SCIENCE NEWS

THE WEEKLY NEWSMAGAZINE OF SCIENCE

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Cover Scientists today can observe the shapes and speeds of shock waves on a grander scale than ever before. This image, taken as a .22-caliber marksman's pistol fired, reveals the spherical shock wave that emanates from the muzzle. (G. Settles/ Pennsylvania State Univ.) Page 218

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See Blind Mice

Algae gene makes sightless eyes sense light

Scientists have prompted mouse-eye cells that aren't normally light sensitive to respond to light. This strategy could lead to new treatments for retinitis pigmentosa and related diseases, which cause blindness in 1 in 3,000 people worldwide.

These diseases occur when the retina's light-sensing cells die. Called rods and cones, these cells—when healthy—convert light into an electrical signal. That signal then passes to nearby cells and eventually reaches the brain, where it's interpreted as vision. If rods and cones die, they aren't replaced.

To restore vision in people who have lost these cells, scientists have suggested several strategies, such as growing rods and cones from stem cells or replacing them with synthetic chips that sense light. But so far, these approaches face myriad challenges.

The new work took a gamble on some preliminary findings that indicated that other cells in the retina continue to function after the rods and cones die. These spared cells include inner retinal neurons, nerve cells that process information from rods and cones before sending it to the brain.

"We came up with the idea that if we can convert these neurons into light sensors, then that might be a way to restore vision," says Zhuo-Hua Pan, a neuroscientist at Wayne State University School of Medicine in Detroit.

To do this, Pan and his colleagues borrowed a gene from green algae. It codes for a light-sensing protein, called channelrhodopsin-2 (ChR2), that forms on algal cell surfaces. Algae use this protein to detect light, which they swim toward to maximize photosynthesis.

The researchers inserted the *ChR2* gene into a harmless virus and then let the virus infect the eyes of healthy mice. Individual inner retinal neurons that carried the light-sensing algal gene generated an electric current when Pan's team shined light on them.

Next, the researchers worked with mice that were genetically predisposed to lose all their rods and cones by a few months of age. The team infected the eyes of blind adult mice with the viruses carrying the *ChR2* gene, and the inner retinal neurons became sensitive to light.

To see whether the electrical signal generated by these cells made it all the way to the brain, Pan and his colleagues inserted electrodes into the brain area that processes sight. When they shined a light on the rodents' eyes, the researchers saw an electrical response. Pan's team reports these results in the April 6 *Neuron*.

Although the light-generated signals reached the brains, Pan notes that it's not yet possible to say whether the blind animals could then see. The genetic condition that affects the mice kills the majority of the rods and cones before a newborn opens its eyes. Because vision is shaped by experience, Pan says, the rodents' brains may not interpret these signals as sight. He and his team plan on developing tests for sight in other animal models for future experiments.

Nonetheless, these preliminary findings offer a novel approach to treat blinding diseases, neuroscientists John G. Flannery and Kenneth P. Greenberg of the University of California, Berkeley note in a commentary accompanying the new report. The study is "clearly a significant first step into this new field of re-engineering [inner retinal neurons] as genetically modified 'prosthetic' cells," they say. —C. BROWNLEE

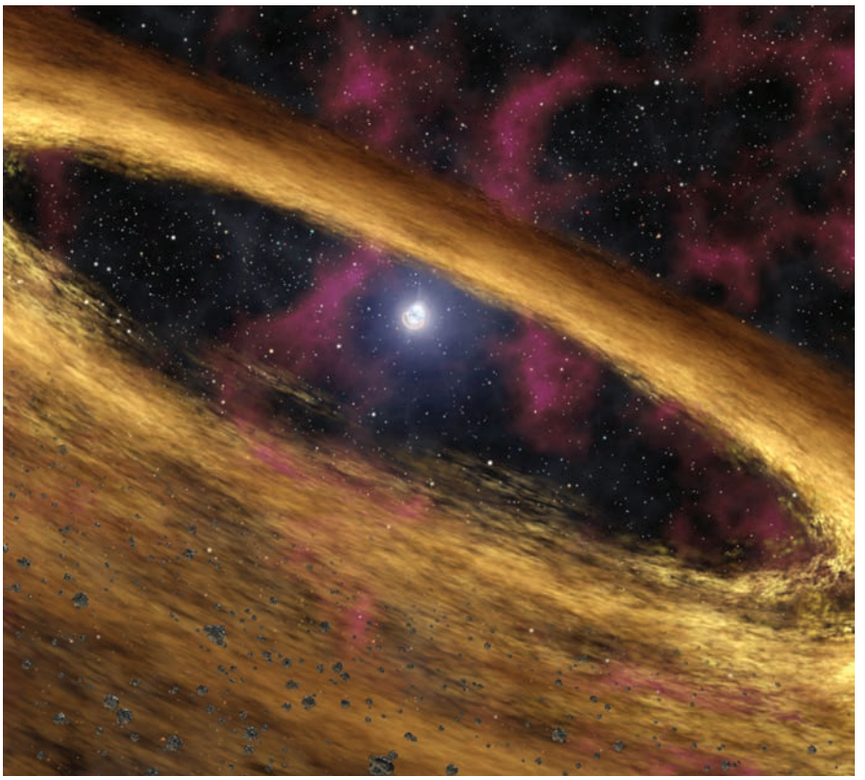
Ring around the Pulsar

Planets may form in a harsh environment

Astronomers over the past 2 decades have discovered several hundred planet-forming disks around young, ordinary stars. But now, researchers report evidence of one of these rings of debris in a most unlikely place—circling the ultradense cinder of a star that died in a supernova explosion.

The finding suggests that these stellar blasts might create an environment in which planets can coalesce. The presence of the disk may also shed light on the still poorly understood events that trigger supernova explosions.

Researchers found the disk around a rapidly rotating neutron star, the dense core left behind when a star 8 to 20 times as massive as the sun collapses under its own weight and explosively ejects its outer layers. This particular core, known as an anomalous X-ray pulsar, broadcasts X rays of high intensity.



CHAKRABARTY ET AL., JPL/NASA

SUPERDISK A disk of rubble and gas, possibly capable of forming planets, surrounds a pulsar known as 4U 0142+61, in this artist's concept. The pulsar lies about 13,000 light-years from Earth.

This radiation heats the surrounding gas and dust, causing it to glow at infrared wavelengths. The Spitzer Space Telescope, which orbits Earth, detected the infrared radiation. Although Spitzer lacks the resolution to create an image of the disk, the pattern of light that the telescope recorded provides the first clear evidence of a disk around an exploded star, says codiscoverer Deepto Chakrabarty of the Massachusetts Institute of Technology. The disk contains about 10 times as much mass as Earth, he and his collaborators report in the April 6 *Nature*.

Although pulsars emit large amounts of high-energy radiation, creating a harsh environment, the new disk nonetheless resembles those found in milder conditions around young, planet-forming stars, Chakrabarty says.

The finding rounds out a 14-year-old puzzle about planet formation outside the solar system, says Charles Beichman of NASA's Jet Propulsion Laboratory in Pasadena, Calif. In 1992, researchers analyzing radio signals from an elderly pulsar announced that they had found evidence of three unseen planets around the dense body (*SN: 1/11/92, p. 20*). Those planets might have formed in a disk that dissipated over the pulsar's lifetime, estimated at a billion years.

The disk discovered by Chakrabarty and his colleagues surrounds a pulsar that's only about 100,000 years old. That's around the time when planet formation around any star is likely to begin, notes Beichman. Taken together, the 1992 discovery and the new finding provide information on some of the early and late steps in planet formation around pulsars.

But how does an exploded star create a disk in the first place? More than a decade ago, Stan Woosley of the University of California, Santa Cruz and his colleagues proposed that when a massive star explodes, it doesn't always have enough oomph to permanently shed all its outer layers. Some of the ejected material would then fall back toward the exploded star.

Most of that material would spiral onto the pulsar, but a small amount could end up as a swirling disk like the one now detected by the Spitzer telescope, notes Woosley.

The disk confirms that fallback is a feature of supernovas, Woosley says. Fallback could build up both the spin and the mass of a pulsar. That's important because the extra rotation could power gamma-ray bursts, extraordinarily energetic outpourings of radiation that have been linked to some supernovas, he adds.

Woosley says that the extra mass might also transform a pulsar into an even more exotic object, a black hole. —R. COWEN

Wired Viruses

New electrodes could make better batteries

With the aid of a bacteria-infecting virus, researchers have engineered cobalt oxide-and-gold nanowires that can be used as electrodes for lithium-ion batteries. The work could lead to thin and flexible power sources, the scientists say.

Angela M. Belcher of the Massachusetts Institute of Technology and her colleagues work with a virus called M13. It's 880 nanometers long, 6 nm wide, and coated with a few thousand identical proteins.

Belcher's group previously engineered the virus to serve as a scaffold to make nanoscale semiconducting wires (*SN: 1/17/04, p. 46*). In the new work, the researchers used the virus to create wires of different materials suitable for electrodes in batteries.

The team added a peptide to the M13 virus' coat protein. The peptide binds to cobalt, which, in its oxidized form, has more energy-storage capacity than does the carbon in the negative electrodes, called anodes, used in commercial batteries.

After growing millions of copies of the engineered virus, the researchers incubated them in a solution of cobalt chloride and then put the cobalt-bound virus in another solution to oxidize the metal. With this process, "you can grow these really beautiful nanowires," says Belcher.

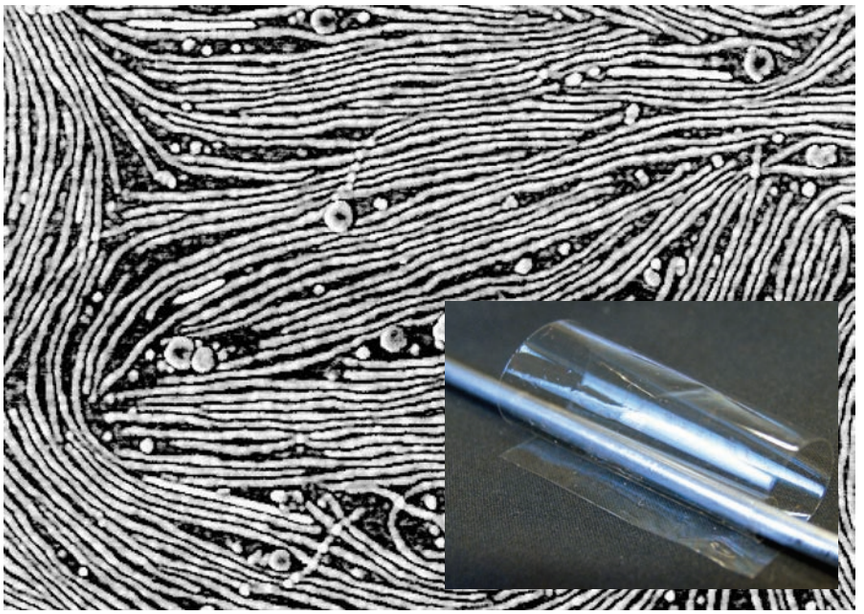
The team tested the wires as the anode in an experimental battery. They found that the cobalt oxide anode has about twice as great a storage capacity as a traditional carbon-based anode does.

Next, Belcher and her colleagues set out to improve the anode's performance. They engineered the coat of the cobalt-grabbing virus to incorporate another peptide—one that binds to gold. The new hybrid anodes, made of cobalt oxide and gold, had 30 percent more storage capacity than the cobalt oxide anodes, the researchers report in an upcoming *Science*.

The strategy of designing a virus to attract different metals is one of the "astounding" features of this work, says Trevor Douglas, a materials chemist at Montana State University in Bozeman. "We want to be able to design complex composite materials [because] it's unlikely that a single type of material will give you all the properties you want," he says.

In the final part of their study, Belcher and her colleagues constructed a prototype battery by painting a layer of the virus wires onto a polymer film. In this case, the wires served as the battery's positive electrode, or cathode, and the researchers used lithium on the other side of the film as the anode. Incorporating virus-based electrodes into flexible films, which can be 100 nm to a few micrometers thick, could lead to batteries "that take the shape of what you want to power," says Belcher.

Her group is now working on virus-produced cathodes and plans to test other electrode and polymer materials in a prototype system. —A. CUNNINGHAM



NO CAN SEE An atomic-force microscope image shows the layer of viral nanowires that sits atop a roughly 1-micrometer-thick polymer film (inset) that can act as a flexible battery.

BELCHER

Polyp Stopper

Controversial drug may prevent colon growths

An anti-inflammatory drug currently prescribed for arthritis and pain can prevent formation of precancerous growths in the colon and rectum, two analyses suggest. The drug might be especially valuable for people at high risk of developing these kinds of polyps, the data show.

However, regulatory clearance of the drug, called celecoxib, for cancer prevention is far from assured. Two nearly identical trials began in 1999 and 2001 but were stopped in 2004 when more than the expected number of participants developed heart problems while taking the drug, a COX-2 inhibitor.

Pfizer, which markets the drug under the name Celebrex, funded one of the two trials. Since 2005, the company has been required to sell celecoxib with a warning label about its heart risks.

The two research teams identified 3,596 people who had had precancerous colorectal polyps removed during a colonoscopy. The scientists then randomly assigned 2,289 of these participants to take daily celecoxib pills. The others received placebos.

After 3 years, the two teams performed follow-up colonoscopies on roughly three-fourths of the participants. The researchers reported their analyses at a meeting of the American Association for Cancer Research in Washington, D.C., this week.

Celecoxib reduced the number of new polyps. In the two studies, 49 and 61 percent of people taking a placebo developed at least one precancerous polyp during the 3 years between colonoscopies, whereas the proportions of people taking the drug and developing polyps were 34 and 40 percent in the respective studies.

Celecoxib reduced the recurrence of the polyps most dramatically in people whose initial colonoscopies had revealed numerous or large polyps, says gastroenterologist Nadir Arber of the Tel-Aviv Sourasky Medical Center, who presented one of the studies.

"We're very confident" that celecoxib prevents polyps, says oncologist Monica M. Bertagnolli of Harvard Medical School and Brigham and Women's Hospital in Boston, who presented the other of the two new studies. Regarding the drug's safety, she says, "it would be misleading to say we know the answer."

Ernest T. Hawk, an oncologist at the National Cancer Institute in Bethesda, Md., who coauthored the study with Bertagnolli, says that the findings represent "an extremely promising start" to establishing celecoxib as a cancer preventive.

Raymond N. DuBois, a physician and cancer biologist at Vanderbilt University Medical Center in Nashville who didn't participate in the studies, notes that the anticancer effect of celecoxib in the trials was greater than that previously shown for aspirin.

He also says that many of the people who experienced heart problems while taking celecoxib were already at high risk of having such problems. In practice, such patients might be prevented from getting the drug, DuBois says.

Pfizer is currently funding a study to pin down the cardiovascular side effects of the drug. Researchers are monitoring 20,000 people taking celecoxib or other anti-inflammatory drugs, such as ibuprofen or naproxen, for arthritis. —N. SEPPA

Mystery Drilling

Ancient teeth endured dental procedures

Welcome to a time so long ago that people with no dental insurance still could get their teeth drilled, and perhaps filled. Flint-wielding specialists performed the work between 9,000 and 7,500 years ago. A total of 11 teeth from nine adults who lived during that period contain holes drilled with sharpened flint points, according to a new report.

The teeth came from residents of a prehistoric farming village called Mehrgarh in what is now Pakistan.

These discoveries represent the earliest known examples of dental work, say Roberto Macchiarelli of the University of Poitiers in France and his colleagues. Drilling occurred in cheek teeth, indicating that the dental alterations weren't intended for display or decoration, the scientists contend.

Four teeth exhibit decay near drilled holes, Macchiarelli's team says in the April 6 *Nature*. Three drilled teeth came from the same individual, and another tooth was drilled twice. Intriguingly, no instance of drilling has been found in teeth from a 6,500-year-old cemetery at the same site.

"We have no idea why the practice [of tooth drilling] disappeared at that time," says anthropologist and study coauthor David W. Frayer of the University of Kansas in Lawrence. "In fact, we're not sure why it was done in the first place, since less than half of the drilled teeth had [decay]."

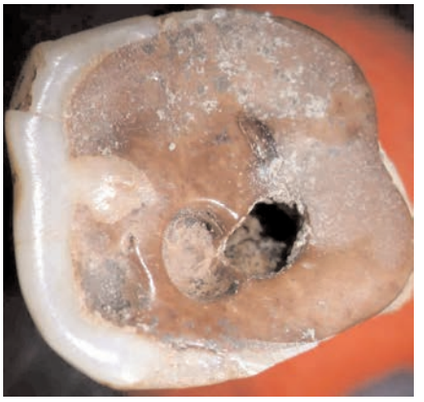
Drilled holes in the Mehrgarh teeth were 1.3 to 3.2 millimeters in diameter with a depth of 0.5 to 3.5 mm. Edge smoothing indicates that drilling was performed on living individuals whose continued chewing caused further dental wear.

Some type of filling may have been placed in drilled holes, which would have exposed sensitive tooth areas, the researchers suggest. The researchers haven't yet identified filling traces on any of the teeth.

Analyses with a scanning electron microscope and a computerized-tomography scanner identified concentric ridges on the inside walls of the holes in the teeth. Macchiarelli's group regards these marks as products of prehistoric drilling tools.

Ancient inhabitants of Mehrgarh attached sharpened flint to wooden rods and used the instruments to fashion beads out of shell, turquoise, and other materials. "Presumably, know-how developed by skilled artisans for bead production was transferred to drilling teeth in a form of [early] dentistry," Macchiarelli says.

Wielding a flint-tipped model of the prehistoric tools, members of Macchiarelli's team drilled holes in cheek teeth on a modern human jawbone at a rate of about one per minute.



MACCHIARELLI AND L. BONDIOLI

PENETRATING FIND **A drilled hole looms large on the chewing surface of this tooth discovered at an ancient farming village.**

Since some of the drilled teeth also had cavities, "it's not a stretch to suggest it might have been early dentistry," remarks anthropologist David DeGusta of Stanford University. DeGusta and his colleagues have examined a 1,000-year-old Native American jawbone that contains a tooth with a hole drilled at the site of gum disease.

Anthropologist John R. Lukacs of the University of Oregon in Eugene calls the relatively small holes in the Mehrgarh teeth "unusual and somewhat enigmatic." He awaits further analysis to confirm the existence of ancient dentistry. —B. BOWER

A Shot against Pandemic Flu

Vaccines would play pivotal role in response

Mass vaccination should be the linchpin of the U.S. response to an influenza pandemic, new computer simulations suggest. Other

measures, including treating people with antiviral drugs, closing schools, and restricting travel, could slow the spread of the virus but would be unlikely to halt an outbreak of a highly contagious flu, say the government-funded researchers who conducted the simulations.

In another development, doctors announced last week that, for the first time, an experimental vaccine appears to protect some people against the H5N1 avian flu (*SN: 9/10/05, p. 171*). Other vaccines are undergoing tests against that lethal virus, which currently doesn't spread among people. But scientists predict that the avian-flu virus could someday give rise to a fast-spreading strain against which people would have less immunity than they do to a typical winter flu.

In the computer study, Timothy C. Germann of Los Alamos (N.M.) National Laboratory and his colleagues simulated how a pandemic flu would spread among 281 million U.S. residents. Even if vaccination gives people only partial immunity to a pandemic strain, widespread flu shots would be the single most effective response, the researchers report in the April 11 *Proceedings of the National Academy of Sciences*.

Use of antiviral drugs would reduce the scale of the outbreak if the virus weren't highly contagious. But if the flu spread readily, demand for the drugs would quickly outstrip the nation's supply.

Closing schools, restricting travel, and imposing other "social-distancing" measures being considered would slow the outbreak, potentially buying time for scientists to tailor a vaccine that has maximum efficacy against the pandemic strain, the researchers predict. But by themselves, those measures would have only a small effect on the number of people eventually infected, Germann says.

In the new vaccine study, 54 percent of the volunteers who got two high-dose shots a month apart had a strong immune response, which scientists expect to be protective against avian flu. Lower doses were less effective at stimulating immunity, and a single shot of any dose produced little measurable effect.

Ensuring that each vaccinated person gets a second shot might be difficult during a pandemic, says John J. Treanor of the University of Rochester (N.Y.) Medical Center. He led the vaccine study, which included 451 volunteers. It appears in the March 30 *New England Journal of Medicine* (*NEJM*).

The high dose needed to trigger a strong immune response suggests that the world's vaccine manufacturers probably could produce enough vaccine for only 75 million people a year, comments Gregory A. Poland of the Mayo Clinic College of Medicine in Rochester, Minn. For each year's winter flu worldwide, vaccine makers can produce enough doses for 900 million people, he notes in the same issue of *NEJM*.

Treanor says that his team and other groups are testing alternative vaccination methods, including adding ingredients that might stretch the number of effective doses.

For their simulations, Germann and his colleagues assumed that 250 million doses would be distributed in the United States during a 6-month pandemic. The Department of Health and Human Services currently has enough of the experimental vaccine to treat 4 million people at the highest dose used in the study. —B. HARDER

Building a Bladder

Patients for the first time benefit from lab-grown organs

The humble bladder is now the world's first bioengineered internal organ to work in people. Several years after surgery, seven young patients who received lab-grown bladders are doing just fine, according to a new report.

"Bladders are a complex organ," and bladder tissue is difficult to replace, says urologist Anthony Atala of Wake Forest University Baptist Medical Center in Winston-Salem, N.C.

A bladder acts as a muscle to expel its contents, while having "natural elasticity" that limits fluid pressures on the bladder walls, Atala notes. Without that elasticity, high pressure could force fluids back into the kidneys, damaging those organs.

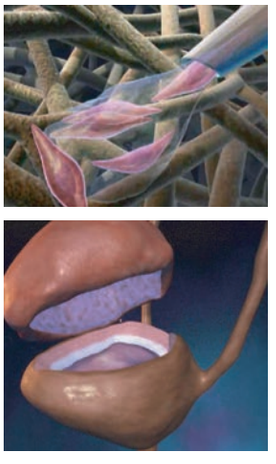
Doctors currently use a century-old method to repair bladders, which may be damaged by injury, illness, or congenital defects such as multiple sclerosis or spina bifida. In the traditional procedure, a surgeon rebuilds a bladder by stitching in pieces of intestine, stomach, or other tissues. However, those tissues can cause complications. For example, using intestinal tissues, which absorb nutrients rather than just hold fluids, can alter the body's metabolism and lead to kidney stones and osteoporosis.

Searching for an alternative to that surgery, Atala designed a biodegradable scaffolding that his team covers with a patient's own cells. The team identified young people, ages 4 to 19, who had severe bladder malfunction from spina bifida. Because the spine doesn't close completely in people with this condition, nerve damage disrupts the flow of signals between brain and bladder, and the organ becomes flaccid or spastic and begins to leak.

In a surgical procedure, the researchers removed most of the damaged bladder tissue from each patient and collected healthy bladder-wall and muscle cells. The team grew the cells in the lab and then covered the outside of the bladder-shaped scaffold with muscle cells and the inside with bladder-wall cells.

After incubating the construction for 4 days, the researchers surgically attached the faux bladders to what was left of the original organs. In four of the patients, the team also wrapped the entire implant with blood vessel–rich abdominal tissue to ensure adequate blood supply.

After monitoring the patients for 2 to 5 years, the researchers found that all the engineered bladders functioned as well as traditionally repaired bladders, and, furthermore, lacked any of the negative side effects of the standard procedures, they report in an upcoming *Lancet*.



HOMEGROWN Bladder and muscle cells thrive on a synthetic scaffolding (top), which surgeons then attach to the undamaged part of the original bladder (bottom). The scaffold eventually dissolves.

COURTESY OF TENGION, INC.

"We're pleased with the results, but we have to go slowly," Atala says. The next step, he says, will be a series of long-term clinical trials with many more patients.

The success of the bladders is "a huge milestone," representing the first time a working organ has been created using tissue engineering, says urologist Steve Chung of St. Margaret's Hospital in Spring Valley, Ill. Even better, Chung adds, the new procedure is less invasive than traditional bladder repair because it leaves other organs intact.

Depending on the results of the next series of clinical trials, it may be 5 to 10 years before implanting tissue-engineered bladders becomes commonplace, Chung says. In the meantime, this study may motivate scientists attempting to engineer other organs. Chung says that the new findings show that "it definitely can be done." —C. GRAMLING

SPIN CITY

Fiber technique fuels materials research

BY AIMEE CUNNINGHAM

In 1934, Anton Formhals patented a spinning technology that produced synthetic fibers with the aid of an electric field. Introduced shortly before the advent of nylon, Formhals' electrospinning technique never caught on. The method's output couldn't compete against the large-scale fiber-spinning methods that later made nylon and polyester into industrial commodities.

The basic premise behind commercial fiber manufacturing has remained largely the same for decades. Most methods force molten or chemically treated polymers through showerhead-resembling devices called spinnerets, following the same strategy as a child's Play-Doh pasta maker. Advances in such extrusion technologies have shrunk the diameter of fibers in all manner of fabrics to micrometer and submicrometer ranges.

Although the fiber diameters have shrunk, the equipment hasn't. Industrial fiber-spinning machinery resembles a "big block of iron the size of a dining room table," says polymer scientist Darrell Reneker of the University of Akron in Ohio.

Among researchers who want to study fiber technology on their laboratory benches, there's been a revival in interest in Formhals' technique. The method requires no specialized equipment. "You can have an experiment going in an hour with a few simple components," says materials scientist Gary Wnek of Case Western Reserve University in Cleveland.

The room-temperature spinning process works because the polymer chains get knotted up during spinning. That tangling holds together a fiber that then is laid down as a mat.

In the new work, scientists often add extra molecules into their polymer mix. "You can put any kind of small molecule in there and spin it at the same time as the fiber," says polymer scientist John F. Rabolt of the University of Delaware in Newark. The additions can include proteins or drugs that wouldn't survive the high-heat processing and might not withstand the chemicals used in conventional fiber-extruding methods.

The flexibility of the technique points to a wide range of applications for the resulting fibrous mats, "primarily in the area of biomedical technology," says chemist Timothy E. Long of Virginia Polytechnic Institute and State University in Blacksburg.

Researchers are already electrospinning potential innovations in drug delivery, wound dressing, and tissue engineering.

TANGLED TALE — A single crisscrossing fiber makes up a 12-millimeter-long mat (inset).

J. STANKUS AND WAGNER

SPIN SPECS Electrospinning starts with a syringe filled with a polymer solution. The terminals of a voltage generator are attached to the syringe's metal needle and to a metal plate, which sits about 20 centimeters below the tip of the syringe's needle. The generator creates a voltage difference between the needle and the plate.

Although the syringe has a plunger, electrospinning isn't an extrusion method. The plunger forces out just enough polymer to create a drop at the needle tip. Surface tension initially holds together the drop, explains Reneker, but the electric forces have the opposite effect. "We can make the electric forces win," he says.

In most setups, the voltage generator creates positive ions in the polymer solution, explains Wnek. As the ions start to repel each other, the repulsive force pulls the drop into a cone shape. At some critical voltage, this force becomes greater than the surface tension, and a thin jet from the cone heads toward the negatively charged plate. The critical voltage—in the range of thousands to tens of thousands volts—depends on factors such as the concentration of the polymer solution and the polymer's molecular weight.

Once launched, the fluid jet takes a circuitous route to the metal plate. Because of jostling among ions in the material, as the jet elongates, it begins to coil into a spiral, says Reneker. As the segments of the spiral itself continue to elongate, the jet becomes unstable and generates smaller coils: spirals within spirals. While the jet elongates, the solvent evaporates. "What you collect are those now-solid polymer coils coming down in a seemingly disorganized way," says Reneker.

As the fiber lands on the plate, it forms a mat that "looks like tissue paper," Rabolt says. "You can generally peel it off," he adds.

Under an electron microscope, the mat "looks like Pick-Up Sticks," Rabolt says. A fiber's diameter can range from about 100 nanometers to several micrometers.

Although setting up an electrospinning experiment is a breeze, researchers are just beginning to understand the complicated combination of physics, fluid mechanics, and polymer science that produces these micro- and nanoscale fibers. Figuring out the parameters that will produce a fiber for a given polymer-and-solvent system has been a trial-and-error process, says Wnek, because every recipe had its own set of instructions.

In the April 25, 2005 *Polymer*, Wnek and his team reported a series of calculations to determine the appropriate polymer concentration. "We want to have some predictive value," he says.

FIBER FILLERS Electrospinning's amenability to additions is providing researchers new ways to consider delivering drugs and other compounds to cells and tissues. In the July 2005 *Biomacromolecules*, Rabolt, Kristi L. Kiick, and their colleagues reported making biocompatible polymer fibers that contain heparin, which has a structure similar to heparan sulfate, found in the body's scaffolding for cells. In the body, heparan sulfate binds growth factors until the cells are ready to use them, says Kiick.

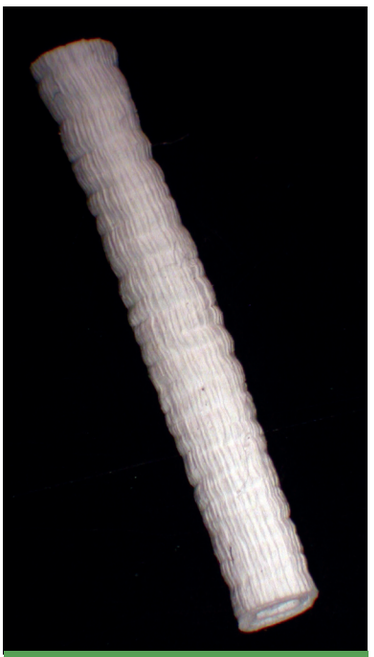
The researchers' recipe included poly(lactide-co-glycolide) and an additional polymer, called poly(ethylene glycol), that was attached to heparin. Mats of the new fibers slowly released their heparin payload for about 2 weeks. The system is intended to replicate the body's measured delivery of growth factors by heparan sulfate reservoirs, Rabolt says.

Rabolt and Kiick have now begun studying how cells respond to the mats, which the researchers say could eventually be used as patches that help the body repair skin or damaged internal organs.

Using a similar approach, Long and his colleagues have made fibers containing antibiotics. The team starts with a polymer, derived from lactic acid molecules, that is both biocompatible and biodegradable.

Electrospinning such molecules into nanoscale fibers "buys you surface area," says Long, so that antibiotics can diffuse readily. There's more surface area in a given volume of small fibers than in the same volume of larger fibers. A small electrospun patch can deliver a sizable antibiotic dose, says Long. His group is currently working on an electrospun-polymer patch that can be implanted in horses' infected ankles, where it will release an antibiotic and then degrade.

In another application, Reneker and his University of Akron colleague Daniel J. Smith have patented an electrospun wound dressing. The bandage contains three layers of polymers that were spun separately. Each polymer binds one ingredient required for a reaction that produces the chemical nitric oxide, which helps wounds heal. The reagents react when water is applied to the bandage, and they don't leave the bandage, which releases only the nitric oxide to the wound.



PLUMBING PROTOTYPE — This tubular, 15-millimeter-long mat made of aligned fibers is a model for replacement blood vessels.

J. STANKUS AND WAGNER

SPUN SUPPORTS Electrospinning could have its biggest impact producing scaffolding for the emerging field of tissue engineering. The natural fibrous proteins, such as collagen, that make up the body's scaffolding have diameters in the range of hundreds of nanometers to a few micrometers. Electrospun polymers offer materials that are "beginning to approach the scale that the cells would see in the natural extracellular matrix," says William R. Wagner of the University of Pittsburgh.

Wagner, his University of Pittsburgh colleague Michael S. Sacks, and their respective research teams are designing biodegradable-fiber scaffolds for cardiac tissue. The scaffolds, seeded with cells and then implanted in the body, are being developed to provide support for heart cells until they produce their natural matrices.

Wagner's team has worked out a method to align the fiber during spinning to create a network that has a more regular structure than the typical crisscrossed mat does. Instead of a metal plate, the researchers use a cylindrical target called a mandrel to make electrospun fibers arrange themselves into tubular mats. In this electrospinning setup, the researchers rotate the mandrel on its axis and move it back and forth under the syringe. When the mandrel's back-and-forth motion reaches 2 meters per second, the fiber lines up along the length of the cylinder. The resulting mat is stiffer along its length than across its diameter.

Having control over the direction of stiffness is desirable for tissue engineering, says Wagner, because "you want to train the cells for the job they will have to do." If a scaffold can behave as an artery does, the cells growing on it should produce a better replacement tissue than those on a static scaffold would, he says.

Sacks' group has applied various stress tests to the scaffolds, loading and stretching them to study their mechanical behavior. Sacks and Wagner demonstrate in an upcoming *Biomaterials* that the resulting scaffold's mechanical properties resemble those of heart-valve tissues, which vary widely in their elasticity in different directions.

In another innovation, Wagner's team has devised a way to seed spun mats with cells. The researchers combine electrospinning with a technique called electrospraying, which uses a smaller voltage difference between the syringe's needle and the plate. The drops containing cells fall to the plate intact instead of elongating into a fiber.

While one polymer-filled syringe propels a fiber to the target, a second syringe sprays vascular smooth muscle cells there. The researchers report in the February *Biomaterials* that the technique uniformly infused the mat with viable cells. The team is just beginning to test such a mat for tissue growth in rats.

Engineering vascular tissue is "a long-term research goal," says Sacks, but he's optimistic that electrospinning can move the technology along. "There's really nothing else I know of that will match this approach."

SPINNING'S SPREAD While new uses abound, electrospinning isn't likely to challenge current manufacturing methods for fabrics. "It's hard to make a lot of stuff quickly," says Wnek. "That's been a criticism of electrospinning for a long time."

But he doesn't consider speed and volume critical issues in biomedical applications of the technique. "If you are thinking about coverings for wounds or a scaffold to grow a little piece of tissue, you don't need much stuff," Wnek says.

Electrospinning is changing the definition of what is spinnable, though. For example, Wnek and his colleagues have created fibers from natural polymers, such as collagen and fibrinogen, a protein that contributes to blood clot formation.

And in the Jan. 20 *Science*, Long's group describes fibers made of a material that isn't a polymer. The team used phospholipids that are components of cellular membranes (*SN: 1/28/06, p. 61*).

Phospholipids behave differently than polymers do. Because they contain a hydrophilic head attached to a hydrophobic tail, they organize into spheres when they're in solution. In water, the hydrophilic heads face out, protecting the hydrophobic tails inside. In oily solvents, the heads stay in and the tails face out. Long's group reasoned that if phospholipid molecules can self-organize in such a way, "then they should also form a fiber," says Long, "and indeed, they did."

Long's team is now experimenting with ways to make electrospun phospholipids more durable. The electrostatic interactions that hold together the fiber break down in water. Mats made from such fibers might be fine for applications in which biodegradability is desirable, says Long. But for other uses, such as a blood filter made of natural materials, an insoluble mat would be necessary.

"Tunable durability," Long says. "That's the next step." ■

REVEALING COVERT ACTIONS

Updated technologies expose air's unseen eruptions

BY PETER WEISS

With a flash and a bang, a pellet of explosive detonates in a cavernous laboratory on the outskirts of the Pennsylvania State University campus. The explosive, triacetone triperoxide (TATP), is the one that terrorists reportedly used in their attack on the London subway in July 2005. Minutes after the lab explosion, engineers—some with bulky ear-protection gear still in place—stare at a laptop screen as they scan frame after frame of high-speed images. Beyond the flame and flying debris, the scientists focus on the ephemeral supersonic shock waves that emanate from the blast. The waves appear in the pictures as rings, ripples, or streaks.

In studies by the Penn State investigators and others, a rare marriage of technologies is yielding unprecedented visualizations of the shock waves created by a variety of phenomena. The researchers have combined modern high-speed digital video with techniques known as shadowgraphy and schlieren imaging, which date back centuries.

In the 19th century, scientists used basic forms of the techniques for detecting flaws in lenses or for visualizing shock waves made by bullets. Today, researchers can study not only the meters-wide blast of a lump of TATP but also kilometers-long pressure patterns from the supersonic flight of an aircraft.

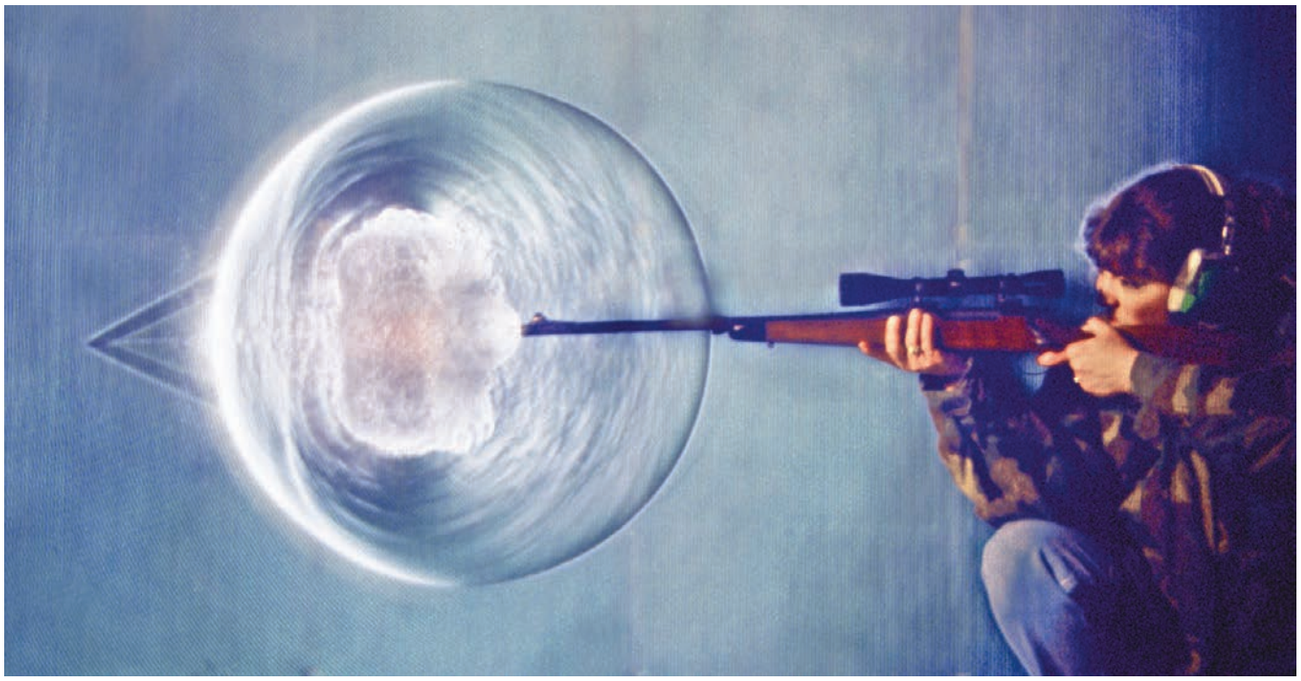
Similar visualizations are illuminating the complex behavior and destructive impacts of shock waves in past and potential aviation disasters, says Penn State's Gary S. Settles, who heads the lab in University Park. The investigators have also been capturing extraordinary footage of gunshots, and their analyses may alter the way in which weapons experts interpret some types of forensic evidence.

"A good fluid dynamicist knows you have to see the flow to know what's going on," says physicist Leonard M. Weinstein of the NASA Langley Research Center in Hampton, Va., who pioneered some of the visualization techniques.

SMOKE AND MIRRORS A simple optical effect underlies both shadowgraphy and schlieren imaging: Light rays bend, or refract, at the boundaries between air masses of different densities. The same phenomenon causes the twinkle of stars and the distorted appearance of objects on the far side of a patch of hot pavement.

The more rudimentary of the two methods, shadowgraphy, requires only a brilliant light source, an air disturbance, a glossy surface on the opposite side of the disturbance, and a camera to take the picture.

Consider a shadowgraph of the air above a heater. Rays of light bend as they pass through rising air currents. So, some parts of the glossy surface receive more light than they would in the absence of the air disturbance, and others receive less. The camera captures the image as a set of density ripples.

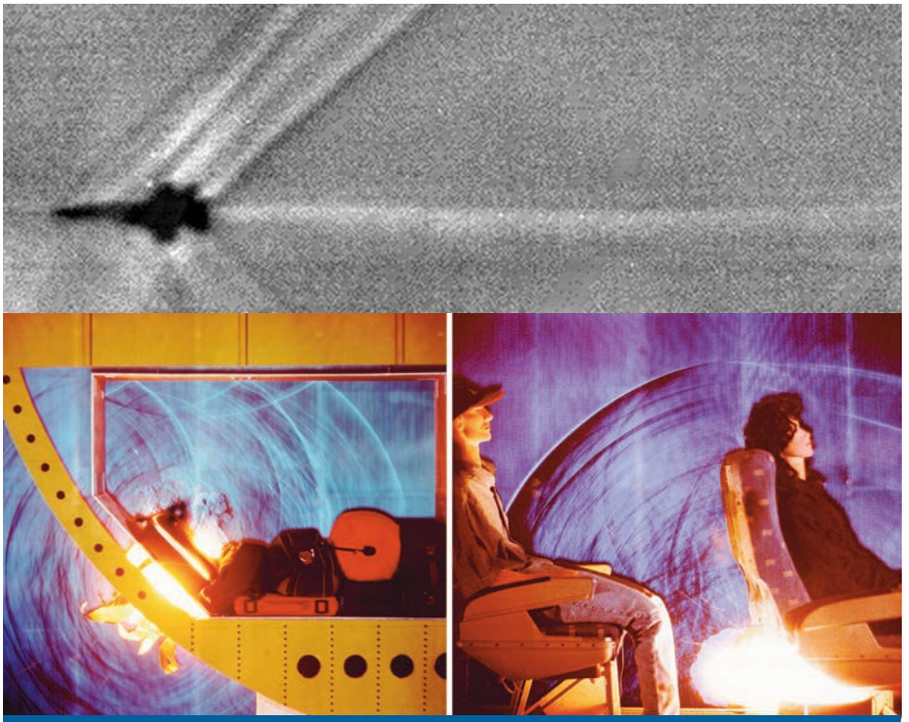


SETTLES

More sophisticated and sensitive than shadowgraphy, schlieren imaging has typically required a bright light, a pair of parabolic mirrors—one in front of and the other behind the air disturbance—and a sharp-edged obstacle. One mirror collects light rays from the lamp and reorients them into a beam of parallel rays aimed at the disturbance. The other mirror collects the projected image and focuses it onto a spot. There, the sharp obstacle blocks many of the divergent rays, deepening the dark areas in the density ripples. Finally, the remaining light goes to a screen or into a camera that records the image.

Because of the focusing and the heightened contrast caused by the obstacle, schlieren imaging can visualize subtler fluctuations than can shadowgraphy, Settles says. On the other hand, schlieren systems typically can make images only of subjects that fit within the light beam created by the first mirror.

For decades, the prohibitive cost of large, high-quality mirrors made for use in telescopes relegated most schlieren imaging to small-scale phenomena such as bullets breaking the sound barrier and miniature models of aircraft in wind tunnels.



AIR POWER — A schlieren telescope recorded, from nearly 20 kilometers away, the image (top) of shock waves from a supersonic F/A-18 jet. At bottom, blasts spew shock waves into a mock-up of an airplane luggage compartment (left) and a passenger cabin (right). These schlieren images reveal reverberation patterns.

Then, in the early 1990s, Weinstein figured out ways to make schlieren pictures without mirrors. Other researchers had considered some of these methods but didn't implement them, Weinstein says.

He illuminated subjects with light bounced off a backdrop of the light-reflecting material, called retroreflective sheeting, that's used in highway signs. Weinstein added vertical black stripes. He used a large-format camera, rather than a mirror, for focusing images. A transparent photographic negative, adorned, like the sheeting, with vertical black stripes sits in front of the film inside the camera. Because the black stripes of the negative exactly fill the spaces between the stripes on the camera's image of the backdrop, the interlocking patterns cut off nearly all light rays except those bent by refraction.

That work led to the unprecedented, full-scale imaging of a range of previously invisible phenomena, including the shock waves created by blasts, flows of gases from industrial equipment, and wavy plumes of air around people, ovens, and air conditioners.

Besides opening indoor schlieren systems to large subjects, Weinstein invented a technique for taking schlieren shots outdoors and observing a truly huge phenomenon—the sky-filling shock waves from supersonic aircraft in flight.

For that last feat, a camera-equipped, sun-tracking telescope observes through a slit a sliver of the sky that includes the edge of the sun. As an aircraft flies through that sliver, the camera composes an image of the plane and the sky above and below it from successive views through the slit.

Because refraction causes more or less of the sunlight in the sliver to pass through the slit, the schlieren image reveals the otherwise invisible shock waves streaming away from the aircraft. "I've taken one [schlieren image] where the shock wave reached 12,000 feet below the plane," Weinstein notes.

KER-POW! — Two different shock wave patterns emerge in this high-speed schlieren photograph (opposite page) of a .30-06-caliber rifle discharge. The wake of the supersonic bullet heads to the left. A much larger, spherical shock wave—a phenomenon recently made visible by advanced imaging methods—balloons from the muzzle's length. Hot gases billow from the muzzle's tip.

WEINSTEIN; (BOTTOM TWO IMAGES) SETTLES

HAVING A BLAST Working with Weinstein a decade ago, Settles and his colleagues built the world's largest indoor schlieren-imaging system. It's in an old warehouse on the outskirts of the Penn State campus. The lab's retroreflective backdrop, which hangs on one wall, measures about 5 meters by 5 m.

The jumbo size of that setup has enabled the Penn State team to undertake schlieren observations of simulations of bomb blasts in passenger aircraft. In tests funded by the Federal Aviation Administration, the researchers constructed a full-scale mockup of a portion of an aircraft passenger cabin and observed the effects of explosions under a passenger seat. They also recorded shock waves emerging from suitcases after a blast in a 60 percent mock-up of an aircraft luggage compartment.

The studies, which the team described in 2003, provided the first direct, visual evidence of the shock-wave reverberations that could cause fuselage damage far from the site of a blast within a plane. The images have led to "useful information for the future so that aircraft can be designed to better withstand an explosion," Settles says.

Recently, the Penn State team has taken remarkable pictures of firearms discharging that show much more than typical schlieren images do. Whereas the old method typically showed shock waves from the bullet and in the immediate vicinity of a muzzle, the newer, wide-view schlieren pictures also reveal shock waves and evidence of hot combustion gases extending for several meters.

"We all knew that that stuff was there, but [Settles] was one of the first to visualize it at that size. Previously, you could only look at a section of it," says Andrew Davidhazy of the Rochester (N.Y.) Institute of Technology. He teaches shadowgraphy and schlieren techniques.

By depicting how shock waves and combustion-gas clouds interact with nearby objects, including the shooter, images could

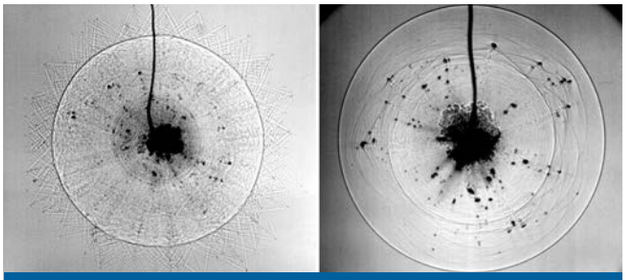
someday enable criminologists to more accurately link aspects of shootings, such as the weapon used and the distance at which it was fired, to powder burns or other gunshot effects on victims and suspects, Settles says. Davidhazy agrees: "The more information you can get about a [fired] round, the better your forensic analysis is going to be."

FAST FORWARD Shadowgraphy went big-time earlier than schlieren imaging did, but until recently, large-scale shadowgraphy didn't catch on. In the late 1950s, high-speed-photography pioneer Harold Edgerton demonstrated large-scale shadowgraphy by upgrading to a large, retroreflective screen. Using a roughly 1-m-by-2-m screen, rather than one the size of a dinner plate, he photographed the explosion of a dynamite cap.

More recently, Settles and his colleagues ushered shadowgraphy into the 21st century by projecting images onto an even bigger screen. They also record the images with a high-resolution digital video camera capable of taking thousands of 1-microsecond-long exposures each second.

A particular advantage of digital video in place of bulky film cameras is that shadowgraphy setups have suddenly become portable. The screen, now the bulkiest piece of the equipment, rolls up for transport.

Putting that road-worthiness to the test for the first time, the Penn State team took its gear to a U.S. Army lab in Aberdeen, Md., last summer to video explosions in aircraft-luggage containers, as part of a study for the Transportation Security Administration. Using protective shielding for their equipment and themselves, the researchers made images showing how the containers responded to explosions. They haven't yet reported their results.



BURSTS INTO VIEW — Stop-action shadowgraphs show explosions of 1-gram charges of TATP (triacetone triperoxide) packed in cardboard containers. Spherical shock waves (dark rings) race outward. Left image captures small fragments at supersonic speeds, each marked by its own leading shock wave. Right image shows larger fragments at subsonic speeds.

SETTLES

Settles described that fieldwork and other recent shadowgraphy developments in September 2005 at a visualization conference in Queensland, Australia.

Next, Settles' team intends to use shadowgraphy to image shock waves unleashed in a full-scale, exploding airplane. The researchers have to wait until federally funded aviation engineers, responsible for fortifying aircraft against threats such as terrorist bombs and fuel-tank explosions, detonate charges in a retired Boeing-747 or another big jet.

The Department of Homeland Security periodically conducts such tests to assess recent antibomb modifications on commercial airliners, but the date for the next experimental blast hasn't been set, Settles says.

For a test of a whole plane, Settles' team would set up its screen so that shock waves could be observed emerging from the side of the plane. If the test is on a cross-section removed from the fuselage, as it often is, the researchers would place their light and screen on one side of the open portion of the fuselage and put their camera on the other to observe shock wave reverberations, Settles says.

No previous test has visualized shock waves during an explosion in an actual airplane, he notes. But his team is now ready with the first-ever, simple, portable means to do so. ■

OF NOTE

BIOMEDICINE

Parasite can't survive without its tail

The parasite that causes African sleeping sickness can't survive in the mammalian bloodstream without its tail, scientists report. The finding could lead to novel ways to fight this disease.

Trypanosoma brucei has a two-part life cycle in which it inhabits the tsetse fly and then a mammal. Although the parasite takes on slightly different forms in these two hosts, both forms have a long, whiplike tail called a flagellum.

While investigating how *T. brucei*'s flagellum operates, microbiologist Keith Gull of the University of Oxford in England and his colleagues made an exhaustive catalog of the structure's 380 proteins. Then, to determine the proteins' functions, the researchers selectively prevented the parasite from making each one.

GULL AND S. GRIFFITHS

DOOMED This parasite might have caused African sleeping sickness, but without a certain tail protein, it has bloated and will soon die.

Disabling any flagellum protein in the *T. brucei* form that inhabits the tsetse fly prevented the protozoan from moving around in lab dishes but had little effect on its hardiness or reproductive success. However, when the researchers performed the same experiment on the form that inhabits mammals, they found that the parasite couldn't divide effectively. Rather than splitting, it formed abnormally large cells with multiple nuclei and then rapidly died.

Developing drugs that have a similar effect on *T. brucei*'s flagellum proteins could eventually be a strategy for attacking the parasite in people, Gull's team suggests in the March 9 *Nature*. —C.B.

ZOOLOGY

Sharpshooter threatens Tahiti by inedibility

In a new twist on invasive-species biology, a North American insect is menacing Tahitian ecosystems by getting itself killed and proving surprisingly toxic to its predators.

The invader is a half-inch–long leafhopper called the glassy-winged sharpshooter (*Homalodisca coagulata*). It's native to the southeastern United States and northern Mexico, but it reached California in the 1980s. It's a strong flyer and has proved an unusually fast spreader of pathogens such as those for phony peach disease or for Pierce's disease, which can kill a grapevine in 2 years.

Now, the sharpshooter has reached French Polynesian islands including Tahiti and Mo'orea, where it's bringing trouble to paradise, warn two University of California (UC) researchers. Kenwyn Blake Suttle of UC-Berkeley and Mark Hoddle of UC-Riverside say that it's too early to tell whether sharpshooters will bring plant epidemics to the South Pacific.

Sharpshooters are already a local nuisance, though. Known as *mouches pisseuses*, they grow into denser populations in Tahiti than they do in California. Anyone standing under a tree where sharpshooters are drinking and excreting sap can get unpleasantly damp.

Native Polynesian spiders face a more serious threat from the sharpshooters, Suttle and Hoddle report in an upcoming *Biological Invasions*. No one has reported North American spiders troubled by sharpshooters. However, when the researchers fed the insects to two species of native Tahitian spiders, 47 percent of the spiders died within an hour, apparently of intoxication.

In fact, the researchers note that some crab spiders collected from island spots infested with sharpshooters walked away from the potentially enticing meal, suggesting that those spiders may have had a previous unpleasant encounter. —S.M.

ANTHROPOLOGY

Chimps scratch out grooming requests

Pairs of adult males in a community of wild African chimps often communicate with gestures, indicating that they possess a basic knowledge of one another's wants and intentions, two researchers contend. Many scientists attribute the capacity to discern others' thoughts and feelings only to people.

The chimp encounters proceed as follows: One animal makes an exaggerated scratching movement on part of his body, such as his forehead, in front of a comrade, who then grooms the indicated spot. Gesturing of this type frequently occurs during social grooming, causing the provider to shift his activities to where the recipient scratched himself.

Simone Pika of the University of St. Andrews in Fife, Scotland, and John Mitani of the University of Michigan in Ann Arbor spent several months in Uganda observing male chimps' grooming behavior in a community of more than 140 animals. The scientists recorded 186 instances in which one chimp used scratching to request grooming of a particular spot on his body from another chimp. The animal that viewed the scratching display usually began to groom the indicated spot, even if he was already grooming another part of the gesturing chimp.

Pairs of high-ranking male chimps were most likely to use and respond to exaggerated scratches as grooming requests, highlighting the importance of the symbolic gestures, Pika and Mitani report in the March 21 *Current Biology*. —B.B.

SCIENCE AND SOCIETY

Two-fifths of Amazonian forest is at risk

The Amazon basin's forest will lose 2.1 million square kilometers of its 5.3 million k^2 by 2050 if current development trends go unabated, according to a new projection. However, aggressive policy changes could prevent deforestation on 1.3 million km^2 of the threatened area, scientists report in the March 23 *Nature*.

Last week, at the eighth United Nations conference on biodiversity in Curitiba, Brazil, the Brazilian government announced that it now protects nearly 800,000 km^2 of Amazonian forest and has beaten a 2012 deadline for achieving that goal.

But governments in the region will need to set aside more protected areas and simultaneously curtail forest clearance by private landowners to prevent substantial deforestation, say researchers led by Britaldo Silveira Soares-Filho of the Federal University of Minas Gerais in Belo Horizonte, Brazil.

For the calculations, the team estimated the consequences of anticipated expansions of cattle ranching, soy farming, and roads. The scientists compared that scenario with the potential protection conferred by policies aimed at, for example, expanding and more vigorously guarding protected areas,

OF NOTE

curtailing road construction, or requiring landowners to set aside private forest reserves. —B.H.

BIOMEDICINE

Experimental drug targets Alzheimer's

A novel drug reverses some Alzheimer's-type symptoms in mice, a study shows.

Researchers used mice genetically engineered to accumulate waxy plaques of beta-amyloid protein in their brains, a symptom of Alzheimer's disease in people. Then, over 8 weeks, the scientists regularly injected some mice with the new drug and gave others inert shots.

The researchers tested how well the mice learned and recalled how to navigate a water maze. Mice treated with the experimental drug, called AF267B, did better than the mice getting inert shots, the researchers report in the March 2 *Neuron*.

A test to gauge "emotional memory" yielded less-promising results. Mice were given a mild shock from the floor when they entered an otherwise-inviting cage chamber. Normal mice subsequently recalled this disturbing experience and avoided the chamber, but the Alzheimer's mice didn't, even after getting AF267B.

The water-maze results suggest that the drug benefits the brain's cerebral cortex and the hippocampus, areas that handle spatial learning and recall and that are affected in Alzheimer's disease, says study coauthor Frank M. LaFerla, a neuroscientist at the University of California, Irvine. Results of the floor-shock test suggest that the amygdala, an Alzheimer's-affected brain area that's associated with emotional memory, didn't benefit from the drug, says LaFerla.

The team further reports that in the Alzheimer's mice, the drug reduced beta-amyloid plaques in the hippocampus but not in the amygdala. The drug, called NGX267 by its maker TorreyPines Therapeutics in San Diego, is now undergoing preliminary tests in people. —N.S.

ASTRONOMY

Twin history

The Milky Way and its nearest large galactic neighbor, Andromeda, are more alike than earlier evidence had indicated. A new study shows that the two spiral galaxies evolved in a highly similar fashion over the first 3 billion to 4 billion years of their histories.

The study reveals that the composition of some 1,000 stars in Andromeda's halo—a vast cloud that includes the outer reaches of the galaxy—are deficient in all elements heavier than hydrogen, just as stars in the halo of the Milky Way are. A halo "is the true fossil relic of the earliest formation of a spiral galaxy," notes Scott Chapman of the California Institute of Technology in Pasadena. The finding therefore suggests that the Milky Way and Andromeda had similar early histories, he says.

SPIRAL NEIGHBOR
Stars in the halo of the Andromeda galaxy, the Milky Way's nearest large galactic neighbor.

Chapman and his colleagues used ground-based telescopes including Keck II on Hawaii's Mauna Kea. They describe their findings in an upcoming *Astrophysical Journal*.

It's not surprising that the two galaxies, which are only about 2 million light-years apart, have similar histories, notes Chapman. But studies over the past decade had indicated that stars in Andromeda's halo were abundant in elements heavier than hydrogen. It now appears that astronomers making those observations had been mistakenly examining stars in Andromeda's disk.

Some puzzling differences between the Milky Way and Andromeda remain. Andromeda has a larger, lumpier, and faster-rotating disk. Galactic disks arise several billion years after halos do. "Clearly, after the first 3 to 4 billion years ... some very different events shaped the evolutionary histories of the two galaxies," Chapman says. —R.C.

PLANETARY SCIENCE

Another red spot, by Jove

Attention, sky watchers. Jupiter has a second red spot.

Formally called Oval BA, it's about half the length of Jupiter's famous Great Red Spot, and nearly the same color. Oval BA derives from a trio of white storms discovered in the 1930s, which merged to form a single storm center in 2000.

The oval stayed white until December 2005, when it became brown. By February, Oval BA had turned red, reports amateur astronomer Christopher Go of Cebu, the Philippines. Scientists don't know whether its scarlet tinge will be permanent.

About twice as wide as Earth, Jupiter's Great Red Spot is the most powerful storm in the solar system and has remained red for at least 300 years. Scientists aren't sure why the Great Red Spot is red, notes planetary scientist Glenn Orton of NASA's Jet Propulsion Laboratory in Pasadena, Calif. A leading idea is that the storm is powerful enough to dredge sulfur-containing compounds or other materials from beneath the Jovian cloud tops and bring them to high altitudes. At such heights, ultraviolet light from the sun would turn some of the compounds red.

If the same explanation applies to Oval BA, it would indicate that this smaller storm has recently intensified and has begun to churn clouds at high altitudes.

Jupiter is now easy to find in the predawn sky. Before sunrise, look south and up; the planet is the brightest object. Viewers using telescopes with a mirror 10 inches across or larger and a digital camera should be able to track the new red spot. —R.C.

ENVIRONMENT

Volcanic mineral caused rare cancer in Turkey

In two Turkish villages, nearly half of all deaths since 1980 have resulted from a form of cancer caused by inhaling erionite, a brittle and fibrous volcanic mineral found in construction materials used in the villages.

Millions of rural residents in central Turkey have probably been exposed to hazardous amounts of the mineral, say Y. Izzettin Baris of Güven Hospital in Ankara, Turkey, and Philippe Grandjean of the Harvard School of Public Health in Boston.

Erionite exposure can cause mesothelioma (*SN: 9/3/83, p. 155*), a rare cancer that develops in the membranes that line the chest and abdomen. Exposure to airborne asbestos can also cause the disease.

Baris and Grandjean studied 661 adults who, in 1979 or 1980, lived in one of two villages where erionite-rich rock is abundant and had been widely used in home construction. Another 230 adults in the study lived in a third village where erionite is rare.

Through 2003, 117 people in the erionite-exposed villages had died of mesothelioma, making that cancer responsible for 45 percent of all deaths there during the study, the researchers report in the March 15 *Journal of the National Cancer Institute*. Just two villagers had died of mesothelioma in the unexposed village, and both of those people had been born elsewhere.

As evidence of erionite's dangers has emerged in recent decades, residents in the affected villages have abandoned contaminated structures. —B.H.

NASA

Books

A selection of new and notable books of scientific interest

CHINA SYNDROME: The True Story of the 21st Century's First Great Epidemic

KARL TARO GREENFELD

In 2003, word began to spread of a mysterious respiratory ailment affecting thousands of people in China and killing hundreds. The disease was severe acute respiratory syndrome, or SARS. Greenfeld was working in Hong Kong for *Time Asia* at the time of the outbreak and thus witnessed the secrecy and panic that accompanied the disease outbreak. In his disturbing account of that time, he explains how the highly contagious illness, originally mistaken for a mutant form of influenza, got away from health authorities. Despite the rising threat in the early days of SARS, most of the Chinese population remained unaware of the epidemic because of a government-engineered media blackout. Despite the efforts of the Chinese Ministry of Health to contain SARS, or at least news of its emergence, the media soon realized that the epidemic was overwhelming hospitals with very sick people. Greenfeld chronicles the frustrating work of medical experts as they raced to isolate the source of SARS and answer fundamental questions about the disease. ***HarperCollins, 2006, 464 p., hardcover, $25.95***.

GREEN INHERITANCE: Saving the Plants of the World

ANTHONY HUXLEY

Conservation efforts have traditionally focused on animals, from monarch butterflies to giant pandas. But the plants on which these and all other animals rely, directly or indirectly, for sustenance are often taken for granted by the public. Nettles, bamboo plants, and potatoes don't inspire the same degree of passion that our nearer relatives do. Huxley's aim is to emphasize plants' unique role in maintaining life on Earth and to illuminate the plight of many crops, trees, and flowering plants that are being slashed or harvested into oblivion. Plants alone have the capacity to convert raw chemicals such as nitrogen, oxygen, and carbon—through the process of photosynthesis—into living tissue. Science writer Huxley details plants' uses as medicines, fuel, food, and objects of beauty. It's just this utility that is threatening many plant species with extinction, Huxley notes. This beautiful book deftly makes the case for botanical conservation. ***Univ. Calif. Press, 2006, 192 p., color plates and illus., paperback, $29.95.***

THE SINGING NEANDERTHALS: The Origins of Music, Language, Mind, and Body

STEVEN MITHEN

Mothers sing to their children. People chant together in rituals. Like language, music is a universal means of emotional expression. Although music is ubiquitous, its origins have been neglected or flat-out ignored by anthropologists and others studying the human mind and its evolution, contends Mithen, a professor of early prehistory. He dismisses the idea that music is just a spin-off of the human capacity for language. He asserts instead that music is the key to language's evolution. The first portion of the book describes how music and language are processed in the brain. It introduces music savants and people lacking all musical ability, a condition called amusia. Other passages examine how musiclike tones and inflections aid infants' language acquisition. Finally, Mithen turns to evolution for clues to how vocalizations became communication. An examination of apes and even the fossil record reveals how music played a role in that process, according to this treatise. ***Harvard, 2005, 384 p., hardcover, $29.95.***

PILGRIM ON THE GREAT BIRD CONTINENT: The Importance of Everything and Other Lessons from Darwin's Lost Notebooks

LYANDA LYNN HAUPT

Charles Darwin's exploits during his voyage on the *HMS Beagle* in 1831 were the impetus of his revolutionary theories on natural selection and evolution. At the trip's outset, Darwin was a youth with merely a passing interest in natural history, traveling for an adventure. Five years later, at the voyage's end, Darwin was a man with ideas that would forever alter scientific and popular notions of the natural world. In this book, nature writer Haupt examines Darwin's publications and lesser-known journals for clues to his dramatic transformation. They show, for instance, that Darwin gleaned a great deal of insight from his observations of birdlife other than the famous Galapagos finches. His *Ornithological Notes* reveals not only Darwin's sensitivity to the minute details of the observable world but also his modesty and zeal for learning. ***Little, Brown, 2006, 288 p., hardcover, $24.95.***

WAVE-SWEPT SHORE: The Rigors of Life on a Rocky Coast

MIMI KOEHL AND ANNE WERTHEIM ROSENFELD

As sure as the tide comes and goes each day, the area at which the water meets land is constantly battered. Despite this stress, the intertidal zone is home to many organisms that have adapted to this unique habitat. Aided by Rosenfeld's 87 stunning photographs of the shore's unique topology and the organisms that reside there, biologist Koehl provides a unique look at this hearty ecosystem. Using basic principles of marine biology and physics, she explains how moving water transports organisms and their reproductive cells among the rocky crevasses and other niches in the partially submerged shoreline. This constant mixing results in the proliferation of life in many microhabitats. The book describes how shore organisms exploit rocks and caves for refuge against the wind and water. Koehl and Rosenfeld reveal the evolved architecture of shore-dwelling plants and animals that now thrive in this unusual zone. ***Univ. Calif. Press, 2006, 189 p., color plates, hardcover, $39.95.***

HOW TO ORDER Visit *http://www.sciencenews.org/pages/books.asp* to order these books or others. A click on the link under a book will transfer you to Barnes & Noble's Internet bookstore. Sales generated through these links contribute to Science Service's programs to build interest in and understanding of science.

LETTERS

Hot and cold

"Warming climate will slow ocean circulation" (*SN: 2/4/06, p. 77*) makes me wonder, Does continental drift cause occasional changes to the ocean's currents? Would major reorganizations of ocean currents tend to cause ice ages by temporarily disrupting the flow of warm water that normally keeps the ice at bay? Would simulations of past continental positions indicate when reorganizations would have occurred?

MATT HENRY, WHITTIER, CALIF.

Computer simulations suggest that continental drift can indeed affect ocean circulation. Analyses suggest that as a result of changes in ocean circulation, the present-day climate of the North Atlantic Ocean is significantly warmer and that the Southern Hemisphere is generally cooler than they were before North and South America were joined by the Isthmus of Panama about 3 million years ago. —S. PERKINS

Remember your vitamins

Trying to explain why "Diabetes most often begins in March" (*SN: 2/4/06, p. 77*), researchers speculate about "cold weather, inactivity, and overeating." Did they consider the possible role of a seasonal deficiency of vitamin D?

JOSEPH DEWHIRST, SHARON, MASS.

Vitamin D would logically be at its most depleted level in the body in March and at its most concentrated level in the body in August, due to people's sun exposure. It would be interesting to find out if cases of diabetes are less likely as people move nearer the equator. In general, the extent to which vitamin D has been ignored as an inhibitor of human diseases is astounding.

DAVID E. MOSTELLER, SHREVEPORT, LA.

The study, which focused on type 2 diabetes, didn't examine vitamin D. Studies have shown that type 1 diabetes is less common near the equator than near the poles. —B. HARDER

Corrections *"Shaken but Not Stirred: Rock formations reveal past quakes' size limit,"* (SN: 3/18/06, p. 164) *misplaced the Elsinore and San Jacinto fault zones in California. They extend southeast from Riverside, not San Diego. "Still Standing: Tsunamis won't wash away Maldives atolls,"* (SN: 3/25/06, p. 181) *misspelled the last name of Gene Rankey of the University of Miami.*

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

Rocks, Minerals and Gemstones

Rocks, Minerals and Gemstones of the U.S. 100 piece set, size: 20"L X 12"W X 1"D, Oak casing. Great for classrooms, collectors or young scientists. No glass covering necessary. Suitable for wall hanging. Order #JPT-1888, Cost: $85.00 *Meteorite included!*

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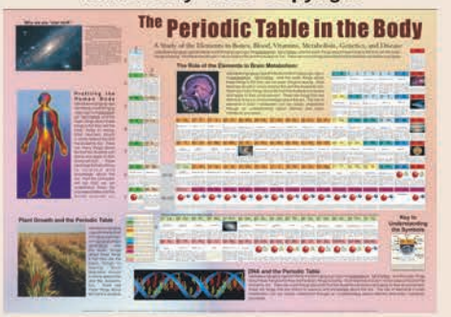
Both puzzles are based on the deluxe poster shown above, right.

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

Oviraptor in Egg Replica
Authentic, hand-painted replica of the first carnivorous dinosaur embryo ever found. It was discovered in 1994, in Mongolia. The replica is the actual size and is constructed of durable polyvinyl. NEW! Comes with educational tag. Size: 5"L X 3" H, Order: #JPT-ovegg, Cost $12.95; #JPT-ovishell, replica with small real, generic dino egg shell, with info. Cost $19.95

Periodic Table in Earth & Sky

Truly becoming a CLASSIC! A colorful poster presentation of the elements in our Universe. Featuring 117 razor-sharp color photos and graphics, this tour-de-force of the elements shows samples of minerals and crystals containing the element in question. Printed on heavyweight stock UV protective coating.
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#JPT-7200 Laminated version: $28.95

Sumerian Medical Tablet

Sumerian Medical Tablet - Reproduction of the earliest known prescription written in cuneiform. A detailed booklet comes with the tablet and gives a translation and history. The original was found a Nippur (c. 2100 B.C.). Size: 6" X 3" X about 3/4" thick. Comes with an adjustable walnut wood easel stand. Order # JPT-sumer, Cost: $69.95

Nautilus Shell - Tri-cut

Beautiful natural nautilus shell from the Phillippines. One of natures best examples of the Fibonacci sequence! Comes with information about the shell and Fibonacci sequence Tri-cut. Size: 5-6", Order#JPT-naut14, Cost $28.95; Pearlized,6-7" JPT-pearlized, cost: $32.95

Attractive Ammonite Pendant(above) wrapped in 14K gold. These are the best quality in the world, and are from Madagascar. The ammonite comes in an attractive jewelry box with information and with authenticity. There will be some variation in color and pattern, as each is different but of the same quality. Size: 1 1/2" W x 2 1/4" L, Order: #JPT-1719 $120

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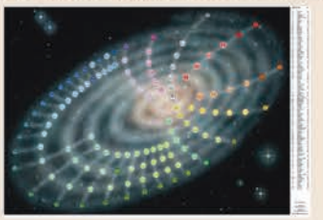
Chemical Galaxy: *A New Vision of the Periodic Table of the Elements*



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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