The Weekly Newsmagazine of Science

SCIENCE NEWS of the Year

When I was a graduate student, my professors would react with scorn to an experiment that took what they called a brute-force approach. The word that they used for admired work was *elegant*. In an elegant experiment, the researcher would have used a clever twist of logic to reveal a universal truth from the outcome of a simple test. Massive amounts of data had no splendor.

Times have certainly changed. This year, biologists won acclaim for their progress in a task that they are tackling with the combined force of labs all around the world. Sequencing the human genome's hundreds of millions of base pairs was unimaginable 25 years ago. Similarly, astronomers are collecting huge amounts of data in ambitious surveys of the heavens. This work is revealing distant quasars, brown dwarfs, and galaxies. Physicists, too, are sifting through enormous quantities of data from accelerator experiments to find the odd event that signifies a difference in how laws of physics apply to matter and antimatter.

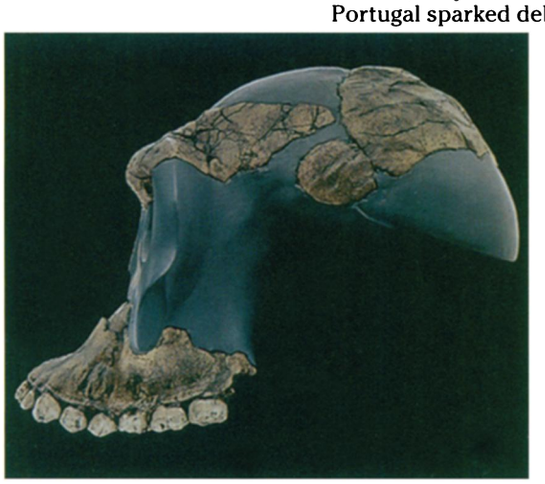
Part of the change in attitude comes from the ever-increasing capabilities of computers. This month, scientists unveiled the design for a machine that would perform more than a quadrillion operations per second.

When a mass of data becomes available, however, questions often appear faster than they are answered. The recent achievement of sequencing most of an entire chromosome still leaves a daunting task. To make medical advances, scientists must pick out the 500 or so genes and learn what each one does. Such knowledge may lead to diagnostic techniques, pharmaceutical treatments, or even gene therapy.

Carrying out this work calls for more brute force but also an intelligent, even cunning, approach. In biology and other fields, future progress will require manipulating massive sets of data with powerful strategies that are also elegant.

—Julie Ann Miller, Editor

Anthropology & Archaeology



Reconstructed skull of 2.5-million-year-old Ethiopian species, Australopithecus garhi.

- Researchers concluded that chimpanzees develop cultural traditions much like those of humans (155: 388).

- A 24,500-year-old child's skeleton found in Portugal sparked debate over possible interbreeding of Neandertals and modern humans (155: 295*).

- Archaeologists discovered the mummified bodies of three children sacrificed by the Incas around 500 years ago (155: 244).

- Fossils unearthed in Africa come from a new species in the human evolutionary family that lived about 2.5 million years ago (155: 262).

- A broken stone point provided direct evidence that Neandertals hunted animals with spears (156: 4). Neandertals also had a taste for cannibalism (156: 213*), although that didn't stop them from surviving a surprisingly long time in Europe (156: 277).

- A nuclear DNA analysis offered an intriguing new view of modern-human origins (155: 181). Researchers reached a stalemate in discerning what mitochondrial DNA studies reveal about human evolution (155: 88*).

- Bone flutes uncovered at a 9,000-year-old Chinese village included the earliest known complete, playable musical instrument (156: 197).

- An African fossil find suggested that ancient apes branched out in several directions 15 million years ago (156: 132), while other fossils fueled controversy over whether anthropoids originated in Asia or Africa (156: 244*).

- Observations of widely varying sleep patterns in traditional societies suggested that scientists need to launch cross-cultural studies of sleep (156: 205*).

Astronomy 1999

● For the first time, astronomers discovered a planet by observing a slight dimming when the body passed in front of its parent star (156: 324*). Researchers also found a system of planets outside the solar system (155: 244*). These discoveries and others brought the total number of known extrasolar planets to 28 (156: 106, 377).

● Images suggested that three nearby, young stars harbor planets (155: 20*). Scientists suggested that stars with an abundance of heavy elements may be the most likely to spawn planets (155: 79) and that most newborn stars have the potential to make planets (156: 231).

● NASA couldn't coax a signal from Mars Polar Lander after the spacecraft descended through the Martian atmosphere, pre-empting a planned 3-month investigation of the Red Planet's south pole (156: 187, 373). The loss came on the heels of the demise of a sister craft, Mars Climate Orbiter. In that mission, key data hadn't been converted from English units to the metric system (156: 214, 229).

● The Galileo spacecraft recorded the most detailed portraits so far of Jupiter's volcanically active moon, Io (156: 276, 382).

● A spacecraft created an extremely detailed, three-dimensional map of the Martian surface (156: 11).

● Astronomers found new evidence that the universe is flat (155: 30) and identified novel tests for the startling notion that the universe's expansion is accelerating (155: 379; 156: 341).

● Astronomers identified the home galaxies of several gamma-ray bursts (155: 53, 203). For the first time, they detected the visible glow of a burst (155: 70*). New evidence indicated that these energetic flashes signal the birth of the darkest objects in the universe (155: 263; 156: 28, 165*).

● Researchers reported a rapid way to determine the distance to gamma-ray bursts (156: 314).

● Several new studies may help scientists forecast solar storms hours to days before they erupt and head toward Earth (155: 150, 164, 200; 156: 5*).

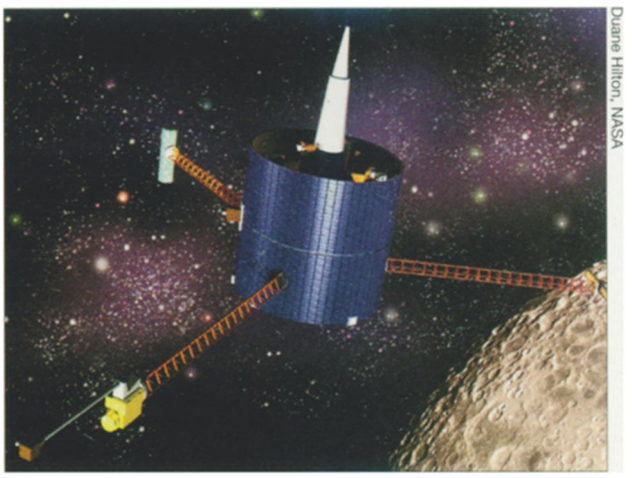
● Researchers reported their most precise value for the Hubble constant, a measure of the expansion of the universe and its age (155: 340*), but another team presented evidence that the cosmos is several billion years younger (155: 379).

● Ghost galaxies, devoid of stars but harboring clumps of invisible matter, may outnumber the luminous galaxies in the universe (155: 38*). Other studies shed light on the distribution and composition of invisible matter in our galaxy (155: 134; 156: 180*).

● Dozens of new quasars revealed themselves, including the most distant one known (155: 57).

● Scientists discovered a galaxy more distant than those previously measured and have evidence that two others could be even more remote (155: 255).

● When space scientists intentionally crashed a craft into the moon to look for water (156: 43), there was no sign of a splash (156: 84, 299).



Duane Hilton, NASA

The Lunar Prospector spacecraft, after orbiting the moon since early 1998, apparently hit its target crater but revealed no water.

● The Hubble Space Telescope shut down after the fourth of its six gyroscopes failed and astronauts planned to embark on a delayed mission to repair the telescope (155: 203; 156: 294*).

● Researchers produced the sharpest and largest radio map of the center of our galaxy (155: 79).

● As far back in time as astronomers could see, the cosmos churned out stars at a prodigious rate (155: 103).

● Supermassive black holes may produce a substantial fraction of the light in the cosmos (156: 198*).

● Researchers reported the discovery of an intermediate-weight class of black holes (155: 286).

● Planetary scientists gathered what may be the best evidence to date that Mars once had a vast ocean (156: 390*).

● A new study added to the evidence that Jupiter's moon Europa harbors a subterranean ocean (156: 219).

● The team that 3 years ago reported controversial evidence of tiny fossils in an ancient meteorite from Mars described possible fossils in two considerably younger Martian rocks (155: 286).

● The 1999 Leonid meteor shower proved a showstopper in Europe and Africa, and there might be even more fireworks in 2001 and 2002 (156: 357*). The 1998 shower came from dust ejected by a comet 665 years ago, researchers found (155: 277).

1999

Behavior

Mary-Anne Martin/Fine Art, New York

Unconscious mental processes are pervasive, some psychologists argued.

- New evidence indicated that, compared with young adults, the elderly experience a richer mix of emotions that they regulate more effectively (155: 374).

- Babies provided glimpses of how perception, thought, and movement coordinate individual development without relying directly on a genetic plan (155: 184). In related work, scientists found that a brain area known to facilitate muscle control also fosters memory for ordering information (155: 165).

- Mice missing a gene that affects a particular chemical messenger in the brain showed promise as an animal model of people prone to anxiety (156: 149*).

- Scientists reported that, from honeybees to humans, simple decision-making tactics prove surprisingly powerful (155: 348*).

- Schizophrenia sufferers displayed an inability to form coherent memories (156: 39). People caring for family members with schizophrenia exhibited, in certain cases, an increased susceptibility to infectious illnesses (156: 119*).

- Childhood experiences help shape shyness and other genetically influenced facets of temperament, researchers reported (155: 55). IQ scores showed responsiveness to environmental influences, increasing most sharply in abused kids adopted into affluent families (156: 54*).

- People suffering from depression or other severe psychiatric disorders demonstrated that they understand what they're doing when consenting to participate in research (156: 182).

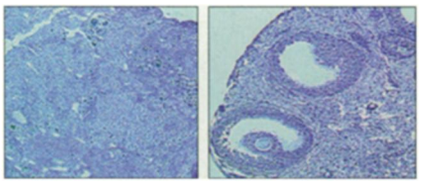
- Several studies indicated that unconscious processes organize mental life and limit free will (156: 280).

- Brain areas involved in emotion and attention exhibited links to both depression and ordinary bouts of sadness (155: 308*). Depression showed signs of elevating the risk of cancer among men who smoke cigarettes (155: 358).

- Brain scans offered clues to how separate brain regions work together in the process of learning (155: 149).

- Medication monitoring combined with behavioral interventions proved highly effective in treating kids with attention-deficit hyperactivity disorder (156: 388*).

Biology



G. Perez, *et al.*/Nature Genetics

Aged ovarian tissue (left) is normally barren, but that of mutant mice (right) still harbors eggs.

- Biologists sequenced human chromosome 22, a milestone in the human genome project (156: 356), and a biotech firm claimed that people have more than 140,000 genes, doubling earlier estimates (156: 239). Also, two chromosomes of a humble plant showed a surprising number of genes (156: 389).

- Microbiologists found the largest bacterium ever—the size of a period on this page—in sediments off Africa (155: 246*) and revived 250-million-year-old bacteria from buried salt crystals (155: 373*).

- Developmental biologists learned that the spinning of hairlike cellular projections within an embryo somehow divides it into left and right halves (156: 124).

- Mice engineered to make extra copies of a brain-cell protein showed improved memory and learning skills (156: 149*).

- Scientists identified the proteins that serve as taste receptors on tongue cells (155: 132*) and began to tease out how olfactory receptors in the nose make sense of smells (155: 236).

- Genetic studies confirmed that the AIDS virus originated in chimpanzees living in central Africa (155: 84).

- Mice lacking the enzyme telomerase aged prematurely in some ways and were more cancer prone than normal mice (155: 166).

- A genetic study showed that the plague bacterium is a relatively recent spin-off from a less harmful germ (156: 343).

- Neural stem cells, like bone marrow, can reconstitute the immune system (155: 54*) and, when injected into brain, can target tumors (156: 319).

- Testosterone continues to shape brains in male and female rats into adulthood (155: 406). The hormone proved addictive in another rodent study (156: 319).

- Biologists discovered that chromosomes end in short loops of DNA (155: 326).

- Scientists found a gene that triggers an embryo's skin to become watertight (156: 117).

- A study of worms swimming in Prozac revealed that the antidepressant has unexpected molecular targets (156: 196*).

- A mutation in a single gene enables mice to retain, egg-filled ovaries into old age (155: 85).

Biomedicine 1999

● The incidence and death rates of most cancers declined steadily between 1990 and 1996 (155: 302).

● An AIDS vaccine made of live HIV that's missing pieces of three key genes still caused disease in monkeys, casting doubt on prospects for an attenuated live vaccine for people (155: 100). Meanwhile, despite debate over the role of an HIV protein called Tat, scientists began using it in experimental vaccinations (156: 300*).

● Giving transplant recipients infusions of the donor's bone-marrow cells along with the donated organ reduced rejection (155: 331). A study in monkeys indicated that an altered antibody could block manufacture of T cells that attack a transplant (155: 372*).

● A study of 161 sets of male twins suggested that Parkinson's disease that strikes after age 50 doesn't have a genetic link (155: 122).

● Hospitals that most frequently perform a medical procedure, such as heart surgery, usually have the best success rates (156: 44).

● The notorious drug thalidomide, banned for causing birth defects, showed promise against multiple myeloma, a lethal blood cancer (156: 326).

● Mouse studies raised the unexpected prospect of a vaccine for Alzheimer's disease (156: 20*). Also, scientists isolated enzymes that help make the protein deposits that clog the brains of people with Alzheimer's (156: 294*).

● Immune T cells that attack insulin-producing cells in the pancreas of a person with diabetes are drawn there by a portion of the insulin molecule itself (156: 181).

● Research in mice showed that an antibiotic can slow muscle degeneration resembling a type of muscular dystrophy responsible for about 10 percent of cases in people (156: 84*).

● An oral drug inhibited the activity of a rogue enzyme that causes chronic myelogenous leukemia, and high doses brought on rapid improvement in the 31 patients tested (156: 372).

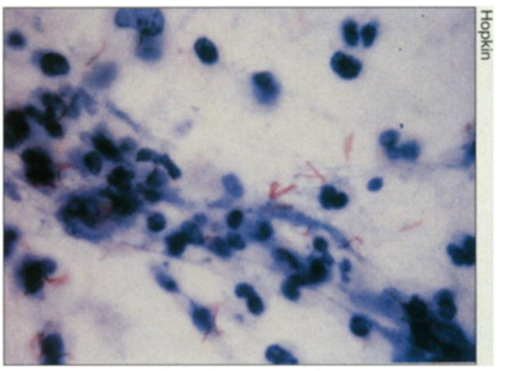
● Studies confirmed that the single-celled organism that causes malaria disrupts the immune system (156: 4). Also, two obscure drugs cured malaria in mice (156: 148).

● Zanamivir, an antiviral medication that can be inhaled, reduced flu cases even among young people who had been vaccinated (156: 20*). A vaccine spurring the body to make antibodies that recognize a small protein on the flu virus' surface curbed the disease in mice (156: 228*).

● Soaking blood vessels in artificial DNA before transplanting them into patients reduced clogging (156: 311). With collagen from pig intestines and cow tendons, researchers have made transplantable blood vessels that don't clog or induce immune rejection in rabbits (156: 279).

● Eradicating flies and dosing entire village populations with antibiotics suppressed trachoma, a blinding eye disease, in three areas of Africa (155: 351; 156: 203).

● Five new studies indicated that adding chemotherapy to current treatments for invasive cervical cancer boosts patients' survival and should become the new standard of care (155: 187).


Hopkin

A well-balanced immune system may require mycobacteria (red) found in dirt and untreated water.

● Miniaturized bioelectronic equipment helped paralyzed people communicate and may lead to development of wheelchairs and prosthetic limbs that a patient can control with brain signals (156: 142).

● Cells from the carotid-body glands in the necks of monkeys with Parkinson's disease, transplanted into their brains, facilitated production of dopamine (155: 260).

● An obscure compound derived from a central African fungus worked like insulin to boost glucose metabolism in mice when administered orally (155: 292*).

● Scientists discovered that mice with an autoimmune condition have B cells that shuffle their genes in the abdomen, which lacks the genetic quality-control mechanisms found in bone marrow, where such rearrangements usually take place (155: 69).

● Cocaine users have an unusually high incidence of coronary aneurysms, caused by weak spots in artery walls (156: 347).

● People with diabetes who have an occasional alcoholic drink face only half the heart-attack risk of teetotalers (156: 52).

● The American Red Cross developed bandages with natural clotting agents (155: 396*).

● Soccer players did worse on memory tests than did athletes in several other sports, suggesting that heading soccer balls causes brain damage over time (156: 348).


Kim Francis

Heading, especially if not done correctly, may harm people who play soccer for many years.

● Two research teams have identified an enzyme that helps cancer cells spread through tissue (156: 53).

1999

Botany & Zoology

Kent Loeffler

A monkarch caterpillar dines on a milkweed leaf dusted with corn pollen.

Jordan Rehm/U. Washington

One monkeyflower (left) attracts bumblebees, but close kin (right) interests hummingbirds.

- Botanists redrew plants' evolutionary tree, clarifying what Darwin called "the abominable mystery" of the origins of flowering plants (156: 85).

- Raising much debate, lab tests showed that pollen of corn engineered to make the biopesticide Bt kills monarch-butterfly caterpillars (155: 324*).

- The second known population of the coelacanth, a living fossil reported in Indonesia in 1998, was declared a new species (155: 267).

- As temperatures rose in recent decades, British birds nested earlier and some 40 species' nesting ranges shifted north, while Mexican jays in Arizona started families earlier in the spring (155: 383).

- Pennsylvania reported the first North American outbreak of plum pox, a dreaded fruit-tree virus (156: 325*).

- A graduate student discovered that fungus-growing ants carry weed-killing bacteria, overlooked by a century of research (155: 261).

- Scientists confirmed that a chytrid outbreak killed boreal toads in Colorado, the second cluster of fungal fatalities in wild U.S. amphibians (156: 219).

- A test of gill nets used for salmon fishing revealed that replacing the top of the hard-to-see net with white mesh reduced accidental seabird drownings (156: 359).

- Researchers used isotopes to trace monarch butterflies to particular wintering sites in Mexico (155: 5*).

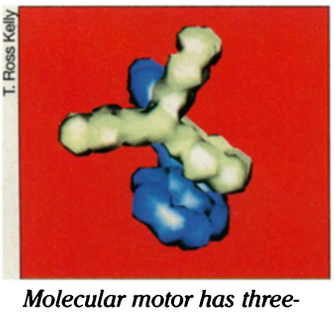
- A few genes in monkeyflowers make a huge difference in pollinators' reactions, suggesting that evolution doesn't always mince along with baby steps (156: 244).

- Threatened mothers produce extra-tough offspring, at least among radishes and water fleas. Moms boost their defenses and pass them along to their young even after danger passes (156: 151).

- In a test of the idea that sexual promiscuity helps fight parasites, bumblebee nests with high genetic diversity were found to have fewer parasites and more young than did colonies of low diversity (155: 78).

- Although males often rank as underbugs among social insects, researchers discovered that in one wasp species, guys rule (155: 116).

Chemistry



T. Ross Kelly

Molecular motor has three-bladed fan (white) attached to ratcheting mechanism (blue).

- Better understanding of the drug vancomycin may lead to new strategies against antibiotic-resistant bacteria (155: 268).

- New evidence explained how DNA strands conduct electrons, a process that might contribute to repair of genetic mutations (156: 104).

- Genetically engineered rape plants produced a healthier saturated fat that can replace the processed canola oil in margarine and baked goods (155: 357*).

- Teeth treated with a synthetic protein remained free of a cavity-causing bacterium for more than 3 months (155: 22*).

- Researchers found hints that harsh conditions at undersea vents foster chemistry that may have led to early life (155: 24*).

- Antibodies blocked the harmful effects of cocaine and PCP in laboratory rats, suggesting a novel way of treating overdoses and addiction (156: 134).

- Microwave heating proved a fast, inexpensive way to make metal parts with superior mechanical properties (156: 31).

- A newly developed leadfree alloy proved cheaper and easier to recycle than conventional steel (155: 406).

- Acetaldehyde, a normal metabolite of alcohol, may be the key to explaining why having a daily drink lowers the risk of heart disease (156: 150).

- A polymer that turns sticky when subjected to a slight temperature change could serve as a glue whose adhesiveness can be controlled (156: 118*).

- A material that combines a liquid crystal with silicon could someday serve as the foundation for computer chips that rely on light signals (156: 87).

- Conservators began a 3-year preservation project on the Star-Spangled Banner (155: 408*).

- DNA can link tiny particles of cadmium selenide into three-dimensional arrays potentially useful as biological sensors (156: 181).

- Researchers built single-molecule motors that spin when powered by light or chemical energy (156: 165).

Earth Science

1999

- An Oklahoma tornado set the wind-speed record, 318 miles per hour (155: 308*).

- Meteorologists discovered a cousin of El Niño in the Indian Ocean (156: 196*).

- The devastating Turkish earthquake struck in a spot that seismologists have long viewed as worrisome (156: 132*).

- Studies of Amazon deforestation proved to be underestimates (155: 228).

- Scientists discovered living bacteria in the Antarctic ice cap just above a lake (156: 230*) and proposed collecting water samples there (156: 216*).

- The carbon dioxide buildup in the air has stunted coral reef growth (155: 214).

- A Taiwanese tremor flooded scientists with more data than any past quake (156: 213).

- Research linked ancient climatic chaos to the release of carbon-rich gas (156: 260).

- Indian Ocean temperatures were found to herald epidemics in Africa (156: 36*).

- Global temperatures in 1998 proved the highest in 140 years (155: 6).

- Magnetic measurements revealed a whirlpool at Earth's core (156: 310*).

- A Wisconsin study showed little agricultural erosion (156: 116).

- Signs of climatic warming appeared in the Arctic Ocean (155: 104).

- Meteorologists predicted that La Niña will skew U.S. winter weather (156: 278*) and started factoring global warming into extended forecasts (155: 188*).

- Scientists studied ways to adapt to climate change (156: 136*).

- A new cloud-seeding technique showed promise (156: 56).

- Strong rooms with thick concrete walls protected people in twisters (155: 335*).

- Scientists explored underground disposal of carbon dioxide (155: 392).

- A seabed slide caused a deadly Papua New Guinea tsunami (156: 100*).

- The history of water movement sparked debate concerning a proposed nuclear waste site (155: 374).

- A new hypothesis emerged to explain how heat stirs Earth's innards (155: 180*).

- Studies of Venice Lagoon revealed the city's long war with water (156: 63).

- Research aircraft found unexpected smog over the Indian Ocean (155: 389).

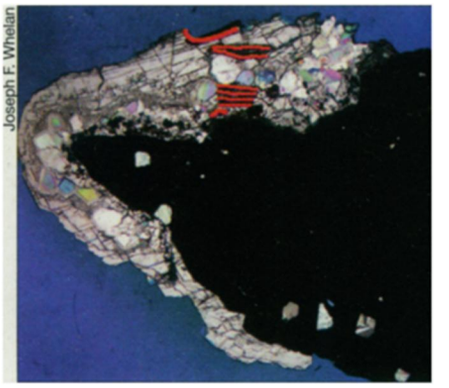
- A volcano added to Mexico City's air-pollution problems (155: 245).

- Geologists linked a massive eruption in Pangea to extinctions 200 million years ago (155: 260*).

- Thick sediments beneath Seattle boost its quake hazard (155: 294).

- Rock samples revealed former Galapagos islands beneath the Pacific (155: 389*).

Reefs are threatened by carbon dioxide in the atmosphere.



Joseph F. Whelan

Calcite and opal coating this rock provide clues about Yucca Mountain's past.

Environment & Ecology

- While European round gobies and fishhook fleas further colonized North American waters (156: 68*, 308*), scientists claimed the first eradication of an established nonnative marine pest—an abalone worm (156: 151*).

- Cutting down on haze-causing pollution could increase crop productivity—perhaps eliminating China's demand for grain exports—a study calculated (156: 356*).

- A large share of the diseases in ocean wildlife traces to a complex interplay of human activities and climate, marine epidemiologists concluded (155: 72*).

- Some of the increasing incidence of frog deformities may be due to parasites and to water pollutants that disrupt the production or action of thyroid hormones (155: 277*; 156: 212*).

- U.S. rivers have become a major reservoir of antibiotic-resistant bacteria that can spread to wildlife and people, new studies showed (155: 356*).

- Roadside monitors revealed that traffic churns up pollen and molds, loading urban air with allergy-provoking pollutants (156: 325*).

- Environmental changes can alter the preference of toxin-degrading microbes for one mirror-image form of a chemical over another, thereby throwing off scientists' calculations of pollutants' effects (156: 276).

- Many compounds that can dock in a cell's dioxin receptor may prove benign—and at

David J. Jude/U. Mich.

Round head of the pugnacious goby, which has invaded all five Great Lakes.

times even therapeutic—new studies indicated (155: 156).

- Scientists have begun analyzing data from hoofprints, remote-camera shots, and dung piles for clues on how to save the world's most endangered rhino (156: 153*).

- Fetal exposure to some of the most abundant hormonelike pollutants can feminize male animals or impair their reproductive organs (155: 213*). Early exposure to estrogen-mimicking pollutants leaves young, migratory fish unable to adapt to life at sea (155: 293*). A National Research Council panel concluded that much remains to be learned about such environmental hormones (156: 101).

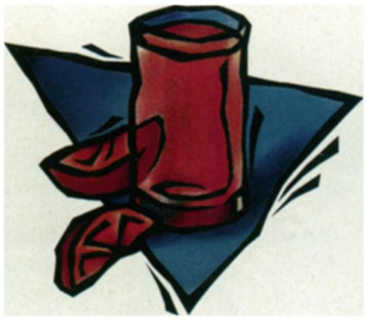
- A Danish study suggested that measurable blood levels of two persistent pesticides can increase a woman's risk of developing breast cancer (155: 56).

- A federal review concluded that although data linking electromagnetic fields to human disease are generally weak, concerns remain that such fields may not be safe (156: 12; 155: 70).

- Exposure to dioxins in breast milk can permanently weaken and flaw some children's molars (155: 119*). A new federal study concluded that heavy occupational exposure to dioxins can increase a person's risk of developing fatal cancers (155: 309).

- Scientists further developed rape, mustards, and other brassica plants as a natural means for infusing crop soils with biodegradable pesticides (156: 228).

- Running an automatic dishwasher is the most efficient means in the home for releasing waterborne pollutants into the air (156: 22).



Long-term consumption of orange juice cuts cancer risk in rats.

Food Science

- A long-running French study concluded that coronary heart disease is primarily a nutritional disease that Mediterranean cuisines can forestall (155: 119). In unrelated studies, low-fat diets boosted heart-disease risks in some people, while high-protein diets may have helped protect others against heart disease (155: 181*; 156: 86).

- Soy compounds not only help prevent the bone loss that leads to osteoporosis, but they also can cut the growth and severity of prostate cancers, researchers found (155: 15; 156: 295).

- New studies showed that beta-carotene and other carotenoids may ward off heart attacks and benefit people with diabetes (155: 127).

- Shortly after a federal court ruled that the Food and Drug Administration had unlawfully attempted to restrict sales of an herbal supplement—by designating it a drug—an international study showed that the product lowers cholesterol (155: 132, 255).

- Orange juice and some unusual fats derived from skim milk show promise in preventing colon cancer (155: 287; 156: 166).

- A new meat-grading system offered more reliable tenderness evaluations, a potential boon to the ailing beef industry (156: 340*).

- Researchers reported diverse recipes for quashing the carcinogens that form on meats as they cook (155: 264*).

- Tea and cherries contain compounds that can defuse painful overreactions by the body's immune system (155: 247).

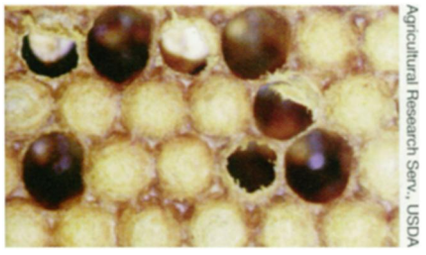
- Diets rich in blueberries appeared to halt or reverse the development of many age-related degenerative changes in brains of laboratory animals (156: 180*).

- Water incorporated into foods can fool hunger sensors into reporting satiation after people eat fewer calories than normal (155: 261*).

North American Blueberry Council

Anthocyanin pigments give blueberries intense color and antioxidant power.

Mathematics & Computers



Agricultural Research Serv., USDA

The honeybee's storage system consists of an array of hexagonal cells precisely constructed from wax.

- Four mathematicians proved the Taniyama-Shimura conjecture regarding elliptical curves, extending work that had previously led to a proof of Fermat's last theorem (156: 221).

- A hexagonal lattice represents the most efficient way to divide a surface into regions of equal area, according to a proof of the honeycomb conjecture (156: 60*).

- Efforts to avert year-2000 computer-chip and software problems held the attention of computer experts, engineers, and public officials throughout 1999 (155: 4*; 156: 294*, 351).

- The Melissa computer virus exposed new software vulnerabilities, while researchers looked for ways to render computers immune to such digital pests (155: 303; 156: 76*).

- Advances in computer technology and mathematical techniques threatened the security of the current standard encryption system (155: 363; 156: 221).

- Taking a fresh look at Fibonacci numbers,

1999

a computer scientist discovered a new mathematical constant (155: 376*).

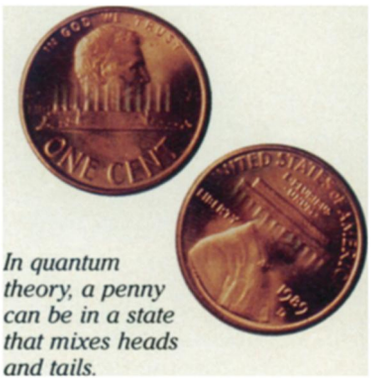
● Several studies revealed that the World Wide Web has a remarkably predictable structure, despite its apparently haphazard growth (155: 37; 156: 203).

● Computer scientists at the University of Tokyo computed the number pi to 206,158,430,000 decimal digits, surpassing their own previous world record (156: 255).

● Theorists studying quantum computation offered novel perspectives on coin tossing, chess, and game theory (156: 334).

● IBM announced plans to build in 5 years a supercomputer 500 times faster than any available today (156: 373*).

● Researchers explored ways to enhance computer programs called intelligent agents by making them autonomous, mobile, and capable of learning (155: 12*).



In quantum theory, a penny can be in a state that mixes heads and tails.

Paleobiology

● The discovery of the earliest fossil vertebrates—two Chinese fish—pushed back the origin of such animals to the Cambrian explosion (156: 292*).

● China yielded two new dinosaur species bearing evidence of downy coats (156: 183). A third Chinese dinosaur had feathers and might have flown (156: 328).

● The earliest evidence of complex cells turned up in Australian shale deposits (156: 141).

● The oldest dinosaur fossil was unearthed in Madagascar (156: 262).

● Fossil finds helped illuminate how early vertebrates evolved the ability to walk on land (155: 328*).

● Biologists debated what animals gave rise to whales (156: 296).

● Ancient leaf fossils helped explain why plants and insects battle most fiercely in the tropics (155: 407).

● Fossilized logs altered the picture of Earth's earliest wood tree (155: 319).

● Paleontologists unearthed skin impressions from dinosaurs (155: 38).

● Eggshells from an ancient emu suggested that people sparked extinctions in Australia (155: 21).

● Evidence indicated that people killed off large mammals at the end of the last ice age (156: 360*).

O. Louis Mazzatenta, © Nat. Geographic Soc.

Model of Archaeoraptor, *a tiny animal with bird feathers and a dinosaur tail.*

Physics

● New elements 114, 116, and 118 made fleeting appearances, leaving hints that scientists can create much longer–lived superheavy elements (155: 85*, 372*; 156: 287).

● Initial experimental data on subatomic particles called B mesons, plus a probing reexamination of their cousins, the K mesons, illuminated subtle, puzzling differences between matter and antimatter (155: 118, 148).

● The long-held dream of nuclear fusion on a lab bench reached fruition, at least on a small scale (155: 196*).

● After years of construction, several new or rebuilt giant accelerators started operations that may lead to deeper understanding of matter and antimatter, the fundamental forces of nature, and the Big Bang (155: 342, 399; 156: 95*). Dismissing some nonscientists' fears of global annihilation, researchers deemed the Relativistic Heavy Ion Collider safe to activate (156: 271).

● As predicted by quantum mechanics, the standoffish nature of fermions—a vast class of particles that includes protons and electrons—revealed itself in experiments on electrons and ultracold atoms (155: 230; 156: 166).

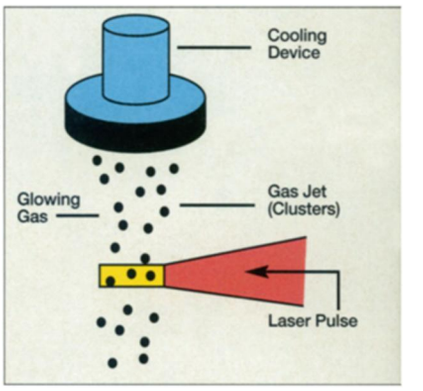
● An experiment showed hydrogen bonds to be partly covalent, a finding that might improve understanding of water's distinctive properties (155: 52*).

● A sensitive measurement showed that gravitational energy is accelerated by gravity, just like mass and other forms of energy, reconfirming Einstein's general theory of relativity (156: 277).

● An atomic-force microscope probe peeled a long, sticky molecule from a surface to make the first direct reading of a chemical bond's strength (155: 167).

● Experimenters slowed light to a bicyclist's pace, demonstrating scientists' increasing control of the quantum properties of ultracold atoms and lasers (155: 207).

● Prototype electronic devices using tricks of quantum mechanics and other innovations may lead to circuits much smaller and cooler than today's (155: 182, 303). Experimental results suggested that an alternative type of electronics based on electron spin instead of charge might work in semiconductors (155: 39).

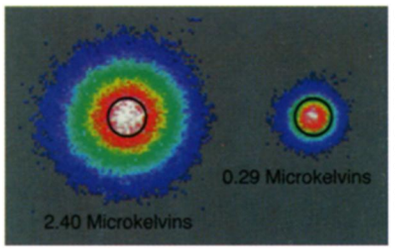


After Todd Ditmire *et al.*

Laser pulses blast clusters of deuterium atoms formed in a cooler at 100 kelvins.

1999

Technology



B. DeMarco and D.S. Jin/JILA

The energy distributions in two clouds of potassium-40 atoms indicate that some atoms assume higher energies than expected.

- Beagles received lab-grown bladders, the first engineered organs to successfully replace whole native organs (155: 101*).
- Although plastics usually burn easily, some new formulations resist fire and may soon begin to improve safety—in airplane cabins, for instance (155: 40*).
- Future electronics may use bits made from organic molecules and vacuum tubes as tiny as transistors (156: 95, 292*).
- Genetic engineering produced trees tailored to be made into paper or fuel (156: 70). Gene-altered plants synthesized commercial-grade plastic (156: 246).
- Microwave mammography, which would eliminate the discomfort of conventional X-ray breast exams, passed preliminary tests (155: 140).
- A new type of battery stored 50 percent more energy than an alkaline cell (156: 141).
- Some garments fought germs (156: 170), others commingled with computers, furthering a trend toward wearable cyberassistants (156: 330*).
- Computer scientists demonstrated that circuitry can redesign itself to handle new tasks (156: 156).

This review lists important science stories of 1999 reported in the pages of SCIENCE NEWS. The reference after each item gives the volume and page number on which the main article on the subject appeared (vol. 155 is January–June; vol. 156 is July–December). An asterisk indicates that the text of the item is available on SCIENCE NEWS ONLINE (http://www.sciencenews.org).

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