12/24&31/05, p. 411*) states that the critters maintain an unappetizing surface pH of 2. Does this make these mats harmful to touch?

ANDREW J. DOLSON, RICHMOND, VA.

Robert Whitlatch of the University of Connecticut, who grows Didemnum *in the lab, says it's fine to handle for short periods of time, "though I wouldn't attempt to taste/eat them, lick your fingers, or rub your eyes after you've been handling them."* —J. RALOFF

Spirited exchange? You got it

Presumably, you were attempting to be funny in "Irreplaceable Perplexity 101: Ms. Cleary has designs on teaching evolution" (*SN: 12/24&31/05, p. 414*), but the bias was too obvious, straight out of the anti–intelligent design talking points. Instead of ridicule, could we get a spirited exchange from the best minds on both sides?

DAVID F. COPPEDGE, NEWHALL, CALIF.

While I'm extremely skeptical of the claims that some intelligent design (ID) proponents make about evolution, practically everything I see about ID is highly politicized (including this article). Finding a nugget of information in this hype I find nauseating. If you can find someone who can write a clear explanation of how the ID technique works and has been effectively applied outside the field of biology, I would appreciate it.

DAVID FOSS, SOLON, OHIO

Your article states, "but religions answer big questions that nearly everyone asks about our connection to the universe and the meaning of our lives." You just threw in the towel by even suggesting that people can actually get answers from their religion about their connection to the universe and the meaning of their lives.

KAREN SPENCE, CAMBRIDGE, MASS.

While entertaining, Ms. Cleary misses a crucial point. Creationism and intelligent design fail as science for a fundamental reason: They both require miraculous or magical events to explain the existence of things in our natural universe.

VIRGIL H. SOULE, FREDERICK, MD.

Actually, taken as a whole, the article seems to support the teaching of intelligent design and making fun of evolution.

DUANE STEINER, RIDGECREST, CALIF.

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This unique LCD screen allows you to take pictures that are virtually impossible to take with other digital cameras. You can take pictures the standard way with the LCD screen on the back of the camera or just flip out the special 180° LCD screen and you can take pictures of yourself for a self portrait, as well as pictures of you WITH your family and friends.

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The Bell+Howell® camera is almost as small as a credit card — so small you can slip it in your shirt pocket (measures about 3⅞" x 2⅜" x 1⅛" slim). Yet it comes with 16MB of built in flash memory to store up to 160 photographs, depending on resolution. Build a lifetime of memories by using the camera's SD memory card slot for removable high-MB memory cards.

Don't run out of batteries

No more expensive hard to find batteries that other digital cameras require. This camera uses ordinary alkaline AA batteries as well as rechargeable AA batteries. So you won't run out of power at an important meeting, get together or on vacation.

Works as a Camcorder & Voice Recorder

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