SCIENCE NEWS of the Year

Imagine opening a future issue of SCIENCE NEWS, fresh from your mailbox, and seeing as the lead news headline "Science Solved: The Final Theory of Everything Worth Knowing." The rest of the magazine, and all issues thereafter, would be packed with descriptions of scientists detailing only small stuff, mundanely filling narrow crevices in perfectly satisfactory ideas. Not likely, I say.

Two years ago, however, writer John Horgan published a book claiming that in the next few years all the major scientific puzzles would be solved. *The End of Science* (1996, Helix Books) triggered an angry reaction from scientists. This year, John Maddox, retired editor of NATURE, responded in his own book by mapping out what he sees as the unsolved but not intractable problems (*What Remains to be Discovered,* 1998, The Free Press). Horgan and Maddox recently continued the argument in a debate in New York.

I believe that Maddox is closer to the truth. SCIENCE NEWS of the Year shows that 1998 brought impressive advances in several areas of science but no sign that scientists are approaching a finish line. Even more important than any list of unanswered questions is the set of problems that have not yet occurred to any of us.

For example, while the newest findings in cosmology (see p. 392) suggest an answer for the question of what fueled the Big Bang, that answer leads to a previously inconceivable question: Is there a multitude of universes? Further advances in all fields will open for exploration even more, often unexpected, territories and prompt questions beyond those that Maddox highlights in his book.

Scientific activity may slow if funding becomes more limited or if fewer talented students choose research careers. But as imaginative people continue to observe the world, they will create explanations for what they find and invent tests for their theories. There can be no shortage of topics for scientific inquiry, so I predict that the pages of SCIENCE NEWS will remain chock-full of reports disclosing exciting findings.

—Julie Ann Miller, Editor

Anthropology & Archaeology


James E. Brady

Pottery found in a Mayan cave exhibits painted designs.

- A 1-million-year-old skull of a human ancestor found in Africa fills a large gap in the fossil record (153: 356).

- Disputed DNA data indicated that modern humans migrated out of Africa around 100,000 years ago and founded modern East Asian populations (154: 212*).

- An evolutionary precursor of modern humans reached an Indonesian island by 800,000 years ago, raising the possibility of surprisingly early sea travel (153: 164).

- Ancient residents of what is now Peru showed a flair for metalworking (154: 292) and maritime occupations (154: 205).

- A specimen thought to be a Neandertal flute made from a bear bone may instead have been punctured and gnawed by wolves or other carnivores (153: 215).

- An analysis of small channels in fossil and modern skulls suggested that humanlike speech abilities arose at least 400,000 years ago (153: 276).

- Cave explorers found that ancient Maya settlements were situated on and around numerous caverns that held great political and spiritual meaning (153: 56*).

- Second-millenium-B.C. Mesopotamians melted and slowly cooled silt to make slabs of rock for construction projects and grinding grain (153: 407).

- By about 8,000 years ago, prehistoric North Americans had fashioned sophisticated sandals and slip-on shoes (154: 7).

- New evidence suggested that humans inhabited an Australian roćk shelter 22,000 years ago, much more recently than previously estimated (153: 343).

- Aerial radar maps helped to locate waterworks and temple remains of an ancient Cambodian civilization (153: 117).

● Rather than slowing down, the universe appears to be expanding at an ever-increasing rate (153: 4*, 185, 344; 154: 277). The landmark finding ties together elements of a cosmic portrait that has emerged over the past decade (154: 392*).

● A torrent of gamma rays from a nearby star pointed to the existence of magnetars, the most highly magnetized stars postulated in the universe (154: 164*).

● Staring down a corridor 12 billion light-years long, the Hubble Space Telescope dramatically increased the number of galaxies that scientists can study (154: 343).

● Astronomers detected several of the most distant galaxies known (153: 280; 154: 228*, 296). They also discovered some 15 distant galaxies whose images are greatly magnified by gravitational lenses (154: 389).

● After finding several hundred distant galaxies, astronomers began to identify patterns in the distribution of visible matter in the early universe (153: 92).

● Astronomers discovered several planets belonging to nearby, sunlike stars, bringing to 16 the known number of such orbiting bodies (153: 405*; 154: 22, 197*, 362). Theorists puzzled over the formation and evolution of these planets (154: 88*).

● Radio and infrared images suggested that three nearby stars may be in the throes of forming a solar system (153: 260*). The thinning, hollowed-out disk of dust surrounding the star Epsilon Eridani bears the most striking resemblance to the early solar system (154: 91). A close stellar partnership may hasten the birth of planets (154: 239).

● Simulations indicated that half the ordinary matter in the cosmos remains hidden because it radiates at hard-to-detect wavelengths (153: 390).

● The Sloan Digital Sky Survey, which will encompass 1 million galaxies in the nearby universe, got under way (153: 375).

● Astronomers made progress in understanding the origin of gamma-ray bursts and the energy they unleash (153: 118, 292*, 326).

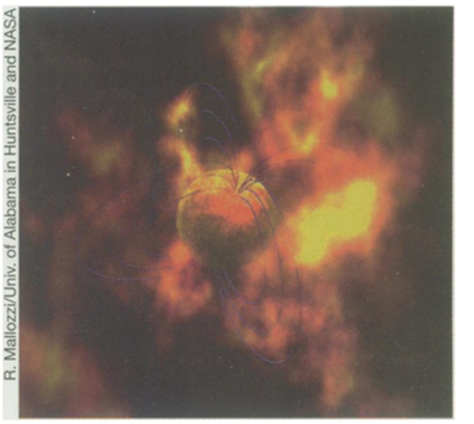
● Observations of a newly discovered supernova remnant indicated that the explosion from which it arose was the nearest one to Earth during the past 1,500 years (154: 309).

● Eleven years after astronomers witnessed supernova 1987A, a shock wave from that cataclysm began ramming into a surrounding ring of gas (153: 100).

● Planetary scientists added to the evidence that water once flowed freely on Mars (153: 84).

● NASA began making plans to carry to Earth bits of Martian rock and soil by 2008 (153: 265*). Geophysical energy on the Red Planet may have powered the evolution of a modest population of microorganisms, perhaps too small for any remains to be detectable now (154: 135). Two studies chipped away at the likelihood that an Antarctic meteorite contains fossils of ancient Martian life (153: 54).

● Astronomers discovered circularly polarized light in a nearby star-forming region, which could explain why life on Earth uses only left-handed amino acids and right-handed sugars (154: 68).



Artist's depiction of a magnetar, a neutron star with the strongest magnetic fields known.

● New findings lent support to the notion that Jupiter's moon Europa had, and might still harbor, an underground ocean (153: 11, 149). Callisto, the outermost of Jupiter's four large moons, may also possess an ocean beneath its icy surface (154: 296).

● A spacecraft gathered the best evidence so far of frost deep within craters at the moon's north and south poles (153: 166; 154: 239).

● Two giant storms on Jupiter merged (154: 150).

● Planetary scientists constructed the first accurate, three-dimensional map of the north polar region of Mars (154: 373*).

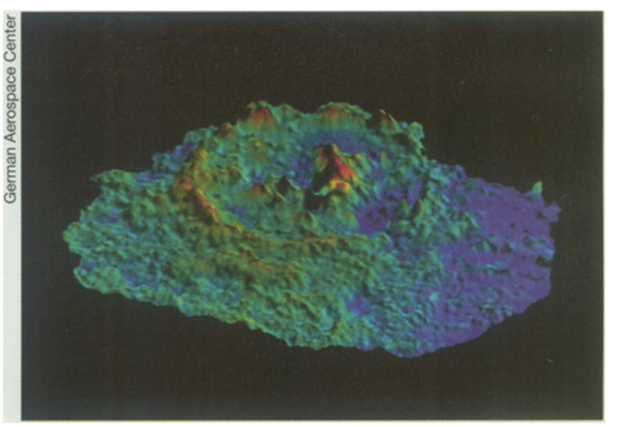
● For the first time, cosmologists harnessed enough computing power to simulate the action of gravity on matter over a huge volume of space, beginning 1 billion years after the Big Bang (154: 11).

● Spacecraft observations homed in on activity at the surface of neutron stars, testing a key prediction of Einstein's general theory of relativity (154: 11, 318).

● Astronomers found stronger evidence that the Milky Way's core contains a black hole as massive as 2.6 million suns (153: 59).

● Voyager 1 became the most distant spacecraft in the solar system (153: 152).

● The orbiting X-ray observatory ROSAT ended its mission (154: 379).



Stereo view of the crator Pwyll on Jupiter's moon Europa.

1998

Behavior

Teenage drinking portends later alcohol problems.

- Immigrants and their children tend to become more susceptible to mental and physical ailments with greater exposure to U.S. culture (154: 180*).

- Rhesus monkeys showed they can order numbers from one to nine (154: 296). In related work, 3-month-old babies learned and remembered the order of up to five items (154: 53). Researchers identified a brain area active in making number comparisons in children as young as 5 years old (154: 27).

- Computerized comparisons revealed that a slightly feminine-shaped face renders men more attractive (154: 132).

- Daily exposure to bright lights for a few weeks showed renewed promise as a treatment for winter depression (154: 260*).

- People with unconventional traits or sexual preferences reported marked social benefits from Internet newsgroup participation (154: 245*).

- Scientists reported that a specific gene exerts a small but noticeable effect on childhood IQ (153: 292).

- Religious faith attracted attention as an aid in treating mild to moderate depression (153: 247). Other data suggested that the official diagnostic criteria for major depression are often misleading (153: 100*).

- People who begin to drink alcohol regularly before age 15 have strikingly high rates of alcohol problems as adults (153: 52*).

- The malfunctioning of a widespread network of brain regions was implicated in the reading difficulties that characterize dyslexia (153: 150).

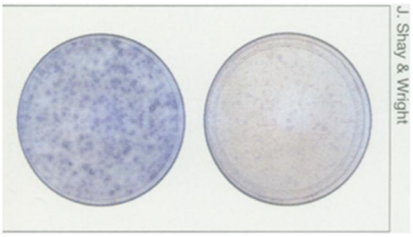
- Researchers began to unravel how people gain expertise at real-life tasks, from fire fighting to weather forecasting (154: 44).

- Evidence that visual perception and consciousness depend on the synchronized firing of far-flung brain cells sparked debate (153: 120).

- Experiments suggested that economic decisions may often reflect a type of cooperation rather than sheer selfishness (153: 205).

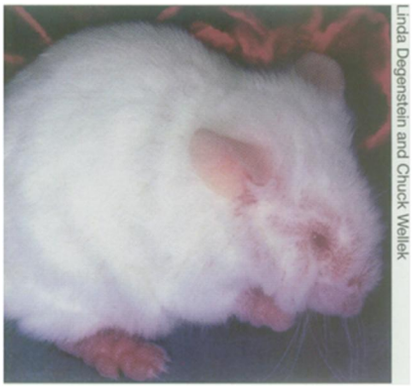
- An antidepressant drug helps cigarette smokers with no history of depression to kick their habit for at least a year (154: 102).

Biology



J. Shay & Wright

Cells making telomerase keep proliferating (left), while those without the enzyme stop.



Linda Degenstein and Chuck Wellek

Genetic engineering created this extra-furry mouse, which keeps adding hair follicles.

- Confirming that Dolly the sheep wasn't a fluke, scientists cloned cows, including a rare breed (154: 21,152), and mice (154: 74).

- Contradicting conventional wisdom, adult human brain and heart cells can divide (154: 54*, 276).

- Sparking a debate on medical ethics, researchers finally isolated embryonic human cells that can diversify into many different cell types (154: 293).

- Scientists unveiled full DNA sequences for a multicellular organism—the worm *Caenorhabditis elegans* (154: 372*)—and the bacteria that cause chlamydia (154: 261), syphilis (154: 79), and tuberculosis (153: 375).

- Engineering cells to keep producing an enzyme called telomerase, which rebuilds chromosome ends, makes the cells immortal (153: 37).

- A private company announced plans to sequence the human genome earlier than the federally funded U.S. effort (153: 334).

- Clear evidence emerged that women produce pheromones that can alter the menstrual cycles of other women (153: 164*).

- X-ray snapshots revealed how enzymes make DNA (153:106) and how the AIDS virus gains access to immune cells (154: 56).

- Subtle gene variations distinguish people who rise early versus late (154: 196) and worms that eat alone from those preferring to eat in groups (154: 167).

- DNA analyses supported the oral tradition of how the Jewish priesthood originated (154: 218) and rumors that Thomas Jefferson had a son with his slave Sally Hemming (154: 379).

- Light shone on the back of people's knees resets their biological clocks, adding to the mystery of how such internal clocks sense light (154: 24).

- An ancient infection may have been the origin of the sophisticated immune system in all vertebrates (154: 302).

- Scientists detected a gene mutation that prevents all hair growth in some people (153: 159), and other researchers created mice that grow new hair follicles throughout life (154: 340*).

- Genetically engineered mosquitoes offered hope of stemming malaria by replacing disease-bearing insects (153: 213*).

- Bacteria that thrive on aluminum were found in hot springs (153: 341*).

- Preventing normal growth of butterfly wings and beetle horns increases the size of other developing body parts (153: 231*).

- Cerebral palsy may often be caused by an inflammatory infection in the fetus rather than lack of oxygen to a baby's brain during birth (154: 244*).

- Compared to other babies, infants with an unusual heartbeat have 41 times the risk of dying from sudden infant death syndrome in the first year of life (153: 372*).

- With cancer vaccines made of cells from a patient's own body, scientists revved up the immune system to destroy tumor cells (153: 380*).

- When they were treated with a genetically engineered protein, damaged hearts grow new arteries (153: 132*).

- Gene therapy in animals successfully halted aging-related muscle loss, pointing the way to therapy for humans (154: 388).

- Miscarriages and birth defects resulting from diabetic pregnancies may be due to uncontrolled cell death in the embryo, a mouse study showed (154: 356).

- Women at high risk halve their chances of getting breast cancer by taking the synthetic hormone tamoxifen, a U.S. study reported. European researchers, however, found no significant difference between breast cancer rates in women taking tamoxifen or an inert substance (153: 228, 154: 37).

- A vaccine against Lyme disease imparts strong protection after an initial dose and a booster one year later (154: 52).

- Mutations in the gene that encodes tau protein, a compound already implicated in Alzheimer's disease, trigger some other common forms of dementia (153: 389).

- The experimental drug T-20 stops HIV from invading immune cells, offering a potential treatment for AIDS (154: 292*).

- A bacterial toxin being tested as a cancer drug also helped heal injured spinal cords in mice and enabled the paralyzed animals to walk again (154: 276*).

- Babies of mothers who smoked during pregnancy and of those who merely were exposed to second-hand smoke harbor cancer- and mutation-causing chemicals from tobacco, indicating that the substances pass through the placenta to a developing fetus (154: 133*, 213).

- Yanomami Indians in the Amazon proved especially vulnerable to tuberculosis, providing a rare modern case of a new disease outbreak (153: 73).

- Known weak links in DNA chains are often broken in tumor cells, suggesting that such fragile sites on chromosomes may foster a variety of cancers (154: 317).

- Analysis of a blood sample taken from an African man in 1959 established the earliest known infection with HIV-1, the cause of most AIDS cases (153: 85).

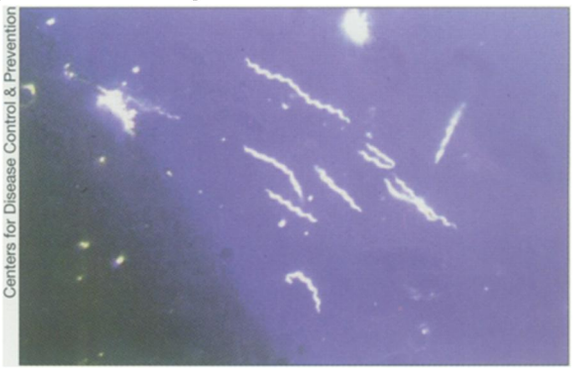
- A vaccine developed to protect against deadly Ebola virus works in guinea pigs (153: 22).

- Most pregnant women infected with HIV can prevent virus transmission to their newborns by taking the drug AZT and giving birth by cesarean section (153: 405*).

- Some age-old remedies for menopause symptoms work by mimicking estrogen, the female sex hormone (153: 392*).

- Women who develop a pregnancy complication called preeclampsia also have high testosterone levels, perhaps explaining their risk of later heart problems (153: 117).

- A study of monkeys showed that beta amyloid, the waxy protein implicated in Alzheimer's disease, damages brain cells—predominantly in older brains (154: 4*).



The corkscrew-shaped bacteria that cause Lyme disease were thwarted in vaccine tests.

- A huge dose of immature blood cells gleaned from a donor reverses the ravages of leukemia in some patients, even when donor and patient cells are slightly mismatched (154: 261).

- Men carrying an unusual version of the gene for angiotensin-converting enzyme face a heightened risk of developing high blood pressure (153: 310).

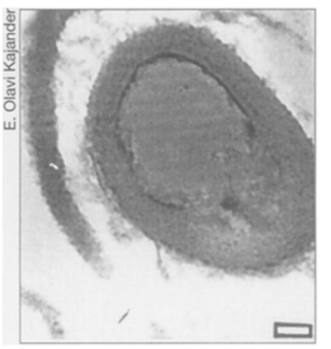
- Doctors conducted novel surgery to reverse brain damage from strokes by injecting laboratory-grown nerve cells into patients' brains (154: 120*).

- Vaccines composed of DNA that encodes compounds that alert the immune system to disease show promise against rabies and rotavirus (154: 85*).

- Microbiologists argued that unusually tiny bacteria may lead to kidney stones and other diseases not normally associated with infection (154: 75*).

- The presence of a pneumonia-causing bacterium in the brains of people with Alzheimer's disease hints that the illness may have an infectious origin (154: 325*).

- Smoking may curb breast cancer by limiting the effect of estrogen (153: 325).



A nanobacterium inside a kidney stone.

1998

Botany & Zoology

Killer whales, running short of sea lions and seals, may now be eating otters.

Many Finnish populations of the Glanville fritillary go extinct each year.

- Two coelacanths caught in Indonesia represent only the second known population of these living fossil fish, despite some 50 years of searching (154: 196*).

- African wild dogs burn more energy than predicted, raising concerns about hyenas' habit of snitching the endangered dogs' catches (153: 104).

- Researchers identified the bacterium causing an unusually virulent coral disease, plague type II (153: 229*).

- Finnish butterflies provided the first demonstration outside of laboratories that inbreeding leads to extinction (153: 214).

- Research teams found what they say is the first evidence of infanticide among dolphins (154: 36*).

- Iguanas that washed ashore on hurricane debris probably traveled more than 200 miles between Caribbean islands, the best evidence yet that animal species can spread by rafting (154: 267).

- Controversy flared over whether sores on fish, used as one of the keys for closing rivers during *Pfiesteria* fish kills, come from the microbe's toxin or from an unrelated fungus (154: 231).

- Fire ants will kill their queen if she carries a certain form of a gene—possibly the first, long-sought example of a so-called green-beard gene, one that marks its bearer for special treatment from other members of its species (154: 86).

- Male stalked-eyed flies with extra-long stalks, which females prefer, father more sons and have more decendants—a rare case of a sexual ornament that advertises real benefits (153: 36*).

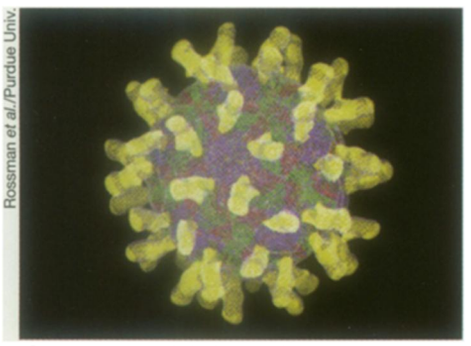
- A group of soil fungi that form partnerships with plant roots turn out to be important in determining diversity and productivity of plant communities (154: 366).

- If female fruit flies have a choice of mates for 10 generations, offspring live longer than flies from lineages of females with only one possible mate (154: 168).

- In a rare demonstration of links between major ecosystems, dwindling of prey in deep water seems to have driven killer whales to kelp forests, where they devastate sea otters (154: 245).

Chemistry

- Chemists found that pregnant women who smoke transmit a potent cancer-causing substance to their babies in the womb (154: 133*).



Computer model shows rhinovirus sites where cell receptor tips (yellow) can attach.

- A fullerene molecule smaller than the buckyball made its debut (153: 406).

- Carbon nanotubes emit light when a current is passed through them (154:116); their electrical conductivity depends on their spiraling lattice structure (153: 22).

- Half of every dose of the drug Ritalin, used to treat attention-deficit hyperactivity disorder, may contribute nothing to its therapeutic activity while possibly adding to its side effects (153: 213*).

- A cluster of six water molecules exhibits properties of the bulk liquid, making it the smallest possible drop of water (153: 180).

- The three-dimensional structure of a receptor protein revealed how it allows cold-causing viruses to enter cells (153: 263).

- Scientists identified the compound in grapefruit juice that increases the potency of many drugs (153: 295).

- A new compound appeared to provide the therapeutic benefit of aspirin without the drug's side effects (153: 327).

- A scientist debunked the notion that antique windows are thicker at the bottom because glass flows slowly downward (153: 341*).

- A replacement blood vessel made entirely of cultured human cells has the strength of a natural artery (153: 38).

- Researchers synthesized proteins able to survive boiling-hot temperatures (153: 296).

- The protein coat of a virus was used as a mold for inorganic crystals (153: 351).

- A vanadium compound inactivates sperm by shutting down the molecular motors that turn their whiplike tails (153: 359*).

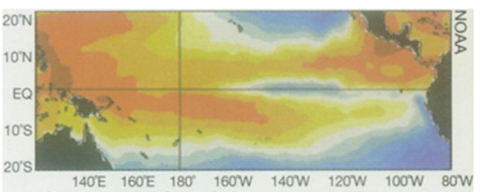
- A newly synthesized substance was expected to promote wakefulness by turning off production of the sleep hormone melatonin (154: 6).

- Under high pressures and low temperatures, oxygen was shown to become a superconductor (154: 47).

Earth Science

- A devastating tsunami struck the north coast of Papua New Guinea (154: 69*, 221*).
- A piece of the asteroid that walloped the planet 65 million years ago turned up at the bottom of the Pacific (154: 324*).
- Computer simulations indicated that greenhouse warming will exacerbate ozone destruction in the Arctic (153: 228).
- The mass extinction at the end of the Permian period happened much faster than previously thought (153: 308).
- Global temperatures continued their push upward into record range (153: 38; 154: 52*).
- A set of nuclear blasts detonated by India stymied seismologists (153: 324).
- Geologists projected that a steep hike in the price of oil will come in the next few years as supplies tighten (154: 278*).
- Errors were discovered in global temperature measurements made by satellites (154: 100).
- An undersea volcano erupted off the northwest coast of the United States (153: 133).
- California began building a warning system to tell when earthquake waves are approaching (153: 169*).
- Geologic stress is building much faster than expected at the candidate site for a high-level nuclear waste repository (153: 251).
- La Niña cooling developed in the Pacific, replacing El Niño warmth (154: 5*).
- Japan, the United States, and other nations explored the energy locked up in frozen deposits of natural gas (154: 312*).
- Geologists suggested that Earth was completely ice-covered at several intervals more than 600 million years ago (154: 137*).
- Seismic discoveries revealed important details about Earth's inner core (154: 58).
- Sound waves crisscrossing the Pacific ocean measured its temperature with high precision (154: 133).
- Seismologists found a partially molten layer at the bottom of Earth's mantle (153: 109*).
- The upper atmosphere may have shrunk in response to global warming (154: 199).
- Researchers shot down the idea that thousands of small comets bombard Earth's atmosphere each day (153: 356).
- A great earthquake hit unexpectedly off the coast of Antarctica (154: 155).
- The Antarctic ozone hole reached record dimensions (154: 246).
- North American forests may be sucking up billions of tons of carbon dioxide each year (154: 332).
- Researchers discovered that Earth is continually ringing like a bell (154: 12).
- Cosmic rays may sow the seeds of droplets and ice particles in clouds (153: 166).
- Southern California may not face as many future quakes as once thought (153: 181*).

Dark-blue ring (arrow) marks the boundary of the ozone hole in this satellite image.



Cool water (blue) has emerged in parts of the equatorial Pacific, setting the stage for La Niña.

Environment & Ecology

- After 34 industrial nations pledged to control many of the most toxic long-lived industrial pollutants, the United Nations began work on a global treaty to ban or phase out these chemicals (154: 6).
- Representatives of 62 nations signed a new Rotterdam Convention to control the export of potentially harmful chemicals into countries that decide they cannot ensure the compounds' safe use (154: 181).
- European chemists found detectable drug residues—excreted by people taking a wide variety of drugs—in samples ranging from treated sewage to open water to drinking water (153: 187*).
- The Environmental Protection Agency described its plan to screen up to 62,000 commercial chemicals for hormonal activity in humans and wildlife (154: 148; 251).
- Certain types of electromagnetic fields foster cancer in animals and can alter normal sleep and heart rhythms in people (153: 29*). Such fields can also affect human cells—perhaps inducing cancer—through enzyme-driven cell-to-cell signaling (153: 119). An expert panel recommended that electric and magnetic fields should be considered possible human carcinogens (154: 127).
- Fishing fleets, a new study showed, are maintaining their yields only by harvesting stocks that are lower and lower in the food chain—an ecologically unsustainable practice (153: 86*).
- The World Conservation Union reported in its first IUCN Red List of Threatened Plants

Alien algae smothering indigenous Mediterranean-floor ecosystems.

that one out of every eight known plant species is in peril (153: 264).

- Invasive algae, apparently escapees from aquariums, have been spreading throughout the northern Mediterranean Sea, wiping out native seafloor life and prompting calls for a U.S. ban on trade in this species (154: 8*, 332).

- A host of new studies, including several conducted in people, suggest that nighttime exposure to light may foster the development of certain cancers (154: 248).

- Heavy exposure to pesticides appears to hinder preschoolers' hand-eye coordination, recall, and ability to draw pictures of people (153: 358*).

- Boys have been making up a smaller proportion of newborns, which suggests that environmental toxicants may be selectively hindering normal development of male fetuses (153: 212*).

- Researchers identified a skin fungus as the immediate cause of amphibian die-offs in otherwise undisturbed areas of Australia, Central America, and the United States (154: 7*). A commonly used pesticide also appeared capable of contributing to frog and toad declines (154: 150*).

- Fifty years may not be enough time to restore animal species to mountain streams that were once choked by farm runoff, and reforesting just stream margins may not protect adequately (154: 375).

- Old bird-egg collections in British museums reveal thinning shells some 50 years before DDT's introduction, adding weight to concerns about the effects of acid rain on wildlife (153: 261*).

Food Science

Fattier burgers cooked up fewer carcinogens in a Kansas study.

- Several natural constituents of soy not only lower blood cholesterol but also improve other measures of cardiovascular health (153: 348). The monounsaturated fats in nuts appeared to offer similar heart benefits, a variety of studies found (154: 328*).

- The genetic engineering of a new potato pointed toward the prospect of one day vaccinating people via their diet (153: 149*).

- The Food and Drug Administration approved a spray that showers newly hatched chicks with beneficial bacteria to prevent their picking up *Salmonella* and other food-poisoning bacteria (153: 196*).

- Three studies indicated that the way meats are cooked plays a role in whether their consumption poses a breast-cancer risk (154: 341*).

- The Food and Drug Administration argued that marketing two new cholesterol-lowering products—one a margarine substitute, the other fermented rice in capsules—as dietary supplements is illegal, despite manufacturers' claims to the contrary (154: 311*).

- Because raw produce can enter the kitchen harboring many bacteria that simple washing can't eliminate, several research groups developed nontoxic germicides for disinfecting fresh fruits and vegetables (153: 340*).

- Microwave cooking can inactivate much of the vitamin B12 in foods (153: 105).

- Diets rich in magnesium, like those with abundant calcium, may preserve bones and head off osteoporosis (154: 134).

- A new analysis of animal studies found that diets rich in wheat bran offer strong protection against colon cancer (153: 303).

- Dietary antioxidants such as vitamin C appear to reduce the risk of the lung damage seen in asthma and emphysema (153: 287).

- The federal government reported success with a small company's novel method of using explosions to tenderize meat (153: 366*).

Mathematics & Computers

Thistlethwaite/Larry Gritz, Blue Moon Rendering Tools

Example of a 16-crossing knot.

- Mathematicians proved Kepler's assertion that the pattern of neatly stacked oranges in a grocery—a face-centered cubic packing—fills space more efficiently than any other arrangement of identical spheres (154: 103*).

- Cryptographers showed that monitoring the power usage of a smart card's microcircuitry can provide data for breaching the card's security (153: 388*). They also dramatically reduced the time required to identify the numerical key for decoding a message encoded with the widely used Data Encryption Standard (154: 77).

- Two teams of mathematicians tabulated all knotted loops having 16 or fewer crossings and came up with 1,701,936 different knots (154: 231).

- Mathematicians demonstrated there are infinitely many primes among whole numbers of the form $a^2 + b^4$ (153: 4).

- A prototype computer program that plays expert poker made an auspicious debut at a human-versus-computer exhibition (154: 40*).

- A college sophomore participating in the Great Internet Mersenne Prime Search discov-

ered the largest known prime number—a 909,526-digit behemoth (153: 127).

● A newly discovered set of approximate solutions of Newton's equations for gravitational attraction corresponds to strings of equally spaced masses chasing each other around closed loops (154: 149).

● The explosive growth of the World Wide Web focused attention on improving search techniques and developing methods to characterize and model Internet traffic (153: 278*, 286; 154: 255).

● A cryptographer invented an alternative to encryption, whereby confidential information is broken into segments that are tagged and inserted into a larger document (153: 286).

● Researchers proposed that a network of chaotic systems can operate as a computer (154: 217).

Paleobiology

● The discovery of feathered dinosaur fossils in China boosted the theory that birds arose from dinosaurs (153: 404*).

● The oldest animal embryos were discovered (153:84).

● The remains of possibly the oldest whale turned up in India (154: 229*).

● Studies of fossil teeth suggested that a drop in carbon dioxide concentrations redirected mammalian evolution (153: 14).

● Fossilized dung from a tyrannosaur offered new insight into the eating style of these king carnivores (153: 391*).

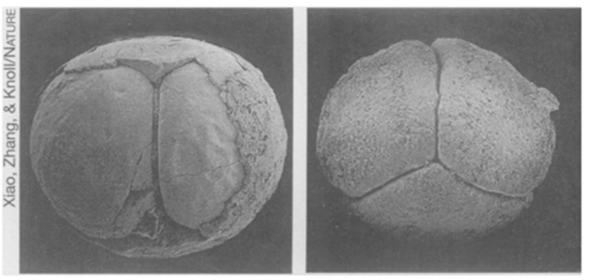
● Researchers debated whether marks on 1.1-billion-year-old sandstone were the oldest animal fossils (154: 332, 255).

● Paleontologists found the remains of muscle fiber, intestines, and the liver within a dinosaur fossil (153: 252).

● An Arctic site yielded 800-million-year-old fossils of early complex cells (154: 294*).

● An expedition in the Sahara uncovered a giant fish-eating dinosaur with a snout like a crocodile's (154: 308).

● Fossilized soil deposits indicate that life may have colonized the continents as much as 2 billion years ago (153: 151).



Fossil embryos from China preserved at the two-cell (left) and four-cell stages.

Physics

● A shortfall of neutrinos passing through Earth to a Japanese detector gave the strongest evidence yet of neutrino mass and suggested the need for a broader model of particle physics (153: 374).

● Researchers created the first ultracold molecules and a superatom, or Bose-Einstein condensate, of hydrogen (153: 342; 154: 54). Condensate atoms stayed in one quantum state even when divided up (154: 342).

● Physicists studying a rare type of radioactivity that emits protons found that certain atomic nuclei are flattened globes rather than spheres (153: 148).

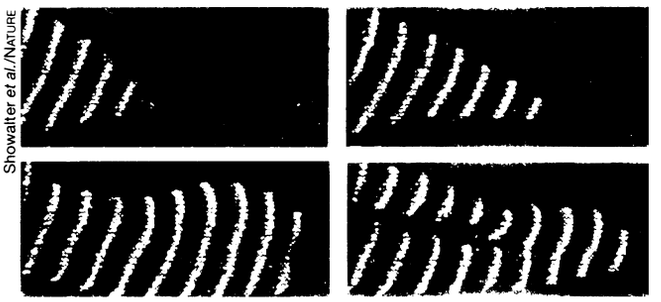
● Random fluctuations of a chemical's concentration made waves of another chemical's activity go farther, suggesting that similar noise may assist long-range signaling in brain tissue (153: 116*).

● Researchers demonstrated quantum teleportation by transferring a photon's polarization state instantaneously to a remote photon (153: 41).

● Particles known as kaons and antikaons provided the first experimental evidence that time has a discernible direction even in the subatomic realm (154: 277).

● Electrons surfed the wake of a laser pulse in the first laboratory demonstration of a scheme for making tabletop particle accelerators (154: 157).

● Error correction for quantum computers passed its first real-world test (154: 165).



Sequence of images showing the influence of noise on wave propagation of chemical activity in a gel.

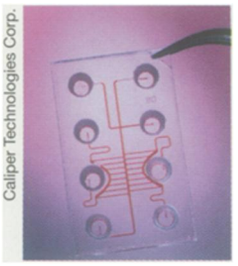
● Tracking atoms in an obstacle course of light indicated that switches between wave and particle identities hinge on quantum entanglements, not Heisenberg's uncertainty principle (154: 149).

● Physicists found surprising similarities and differences between the electron behavior of artificial atoms made from semiconductor layers, known as quantum dots, and natural atoms (153: 236).

● The search for single magnetic charges, or monopoles, at the highest particle masses explored so far came up empty (154: 4).

1998

Technology



A network of channels connects eight reaction chambers etched into a glass chip.

- Eye scans and other identification techniques that measure anatomical traits began to be used in security screening (153: 216*).

- Researchers created some of the first chemistry labs-on-chips, promising to speed chemical synthesis, diagnostic tests, and gene sequencing (154: 104*).

- Ink that changes color on electrical command fueled early work on digital reading materials that may someday rival paper's feel and convenience (153: 396*).

- Makers of car safety systems raced to develop smart air bags and other sophisticated restraints to lessen injury from forceful airbag inflation (154: 206*).

- Prototypes of less-than-lethal weapons that stun, dazzle, or otherwise incapacitate opponents emerged from military and law-enforcement projects (153: 156).

- A miniature device that bends light sharply but keeps it bright suggested a path to faster, smaller circuits for telecommunications (154: 271).

- A new device harnessed sunlight to split water electrochemically, generating hydrogen gas (153: 246).

- A technique to form exhaust manifolds from energy-saving steel rather than iron debuted at U.S. car factories (154: 79).

This review lists important science stories of 1998 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. 153 is January–June; vol. 154 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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