SCIENCE NEWS of the Year

This is a review of important science news stories of 1990 as reported in the pages of SCIENCE NEWS. *The references after each item refer to the volume and page number in which the main article on the subject appeared in* SCIENCE NEWS *(Vol. 137 is Jan.-June; Vol. 138 is July-Dec.). Where several references exist, the news developed and was reported in more than one issue. Back issues or, when out of stock, copies of articles are available for one dollar each by writing to* SCIENCE NEWS, *1719 N Street, N.W., Washington, D.C. 20036.*

1990

Anthropology

• Microscopic analysis of horses' teeth from a Ukrainian site indicated that people domesticated and rode horses about 6,000 years ago, much earlier than previously thought (137: 340).

• Linguists and anthropologists argued fiercely over whether diverse Native American Indian languages derived from three ancestral tongues carried to the New World in three waves of migration (137: 360). Genetic characteristics of living American Indians suggested that the vast majority descended from a single Asian population (138: 68).

• A controversial study recast a group of South African fossils, widely considered the earliest examples of anatomically modern humans, as a transitional form of *Homo sapiens* (137: 228).

• Archaeologists concluded that a temple excavated in Iraq served as a center for Babylonian healing activities more than 3,000 years ago (137: 405).

• A new and much-debated theory proposed that the evolution of a network of brain-cooling veins allowed for the striking expansion of brain size among human ancestors (138: 232).

• A unique collection of chimpanzee skeletons gathered over the past 30 years provided fresh insight into what bones can reveal about individuals and species (138: 106).

• An investigation of 5,000-year-old artifacts found on the Mediterranean island of Cyprus indicated they were used in an early birth-and-fertility ritual (137: 5). Another excavation project at a collapsed rock shelter dated the human colonization of Cyprus to at least 10,000 years ago, when now-extinct creatures roamed the island (138: 359).

• Microscopic plant remains on the fossil teeth of an enormous, extinct Asian ape that lived more than 300,000 years ago suggested the creature ate both fruits and fibrous grasses (138: 245).

• The identification of Australia's oldest known human settlement, dating to 50,000 years ago, led scientists to contend that humans first colonized the continent about 60,000 years ago (137: 293).

• Artifacts from a cave in Italy suggested that, between 55,000 and 40,000 years ago, Neanderthals in the region shifted from scavenging to ambush hunting, a behavior usually not attributed to them (138: 235). One anthropologist argued that the Neanderthals' extinction stemmed from an inability to adapt to a cooling climate and the resulting ecological shifts (137: 189).

• Evidence from two African sites indicated that the analysis of ostrich eggshells with a controversial dating technique may help pinpoint the antiquity of many early human sites (137: 215).

• Archaeologists digging on the Mediterranean island of Crete reported that the Minoan civilization, which disappeared around 1450 B.C., survived a major volcanic eruption previously thought to have spurred its collapse (137: 22).

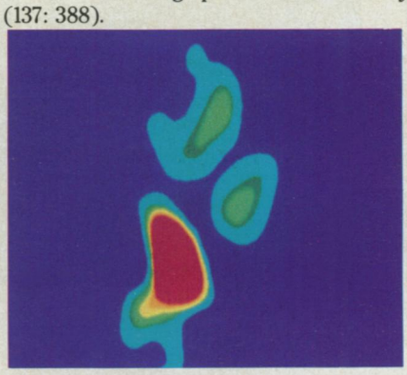
• Researchers who found a 9- to 10-million-year-old skull in Greece said it came from a direct ancestor of the evolutionary family that includes modern humans, but other scientists said the skull represented an early forerunner of orangutans (137: 390).

1990

Astronomy

• The Cosmic Background Explorer (COBE) spacecraft provided new evidence that the universe had a remarkably uniform, smooth beginning (137: 245). Its measurements placed stringent constraints on established theories and prompted new conjecture on how the universe evolved to its present lumpy state of galaxies and supergalaxies (137: 36; 137: 184). COBE's sky map also yielded the first clear picture of the Milky Way's center (137: 260).

• Telescope observations revealed two tiny spots of visible light near an intense radio source at the Milky Way's core, which may indicate whether a black hole or compact star lurks at our galaxy's center (138: 310). The most detailed radio-wavelength portrait to date of the heart of the Milky Way depicted that radio source, as well as two huge plasma blobs nearby (137: 388).



Nat'l Radio Astronomy Observatory

• Astronomers discovered what appears to be the largest and brightest galaxy known (138: 301).

• Astronomers reported they had defined and confirmed the existence of the Great Attractor, a concentration of mass that significantly alters the rate at which the Milky Way and its galactic neighbors spread apart as the universe expands (137: 60).

• With nine of its 36 tiled mirror segments in place, the Keck telescope – the world's largest optical telescope when fully assembled next year – produced its "first light" image (138: 348, 359).

• Focusing on the Orion constellation, researchers created the most extensive map yet of radio-wave emissions from atomic hydrogen in a star-forming region (137: 45).

• Astronomers retracted their 1989 report that a rapidly spinning pulsar lies at the heart of supernova 1987A, after discovering that the "data" consisted of a stray television signal (137: 119).

• The most extensive computer simulation of the evolution of the universe indicated that gravity alone could have magnified tiny fluctuations in cold dark matter just after the Big Bang, possibly giving rise to the present-day clusters of galaxies (137: 68).

• Creating the largest two-dimensional map of the universe ever achieved, astronomers found that some lumps and clumps formed by galactic clusters persist up to a scale of 150 million light-years (137: 262). Other researchers who made their observations along three longer, narrower lines of sight reported that galaxies appear to clump in groups about 420 million light-years apart (138: 260).

• Using radio-wave observations of a galaxy's ability to act as a gravitational lens, astronomers determined the mass of the most distant galaxy ever "weighed" (137: 133).

• Using special computer software to analyze faint background light and to detect its bending by gravity, researchers created the first "map" of the dark matter hidden within galaxy clusters (137: 52).

1990

Behavior

• A sample of healthy young adults reported a surprisingly high number of nightmares, suggesting that frequent nightmares usually do not reflect severe anxiety (137: 132).

• Skipping grades and taking college-level classes exerted no ill effects on the social and emotional lives of a group of mathematically gifted teenagers, and even enhanced the peer-group relations of gifted females in the study (138: 212).

• Psychologists reported that faces commonly judged as physically attractive possess features approximating the mathematical average of all faces in a population (137: 298).

• A study of Chicago jail inmates suggested that serious mental disorders occur two to three times more often among men in urban jails than among men in the population at large (137: 372).

• Researchers observed that children and adults given repeated memory tests often first recall items they previously had the most trouble remembering, apparently in an unconscious effort to salvage weak memories (138: 36).

• People with mild to moderate depression responded just as well to a computer programmed to use specific psychological techniques as they did to human therapists using the same techniques (137: 37).

• Scientists reported evidence that a specific gene may create susceptibility to a life-threatening form of alcoholism (137: 246).

• Brain imaging revealed that adults with lifelong hyperactivity display reduced metabolism in brain areas regulating motor activity and attention (138: 325).

• Citing evidence from studies of small-group decision making, scientists argued that social behavior, not selfishness, reigns over human nature (137: 266).

• Many reading-comprehension questions on the Scholastic Aptitude Test were found to measure test-taking skills rather than knowledge about previously read passages (137: 199).

• Numerous studies of unintended memories indicated that unconscious interpretations of previous experiences mold much of what we consciously remember (138: 312). In contrast, another study demonstrated that people who take college math courses remember most of what they learned in high school algebra and geometry classes up to 50 years after graduating from high school (138: 375).

• Researchers observed that newborn babies cried less when given a few drops of sugar water, possibly because sucrose activates natural opioids in the brain (138: 229). In a related study, elderly volunteers given glucose-flavored lemonade performed better on long-term verbal memory tests, perhaps because glucose boosts transmission of the neurotransmitter acetylcholine (138: 189).

• Bright-light therapy offered new hope for people with nonseasonal depression, as well as for chronic night owls experiencing serious problems with daytime alertness (137: 325).

1990

Biology

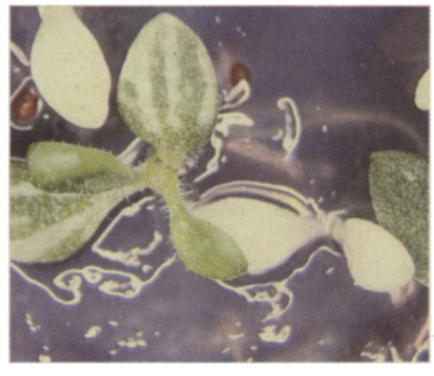
• Neuroscientists successfully maintained the first long-term cultures of mature human neurons, opening the door to unprecedented studies of the central nervous system and a possible substitute for fetal neurons as a treatment for some neurological diseases (137: 276). Other work suggested that astrocytes, cells previously thought to play only a supporting role in the brain, may be part of an information-transmitting network there (137: 54).

• The FDA and an NIH panel declared that milk produced in cows given bovine growth hormone appears safe (138: 116, 372).

• Officials destroyed the first swarm of African bees discovered in the United States (138: 261) as researchers continued to investigate the genetics of the intruding species (137: 328).

• Several animal studies hinted at future clinical applications: A compound that blocks new blood-vessel formation stymied the development of tumors in mice (137: 308); antibodies directed against nerve growth inhibitors enhanced nerve regeneration in rats (137: 38); specific antibodies reversed the ravages of a disease resembling multiple sclerosis in mice and guinea pigs (137: 218); and an experimental vaccine against Lyme disease showed promise in mice, although some scientists warned that an equally effective human vaccine might be more difficult to make (138: 261).

• Molecular biologists inserted foreign genes into the photosynthetic machinery of plants, boosting hopes for high-tech crop improvement (138: 295). Other biologists identified specific genes that allow some plants to respond to pressure cues such as wind, rain and human touch (137: 117).



Maliga

• Marine scientists proposed that unusually warm temperatures may have significantly contributed to the massive seal die-offs in 1988 (138: 84) and may underlie an apparent increase in coral reef mortality in tropical regions (138: 364).

• Researchers discovered a new form of RNA, called guide RNA, that directs nucleic-acid editing in the single-cell human parasites called trypanosomes and leishmania (137: 102). Other scientists performed the first genetic manipulations of these organisms, lending hope to the possibility of creating genetically engineered vaccines against the tropical scourges (138: 292).

• An analysis of DNA from a 20 million-year-old magnolia leaf – by far the oldest bit of genetic material ever tested – provided new information about the evolution of photosynthetic plants (137: 230). Paleobotanists discovered living members of a species of dogwood thought to have gone extinct 4 million years ago (137: 359).

• Entomologists found that a Japanese fungus, imported into the United States decades ago, has begun taking a significant toll on the tree-destroying gypsy moth (138: 77).

• Molecular biologists provided the strongest evidence yet that a mammalian gene known as SRY carries the genetic information required to make a male (138: 61). Researchers also identified two genes involved in the recombination process that underlies the creation of antibody variants (137: 4).

• Scientists cloned a protein that blocks the interleukin-1 receptor and speculated that related proteins may serve as novel anti-inflammatory drugs (137: 52).

• The first tigers produced by *in vitro* fertilization were born in Omaha, Neb., bolstering conservationists' hopes for several tiger species threatened by disappearing habitats (137: 327).

• Studies of mitochondrial DNA clarified the relationships among populations of endangered turtles (137: 294). Biologists in Brazil discovered a previously unidentified species of lion tamarin (137: 406).

• Ornithologists reported progress in using recorded bird calls, decoys and other gambits to lure seabirds back to ailing island ecosystems (138: 136).

• Researchers measured the oxygen consumption of a bumblebee during forward flight – the first such measurement for a free-flying insect (138: 215).

1990

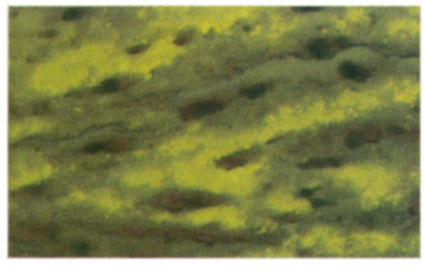
Biomedicine

• Scientists performed the first U.S.-approved infusion of therapeutic, genetically engineered cells into a human patient – a child suffering from an inherited immune deficiency (138: 180) – and reported that the therapy seemed to be rescuing the child's immune system (138: 388). Federal officials also approved a plan to inject gene-altered cancer-fighting cells into terminally ill melanoma patients (138: 68).

• At the Sixth International Conference on AIDS, scientists unveiled new data that may ultimately lead to a vaccine for the disease, and a prominent AIDS researcher supported a controversial theory regarding an AIDS cofactor (137: 404). Others at the conference described a surge in the incidence of an aggressive form of lymph cancer among people infected with the AIDS virus (138: 104). Elsewhere, investigators reported preliminary evidence that treatment with a photoactive drug and ultraviolet light may inactivate the AIDS virus in the blood of people with early AIDS (138: 103), and virologists reported experiments suggesting that injections of harmless fragments of the AIDS virus might protect humans from the infection (137: 363). A genetically engineered compound called soluble CD4 slowed the progression of AIDS (137: 101), while the drug dideoxyinosine sparked concerns about serious side effects (137: 315).

• Scientists identified several clinically important genes, most notably the gene causing neurofibromatosis – the first such discovery for an inherited neurological disease (138: 61). Investigators found that this gene's protein product belongs to a family of proteins involved in cancer (138: 101). Other researchers identified genes linked to arterial ruptures (138: 293) and to a class of arthritic diseases (138: 357). Rat experiments turned up the first known link between a gene and high blood pressure, boosting hopes that scientists might soon identify an equivalent gene in humans (138: 148).

• Researchers confirmed that coronary artery disease can begin during childhood (137: 37). Middle-aged men who adopted a heart-healthy lifestyle showed a reduction in heart attack risk (137: 230). Blood tests revealed a link between fat bellies and high blood cholesterol levels (137: 334), and researchers identified the newest cholesterol-carriers in the heart disease saga (137: 100).



Kruth

• Genetic tinkering in the lab reversed the cellular defect causing many cases of cystic fibrosis (138: 181). Researchers reported that many different genetic mutations can cause cystic fibrosis, and others showed that the most severe of those mutations may cause the mildest forms of the disease (138: 52, 245). Monkey experiments revealed that the most prevalent mutation results in incomplete processing of a critical protein cell-membrane location (138: 324). On the clinical front, a diuretic drug slowed the lung damage of cystic fibrosis (137: 260).

• An inexpensive, widely used anti-inflammatory drug became the first compound shown to prevent or reduce the degree of paralysis in people with spinal injuries (137: 212).

• Researchers reported that treatment with aspirin or warfarin, an anticlotting drug, lowers the threat of stroke among people with an irregular heartbeat (137: 180). Aspirin also lowered the risk of migraine headaches (137: 103) and boosted blood alcohol levels (138: 327).

• Widespread distribution of the antiparasitic drug ivermectin helped lower the incidence of river blindness in West Africa (138: 215). Scientists discovered an unexpected side benefit: Disease-spreading mosquitoes become sterile or die after feeding on human blood containing high concentrations of the drug (138: 318).

• Embryo transfers using eggs from younger donors enabled several postmenopausal women to deliver healthy babies (138: 263).

• Melanoma tumors showed significant shrinkage in patients treated with monoclonal antibodies (137: 324) or with vaccination-like injections of fragmented melanoma cells (137: 197). Radiation oncologists identified a new mechanism – cellular secretion of a powerful toxic chemical – through which radiation indirectly kills some tumor cells (137: 20).

• Scientists linked OKT3, an immunosuppressant used in organ-transplant patients, with an increased risk of non-Hodgkin's lymphoma (137: 343).

• Transplants of fetal brain cells and adult adrenal cells into the brains of patients with Parkinson's disease continued to elicit moderately promising results (137: 70, 140).

• Researchers advanced their understanding of the cellular and molecular mechanisms underlying Alzheimer's disease, but an effective treatment remained elusive (137: 120).

• A form of human growth hormone counteracted some signs of aging and improved strength and endurance when given to men aged 60 and older (138: 23). British researchers observed disturbing physical and metabolic changes in short but clinically normal children receiving supplementary doses of human growth hormone (138: 356).

• A nonhormonal drug boosted bone mass and decreased fracture incidence in postmenopausal women with osteoporosis (137: 334; 138: 22). Scientists reported indications that a subtle menstrual abnormality can spur bone loss in young, outwardly healthy women (138: 279). Investigators found a possible link between PMS and the metal zinc (138: 263), while others challenged the usefulness of progesterone in treating PMS (138: 37).

• Scientists measured levels of a blood protein to predict Type I diabetic complications months in advance (138: 247).

• In preliminary human trials, a new drug appeared to offer the first effective and relatively side-effect-free treatment for ulcerative colitis (137: 277).

• Injections of muscle cells showed some promise as a treatment for Duchenne's muscular dystrophy (137: 380).

• A drug prescribed to prevent fever-associated seizures in children was linked to lowered scores on intelligence tests (137: 111).

• The Nobel Prize in Physiology or Medicine went to organ-transplant pioneer Joseph E. Murray and bone marrow specialist E. Donnall Thomas (138: 231).

1990

Chemistry

• Researchers developed a technique for synthesizing fullerenes, a new class of carbon materials made of spherical molecules, including a soccerball-shaped version previously postulated but never before made in large enough quantities for in-depth study (138: 238). The work sparked a flurry of investigations into the physical properties of fullerenes (138: 357).

• The Nobel Prize in Chemistry went to organic chemist Elias J. Corey, who developed much of the logic behind modern chemical synthesis and who has made dozens of useful chemicals, most based on natural structures (138: 262).

• Chemists devised a two-component molecular machine that can replicate itself by serving as a template on which new components arrange themselves and by acting as a catalyst to link together the newly arrived parts before releasing the assembled copy (137: 69).

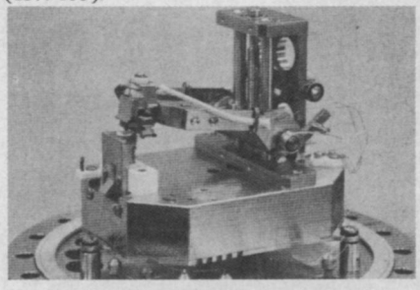
• Researchers reported expanding the standard four-nucleotide genetic alphabet by adding two artificial nucleic acids that cellular biochemical machinery can recognize and build into new DNA and RNA molecules (137: 88).

• After using computers to design an enzyme nearly from scratch, biochemists assembled the enzyme and observed that it worked almost as well as a natural enzyme with the same function (137: 388).

• At the first Annual Conference on Cold Fusion, believers reported supportive evidence for cold fusion and nonbelievers pointed out negative results (137: 212). Legal shenanigans, political embarrassments and revelations of potentially tainted results darkened the view of cold fusion research (137: 374).

• Chemists hooked together five molecular components into a pentad that mimics the early stages of photosynthesis (137: 247).

• Robotics engineers used a "magic wrist" to rig up a device that enables them to steer a scanning tunneling microscope (STM) over atomic and molecular landscapes while "feeling" the contours of those landscapes (137: 216). The family of scanning probe microscopes gained a new member, the scanning chemical-potential microscope (137: 223). Researchers used the solid tip of an STM to deposit microscopic characters onto surfaces (138: 310). Others used STMs to study how molecules interact with the surfaces of catalysts known as zeolites (137: 165).



Hollis

• Physicists using diamond anvil cells found indications that hydrogen molecules under ultrahigh pressures become a solid and perhaps even a metal (137: 164).

1990

Computers & Math

• Computer simulations offered new perspectives on the early history of the universe (137: 68, 184), the structure of materials (137: 26, 231; 138: 5), chemical reactions (137: 53) and the effects of global warming (137: 23, 280, 308).

• A National Research Council study identified potential security problems with computers and recommended policies to help protect against intruders (138: 373). Researchers built an electronic device that depends on quantum effects to ensure the security of data transmission (137: 342).

• Two computer scientists factored a record-breaking, 155-digit Fermat number (137: 389; 138: 90).

• Number theory provided a novel strategy for packing spheres efficiently (137: 316).

• Fields medals for innovative research in mathematics went to Vaughan F.R. Jones, Edward Witten, Shigefumi Mori and Vladimir G. Drinfeld (138: 119).

• A graduate student constructed a mathematical scheme corresponding to a dynamical system that behaves more unpredictably than a typical chaotic system (137: 327).

• Computer programs known as cellular automata played an important role in schemes for creating artificial systems that mimic the behavior of living organisms (137: 86, 103, 110, 312).

• A scheme for speeding up multiplication led to the design and construction of a unique, general-purpose scientific computer (138: 222).

• Two graduate students pioneered a novel graphics technique for illustrating the effects of special relativity (137: 232).

• Researchers developed a technique for visualizing the solutions of equations describing the motions of Earth-orbiting satellites (137: 116).

• A new mathematical analysis challenged the common explanation for the 1940 collapse of the Tacoma Narrows suspension bridge (137: 344).

• Researchers developed a powerful new mathematical procedure for reconstructing the internal structure of objects that scatter incoming radiation (138: 47).

1990

Earth Sciences

• In a firm consensus statement, hundreds of climate experts from around the world concluded that the planet will warm dramatically unless nations move to halt the buildup of greenhouse gases in the atmosphere (137: 391). While almost all western industrialized nations announced plans to at least stabilize their carbon dioxide emissions by the year 2000 (137: 263), the United States avoided setting specific targets for limiting CO_2 emissions (137: 102, 391; 138: 310).

• To combat the threat of global warming, a panel of experts called for a substantial increase in federal support for U.S. research into energy conservation and the use of renewable resources (138: 151). Scientists identified atmospheric aerosol particles as a critical unknown in discussions of climate change (138: 118). Agricultural experts predicted that global warming should not seriously damage U.S. agriculture as a whole, although it could hurt farming in several states (137: 308).

• A federal panel substantially increased its estimates of the earthquake hazard in the San Francisco Bay area (138: 52). Studies suggested that the so-called "clockwork" quakes in Parkfield, Calif., may not strike with as much regularity as scientists have thought (137: 278).

• Representatives from 59 countries voted to stop producing most chemicals that harm the Earth's ozone layer (138: 6). The Antarctic ozone hole reached record dimensions (138: 198, 228), and pollution caused observable ozone depletion in the Arctic (137: 183). Data gathered in the Swiss Alps indicated a local rise in ultraviolet radiation over the last decade, possibly due to thinning of the ozone layer (137: 228). Studies suggested that increasing ultraviolet light in Antarctica could alter the polar food web (138: 87).

• Studies of Barbados coral revealed large errors in the carbon-14 dating scale used to measure the age of geologic and archaeological finds (137: 356).

• Scientists located the oldest portion of the Pacific plate (137: 69) and the deepest known rocks to come out of the Earth's interior (137: 324). Using seismic waves, geophysicists probed the base of one of Earth's lithospheric plates (138: 62).

• Geologists proposed several Caribbean sites as possible scars from a meteorite that purportedly slammed into Earth about 66 million years ago, wiping out the dinosaurs and many other species (137: 268, 311; 138: 319).

• Noting a connection between African rains and U.S. hurricanes, a meteorologist predicted that devastating storms will lash the U.S. East Coast and the Caribbean in the 1990s (138: 164). Meteorologists devised new techniques to help them divine whether atmospheric chaos is likely to ruin a given long-term forecast (137: 280).

• Studies indicated that humans are destroying tropical forests at a much faster rate than believed (138: 40). Others showed that burning practices around the world pollute the atmosphere far more than assumed (137: 196).

1990

Environment

• After a decade of debate, Congress finally passed amendments to the Clean Air Act, strengthening pollution controls, stepping up the monitoring of atmospheric emissions, launching a host of research initiatives and reviving the National Acid Precipitation Assessment Program (NAPAP) (138: 277).

• NAPAP issued a 28-volume analysis of acid rain's effects, controls and monitoring technologies and mapped the potential benefits of proposed pollutant controls (137: 119, 127, 143; 138: 165).

• A review of human studies concluded that chrysotile asbestos, the type most commonly used in the United States, poses no hazard at levels normally encountered outside the workplace (137: 79). Other research suggested that workplace asbestos exposures may be dangerous even in some occupations (such as firefighting and custodial work) not traditionally linked with asbestos (137: 373).

• Scientists linked the mysterious decline of many U.S. amphibians to environmental factors, including acid precipitation and gamefish stocking in lakes (137: 116, 142). A survey of fish populations hinted that species losses due to environmental changes in temperate aquatic ecosystems may exceed those in the tropics (138: 213).

• Toxicologists reported that many adults apparently never fully recover from neurological effects — including diminished IQ — resulting from childhood exposure to lead (137: 63). Epidemiologists showed that childhood lead exposure may predispose black men to high blood pressure (137: 261).

• Researchers uncovered the first strong genetic clue to how extremely low-frequency electromagnetic fields might increase cancer risk (137: 229). Several epidemiologic studies and an EPA review of research turned up data strongly suggesting these fields might cause human cancers (137: 404).

• A study of radon levels in the homes of 800 women yielded the first indication that low residential radon exposures may increase the risk of lung cancer (138: 260).

• Mouse experiments showed that inhalation of the nitrogen oxides emitted during fossil-fuel combustion fosters the spread of cancer cells in the blood (137: 221). A study of people with coronary artery disease showed that those who inhale high levels of carbon-monoxide-polluted air suffer more episodes of cardiac arrhythmia (138: 149).

• Chemists discovered that adding phosphorus to stack-gas scrubbers turns these pollution-control systems into efficient and inexpensive traps for nitrogen oxide pollutants (137: 63).

• New analyses suggested that cutting down old-growth forests and then replanting trees will not slow an impending global warming by increasing woodland storage of carbon dioxide (137: 85). Another study showed that the cooling contributed by urban trees apparently plays an important role in limiting smog development (138: 5).

• Chemists reported that lakes appear to slow the removal of toxic chemicals from the air (137: 166). Two studies demonstrated that microscopic dirt and other particles can dramatically enhance the ability of pollutants to travel long distances through water (137: 169).

• Landfill designers reported progress in making municipal landfills safer and less polluting (138: 218). An excavation of the world's largest landfill uncovered new insights into factors fostering decay (138: 324).

• Two studies showed that shoes can track in high levels of toxic substances and embed them in carpets (138: 86).

• Researchers established that the single most important risk factor in carotid artery disease, which affects an artery that supplies the brain with blood, is the number of years a person has smoked cigarettes. Others found that cigarette smoke's effects on the stickiness of blood platelets can extend to nonsmokers (137: 326). A pair of new studies suggested that smoking impairs the sense of smell and the sensitivity to pain (137: 134; 138: 326).

• A long-awaited federal animal study showed only an equivocal link between cancer and sodium fluoride, used widely in municipal drinking water (137: 278).

• Researchers estimated that up to one-third of all water-based house paints may release dangerous mercury vapors into indoor air (138: 244).

• A federal report concluded that radioactive emissions from the Hanford Nuclear Site in the 1940s apparently were high enough to pose a cancer risk to some children who drank milk obtained from contaminated cows (138: 39).

• The U.S. Department of Transportation estimated that airline crews on long routes probably face higher radiation exposures than the average nuclear plant worker (137: 118).

1990

Food Science

• The search for links between diet and breast cancer turned up diverse findings. Several human studies suggested that high-fat diets can directly increase the risk of this cancer (137: 245; 138: 126). Others indicated that a woman's breast-disease status at the time she eats a food with cancer-fostering or -inhibiting properties may largely determine whether that food will influence her breast cancer risk (137: 84, 375). One animal study hinted that a woman's dietary risk of breast cancer might depend on her mother's fat consumption before preg-

nancy (137: 5). But a reanalysis of 100 animal studies suggested that high-calorie diets pose an independent and far stronger risk than fat (138: 302).

• Researchers identified a mechanism — protection against free radicals — by which olive and canola oils may limit atherosclerosis (137: 367). Others showed that vitamin C may reduce high blood pressure and that beta carotene may slow artery disease through similar protection from free radicals (137: 292; 138: 308). Presurgical treatment with vitamin E, another free-radical inactivator, appeared to limit heart damage from coronary artery bypass surgery (138: 333).

• Medical researchers showed how high-fiber diets may protect against colon cancer (138: 69). Another study indicated that consumption of red meats increased colon-cancer risk, while eating fish, skinless chicken and fruits reduced this risk (138: 374).

• Scientists reported that "trans" fats in shortening and margarine elicit adverse serum-cholesterol changes comparable to or worse than those caused by saturated fats (138: 126).

• A report asserting that oat bran has no special cholesterol-lowering properties in healthy people was challenged by a number of fiber researchers (137: 36, 331). Several teams reported progress in designing new food products rich in the soluble fiber responsible for oat bran's cholesterol-curbing abilities (137: 330).

• A study of people with mild glucose intolerance suggested chromium-rich diets may prevent Type II (non-insulin-dependent) diabetes (137: 214). Other research indicated diets high in gummy soluble fibers may provide similar protection (137: 350; 138: 109).

• Given the same caloric intake, thin people gain more weight than fat ones, a new analysis of diet studies indicated (138: 138). Researchers showed that per calorie eaten, fatty diets tend to foster obesity more than nonfatty ones (138: 238).

• Chemists reported that a single sensory receptor on taste buds seems to respond to all sweet and bitter compounds (137: 315).

• Several studies suggested that eating garlic may inhibit the body's production of cholesterol and blood-clotting agents, reduce the risk of heart disease and help prevent cancer (138: 157).

• Epidemiologic findings appeared to link diets high in retinol, the primary form of vitamin A, to an increased risk of esophageal cancer (137: 156).

1990

Materials Science

• A relatively inexpensive and simple technique for coating materials with synthetic diamond and diamond-like materials offered the prospect of a new and a wide-ranging industry (138: 72). Using an isotopically purified source of carbon, engineers made synthetic diamonds that conduct heat 50 percent better than natural diamonds and withstand 10 times as much laser energy (138: 37).

• Scientists created "smart" materials and structures by combining materials that both sense environmental conditions, such as temperature or pressure, and respond to those conditions with changes in one or more of their properties, such as shape or electrical conductivity (137: 152).

• Using a scanning tunneling microscope, researchers obtained striking graphic evidence that certain metallic alloys form quasicrystals, which have symmetries forbidden by the usual rules of crystallography (137: 22). Other researchers used a new optical technique to assemble tiny plastic spheres into a quasicrystalline arrangement (138: 101).

• Materials scientists used silica to make the lowest-density solid materials on Earth (137: 287). Others expanded this "aerogel" family by using other ingredients (138: 316).

• Researchers found ways to circumvent processing difficulties that have hampered commercial production of electrically conductive polymers (137: 230).

• Researchers made an organic superconductor with the highest operating temperature to date (138: 167). Efforts to develop commercially viable high-temperature superconductors yielded incremental advances (137: 95, 341, 367).

1990

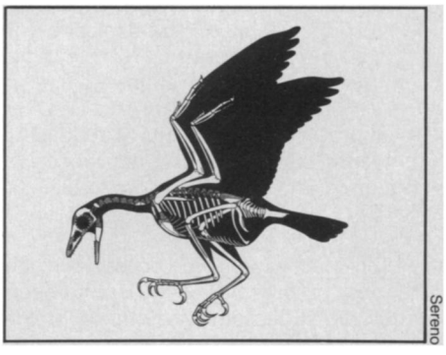
Paleobiology

• Paleontologists found the oldest known fossils of land creatures, indicating animals first crawled onto the continents much earlier than believed (138: 292).

• Excavations in Egypt uncovered the remains of a 40-million-year-old whale with feet, documenting an important step in cetacean evolution (138: 21). Antarctic whale fossils of a similar age showed notched teeth that may represent the forerunners of a comb-like structure called baleen (137: 158).

• Researchers challenged the idea that *Tyrannosaurus rex* had wimpy forearms (138: 31), while others attacked the theory that *Triceratops* could gallop like a rhinoceros (138: 255). Fossil hunters in Colorado discovered fragments of the Northern Hemisphere's oldest known dinosaur embryo (138: 212).

• Scientists reported that a 135-million-year-old fossil bird found in China represents the oldest known bird with modern flight features (138: 246). The discovery of a cache of 180-million-year-old bones in Arizona yielded clues to the evolution of worm-like amphibians called caecilians (138: 270).


Sereno

• Signs of injuries and diseases in fossil remains provided information about the behavior of long-extinct animals, including dinosaurs (137: 40). For the first time, researchers used magnetic resonance imaging to probe the interior of fossilized animal bones (138: 244).

• Swamp fossils from earlier stages in Earth's history suggested that modern ecological communities follow evolutionary rules that differ from those that shaped such communities millions of years ago (138: 184).

1990

Physics

• Studies of superdeformed atomic nuclei revealed a host of surprising features (138: 53).

• Two groups of researchers caught tantalizing glimpses of the metallic form of molecular hydrogen (137:164).

• Scientists demonstrated that a proton and an antiproton have the same mass to within four parts in 100 million (138: 38).

• Researchers developed improved methods for squeezing light (137: 151, 335).

• Physicists focused a beam of hydrogen atoms by reflecting them from a concave mirror coated with liquid helium (137: 180).

• In the most precise experimental test to date, researchers found no evidence for any violations of the Pauli exclusion principle (137: 287).

• Theoretical physicists uncovered the possibility that photons may, under special circumstances, travel faster than the established speed of light in a vacuum (137: 303).

• Using the flood of new data on Z particles, physicists established stringent limits on the number of particle families (137: 270) and refined estimates of the top quark mass (138: 204).

• Researchers reconstructed a surface's three-dimensional crystal structure from the pattern generated by electrons emitted from surface atoms (138: 134).

• Laboratory experiments provided no evidence supporting the existence of a nongravitational, "fifth" force (138: 183, 319).

• Physicists explored potential techniques for preventing the spontaneous emission of photons by atoms (138: 196).

• A novel cooling technique allowed researchers to chill atoms to 1.1 microkelvins — the coldest temperature ever achieved (138: 215).

• The Nobel Prize in Physics went to Richard E. Taylor, Jerome I. Friedman and Henry W. Kendall for work demonstrating the existence of quarks (138: 263).

1990

Science & Society

• President Bush's proposed dollar increase for civilian R&D budgets in fiscal year 1991 was three times larger than the increase he requested for defense R&D (137:71). Congress went on to cut defense R&D allocations while parceling out nearly all the funding requested for civilian programs (138: 378).

• The EPA estimated that costs of adapting to global climate change will be high but affordable by developed nations. The International Energy Agency said governments should immediately embark on radical changes to cope with global warming (137: 95).

• The State of Nevada challenged plans to build the nation's first high-level radioactive-waste repository in Yucca Mountain (137: 11). To avoid such roadblocks in the future, the National Research Council advised the federal government to relax its policies on radwaste siting and storage (138: 55).

• EPA announced it would begin overhauling research and regulatory priorities with the aim of addressing the most important environmental threats first and in the most cost-effective manner possible (138: 283).

• The National Science Foundation, responding to charges that it violated the Privacy Act, announced that it would revamp its procedures for creating and reviewing grant-proposal files and would make most file materials available to grant applicants (137: 234). NSF's inspector general acknowledged that past NSF practices had effectively subverted the intent of the Privacy Act (137: 359).

• A draft EPA report designated the tobacco smoke inhaled by nonsmokers as a "known human carcinogen" — making it the 10th substance to win that title — and recommended that employers forbid smoking at work or restrict smoking to confined, ventilated spaces (138: 4).

• The National Institutes of Health established an Office of Research on Women's Health to ensure adequate representation of women in medical study groups (138: 180).

• A controversial scientific paper on the immune system continued to draw federal scrutiny. NIH launched a misconduct/fraud probe of the case (137: 53), and a House subcommittee obtained forensic evidence suggesting that someone had tampered with dates and laboratory data recorded in the notebooks of a researcher involved in the study (137: 310).

• The President canceled scheduled sales of leases for oil and gas drilling on environmentally sensitive offshore tracts and postponed any future leasing there for at least a decade (138: 47).

• A federal study found that Vietnam veterans face a high risk of developing a deadly cancer (137: 236). Although the report did not link the cancer to Agent Orange exposure, a congressional report alleged that top federal officials — with the expressed intent of avoiding federal liability — interfered with the study (138: 103).

• The U.S. medical establishment reached its first consensus on healthy levels of dietary fat, extending its conclusions to young children (137: 132). A research review indicated that Americans have cut back on their fat consumption since the 1960s — a trend that may help account for the huge drop in coronary artery disease deaths (138: 238).

• The American Medical Association issued ethical guidelines for privately funded transplants involving human fetal tissues (137: 54).

1990

Space Sciences

• The Hubble Space Telescope finally went into orbit to begin its long-awaited observations of planets, stars, galaxies and more (137: 8, 325, 407; 138: 151, 308). A series of problems soon emerged: a jammed antenna, periodic wobbling and the discovery of a serious flaw in the telescope's primary mirror (137: 276; 138: 4, 21, 39, 295). A NASA-established investigation of the mirror problem faulted both the company that made it and NASA (138: 54, 220, 276, 359).

• The Magellan spacecraft began its radar mapping of Venus, revealing details ranging from volcanic domes to a baffling cross-hatched pattern (138: 100, 181, 199). But Magellan, too, suffered early setbacks, including repeated losses of communication with Earth (138: 117, 135, 340).

• The Astro Observatory obtained exceptional X-ray and ultraviolet data from galaxies, supernovas and ultrahot stars, despite problems that allowed it to observe only about half its planned targets (138: 356, 372).

• The Galileo spacecraft, launched in 1989, continued on its journey to Jupiter with a speed-increasing "slingshot" turn around Venus and another around Earth (137: 103, 119; 138: 382, 391).

• A large white spot appeared in the atmosphere of Saturn (138: 228) and continued to grow and change shape until it formed a band completely encircling the planet (138: 325).

• Scientists found an 18th moon of Saturn (138: 69).

• Researchers mapped the shapes and locations of Uranus' auroras (138: 248).

• Radio-frequency maps of Mercury confirmed that the locations and intensities of the planet's two hottest places are due to concentration of solar heat by Mercury's orbital motion (137: 375).

• Photos showed the comet-like coma of Chiron extending about 80,000 kilometers on either side of the object — a marked change from its slightly fuzzy appearance in 1987, which suggested Chiron was not a bare, rocky asteroid (137: 244).

• Astronomers obtained their first X-ray image of the moon, made by the German-British ROSAT satellite (138: 167).

• Japan became the third country ever to send a spacecraft to the moon, where the craft released a satellite into lunar orbit (137: 138, 198).