



Energy

MOBILE POWER

NEXT-GENERATION CONVENTIONAL FUELS

BIOFUELS

2002 Trees generate electricity. Britain's Arbre power plant in Yorkshire converts wood chips into natural gas to produce 10 megawatts of electricity.

2003 Cell phones play video clips. Schoolchildren in Japan exchange full-motion video on I-motion mobile phones. Once NTT DoCoMo moved to a 384-kilobit wireless network, the company began selling the phones, which transmit MPEG-4 streams to a square screen the size of a dinner mint. NTT execs gloat that the capability burns up airtime nicely.

WIRELESS COMPUTING

SENSORS

ADVANCED ANALYTICS

QUANTUM COMPUTING

2003 First quantum secret. A Harvard research team sends the first absolutely secure message to colleagues in Japan. The text, "What hath God wrought," is sent down a fiber-optic cable as a series of single photons. If anyone views the message before it reaches the recipient, the particles are disturbed and the message is irretrievably scrambled.

2004 Software warns of disease outbreaks. A new software package developed by Sun Microsystems and the Centers for Disease Control pinpoints viral hot zones the moment they appear. The program distills data on a 100-teraflop computer to look for subtle trends in hospital reports, school absentee lists, and veterinary clinic alerts.

2005 Super steel creates cleaner power. Advanced, heat-resistant steel is used to build coal-fired power plants that can operate at temperatures of 1,600 degrees Fahrenheit. This increases efficiency and reduces CO₂ and other pollutants.

2005 Broadband toaster talks to bread. Most household gadgets and major appliances now have wireless capability using a short-range form of the 802.11 standard. Microwaves set their own clocks, ovens display step-by-step recipes, and toasters query bread boxes for stale loaves.

2005 Soldiers wear sensors to detect bioweapons. Ground troops are issued small clip-on biosensors, reminding some of rock-band buttons. Muscle-protein molecules spread over the surface of a cheap polymer substrate are connected to a wireless alert system. When the molecules stop moving, anthrax is near and it's time to find a medic.

COGNITIVE COMPUTING

2007 New television from Philips shows only desired ads. A new Philips TV, featuring an intelligent remote control and an internal hard drive, plays only commercials that appeal to the viewer holding the remote. When a viewer clicks past an ad, that information is transmitted to the manufacturer. Supercomputers instruct the TV not to play such ads in the future and to substitute more ads like those the viewer has watched in the past.

2010 Arthritis patients get personalized medicine. With help from researchers who identified the genes and proteins that trigger joint cell inflammation, drug companies are preparing to roll out new drugs targeted to the specific genetic makeup of arthritis patients. Doctors can now use the genomic information encoded on the back of HMO cards to select from hundreds of drug variants, achieving relief with fewer side effects.

2010 Genetically engineered fuel grows like wildfire. Yes, there's an awful lot of coffee in Brazil—as well as hundreds of willow and poplar varieties. Geneticists perfect fuel-wood trees that grow quickly in the Amazon climate and can be chopped up and delivered to gasification plants all over the world. In these facilities, the wood is subjected to high heat until it forms a natural gas that can turn a turbine.

2008 "Plug and play" unplugs. Sony's newest DVD player uses a 20-megabit-per-second wireless link instead of cables to deliver audio and video.

2015 First qubit weather forecast. Exactly 1,024 very cold electrons are delivered to the National Weather Service. The electrons are subatomic particles, or qubits, suspended in liquid helium at .01 degrees kelvin. Because each qubit is capable of holding both a 1 and a 0 value at the same time, this kilobit device performs 2^{1,024} calculations simultaneously, whipping up global weather models in real time.

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2010 Woman types with her mind. Janice Appleby, a paralyzed stroke victim, reclaims her job as a court reporter with the aid of a wireless transceiver in her brain. The transmitter is connected to tiny polymer electrodes in her motor cortex, picking up signals from nearby neurons. With some practice, Appleby is faster than ever on her stenograph.

2010 Researchers produce cloned horse with normal life expectancy. Most cloned animals have been born with defects that drastically shorten their lives. Now researchers at Edinburgh's Roslin Institute have produced a viable cloned foal by tinkering with proteins that regulate gene expression during fetal development. Six months after its birth, the cloned colt, named Brownie2, appears to be quite normal.

2015 Human clone becomes media star. After weeks of hype, a teenager claiming to be the first human clone appears on the *Live With Dr. Phil* television show. The boy, Paul Clonaid, appears dangerously thin. Born into Canada's cloning-obsessed Raelian cult under great secrecy in June 2002, he has left the sect after learning that he needs dialysis. Many of his organs are aging rapidly.



Infotech



Bioscience

GENOMICS

PATHWAY BIOLOGY

LIFE EXTENSION

AGRIBIOTECH

BIOENVIRONMENTAL MANAGEMENT

BIOMANUFACTURING

2002 New climate models predict global warming. Harnessing a 3,328-processor mainframe at Lawrence Berkeley National Laboratory, researchers produce global circulation models that show how global warming will alter the climate in individual states and counties.

2002 Nanotech becomes big business. Research firm CMP-Cientifica reports that worldwide government and private nanotechnology investment tops \$4 billion. The study counts anyone designing new products smaller than 100 nanometers. (One nanometer is about three or four atoms long.)

2004 Old wine sold in new bottles. "Relic" wine is produced from grape seeds that are genetically identical to those grown in A.D. 30.

2005 Price of DNA chips falls to \$25. DNA chips, which have been used since the 1990s to identify gene sequences, fall to prices that make gene sequencing dirt cheap. At these levels, researchers predict, personalized genetic profiles will soon become part of basic family medical practice.

2008 An ear is replaced. Eddy Duff of Sterling, Va., loses an ear in a fireworks accident. Doctors remake the outer ear by stretching skin grafts over an ear-shaped hydroxide polymer. To restore Duff's hearing, doctors lower the immune response around his inner-ear tissue and add the enzyme thrombin, which regenerates crucial structures. After his recovery, Duff says his hearing is fine, except for occasional ringing.

2010 Colon cancer becomes avoidable. Doctors at the University of Kansas Medical Center now screen for one of the most common and dangerous cancers. Researchers analyze patient DNA for a signature combination of 85 gene mutations that signals a predisposition for the disease. Patients who match the signature are offered a gene therapy that slowly installs alternate DNA sequences into bowel cells.

2010 Spray soap eliminates food stains without washing. Procter & Gamble releases an aerosol detergent containing a natural enzyme that eats food stains from the surface of fabric. To develop the enzyme, P&G spent years modeling thousands of protein compounds. In a process called directed evolution, the most promising proteins were selected for further lab breeding, yielding, after thousands of "generations," the perfect stain remover.



Materials Science

NANOTECH

SMART MATERIALS

HIGH-PERFORMANCE MATERIALS

NANOTECH

SMART MATERIALS

HIGH-PERFORMANCE MATERIALS

2004 Boeing aircraft wings are sharper than Ginsu knives. Testing a new type of wing material, Boeing flies a prototype jet twice around the world without refueling. The wing was created from a new, ultrathin steel that's tougher than aluminum and 50 percent lighter. Engineers started with computer-modeled steel built molecule by molecule, then spiked it with nanotube conduits made of carbon atoms.

2005 La-Z-Boy repairs itself. A new form of vinyl fixes tears using a polymer embedded with tiny capsules of chemical catalysts. When a tear occurs, the catalysts automatically line up plastic molecules to forge new bonds.

2007 Smart battle suit provides medical attention, custom camouflage. Part of MIT's Institute for Soldier Nanotechnology, Exogear is a lightweight jumpsuit designed to give soldiers an advantage in the field. If the wearer sprains an ankle, an electric current passes through a fluid in the pant leg, making that part of the garment as hard as a cast. In the cloth, layers of polymer form a flexible video screen, allowing warriors to blend into any background.

2008 First targeted nanomedicine takes on prostate cancer. Nanotech firm BioAngstrom has developed a molecule that acts as a dispenser for prostate cancer medicine. The drug is released only when the dispenser detects tumor-specific proteins. The molecule also generates a blue "signal" pigment that appears in the urine. Thousands of men now pay more attention while peeing.

2010 Honda generates electricity using waste heat. The engine in the new Honda Accord is coated with alternating layers of an extremely thin thermoelectric film that produces enough electricity to power the car's satellite phone, satellite radio, and video entertainment system.

2012 Japan ends its reliance on oil. Japanese researchers find an alternative to foreign oil in the oceans around their homeland. Technicians use an organic catalyst to create liquid methanol out of crystal methane hydrate, a type of natural gas found frozen on the ocean floor.

2020 Palm XXVII goes nuclear. A new Palm PDA uses nickel-63 to power its color screen. The juice comes from low-level nuclear material on a chip, releasing beta particles that are collected and amplified by nanocapacitors. Since the half-life of nickel-63 is 102 years, the device runs continuously for a half-century. Palm users complain that the calendar feature runs only to 2040.

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