

Acknowledgments

The editors wish to thank the copyright holders of the excerpted criticism included in this volume and the permissions managers of many book and magazine publishing companies for assisting us in securing reproduction rights. We are also grateful to the staffs of the Detroit Public Library, the Library of Congress, the University of Detroit Mercy Library, Wayne State University Purdy/Kresge Library Complex, and the University of Michigan Libraries for making their resources available to us. Following is a list of the copyright holders who have granted us permission to reproduce material in the Gale Encyclopedia of Science, Second Edition. Every effort has been made to trace copyright, but if omissions have been made, please let us know.

PHOTOGRAPHS AND ILLUSTRATIONS APPEARING IN GALE ENCYCLOPEDIA OF SCIENCE, SECOND EDITION, WERE RECEIVED FROM THE FOLLOWING SOURCES:

Aardvark--An immature aardvark standing in the grass. Reproduced by permission--Photo Researchers, Inc. Abacus--An example of addition on a suan pan. The heaven beads have five times the value of the earth beads below them. Gale Group. Abacus--A Chinese abacus called a suan pan (reckoning board). Gale Group. Abscess--An amoebic abscess caused by *Entamoeba histolytica*. Reproduced by permission--Phototake. Accelerators--The End Station A experimental hall at the Stanford Linear Accelerator Center (SLAC) in California contains three giant particle spectrometers which detect particles of various energies and angles of scatter. Reproduced by permission--Photo Researchers, Inc. Accelerators--This particle-beam fusion accelerator can direct 36 beams of charged atomic particles at a single target simultaneously. Reproduced by permission--Photo Researchers, Inc. Acid rain--Acid rain damage done to a piece of architecture in Chicago, Illinois. Reproduced by permission--JLM Visuals. Acid rain--Trees killed by acid rain in the Great Smoky Mountains. Reproduced by permission--JLM Visuals. Acne--*Acne vulgaris*. affecting a woman's face. Acne is the general name given to a skin disorder in which the sebaceous glands become inflamed. Reproduced by permission--Photo Researchers, Inc. Acoustics--Figures 1 through 5. Gale Group. Acupuncture--A woman undergoing acupuncture. Reproduced by permission--Phototake. Acupuncture--Acupuncture sites and meridians on the face and neck. Gale Group. Addiction--Crack users. Crack, a form of cocaine, is one of the most addictive drugs. Reproduced by permission--The Stock Market. Adenosine diphosphate--ADP is formed during cellular respiration with energy released by the breakdown of glucose molecules. Gale Group. Aerobic--A scanning electron micrograph (SEM) of the aerobic soil bacterium *Pseudomonas fluorescens*. The bacterium uses its long, whip-like flagellae to propel itself through the water layer that surrounds soil particles. Reproduced by permission--Photo Researchers, Inc. Aerodynamics--Wind tunnel testing of an aircraft model. Reproduced by permission--Photo Researchers, Inc. Africa--Mount Kilimanjaro in Tanzania is the highest point in Africa at 19,340 ft (5,895 m). Reproduced by permission--JLM Visuals. Africa--Africa. Gale Group. Agricultural machines--A combine harvesting wheat in Oklahoma. Reproduced by permission--JLM Visuals. Agrochemicals--Agrochemical spraying in a Michigan orchard. Reproduced by permission--Phototake. Agronomy--An irrigated area along a river near Yazd, Iran. Note the unirrigated desert in the background. Reproduced by permission--JLM Visuals. AIDS--Mature HIV-1 viruses (above) and the lymphocyte from which they emerged (below). Two immature viruses can be seen budding on the surface of the lymphocyte (right of center). Reproduced by permission--Photo Researchers, Inc. Air pollution--Smog over Mexico City, Mexico. Reproduced by permission--The Stock Market. Aircraft--The B-2 Stealth Bomber. Photo Researchers, Inc.

Aircraft--The first supersonic transport to fly, the Soviet Union's Tupolev-144. NASA. Airship--A 1929 photo of the Graf Zeppelin. airship, which used lighter-than-air hydrogen gas. The Library of Congress. Airship--The internal structure of an airship. Gale Group. Albatrosses--Two waved albatrosses. Reproduced by permission--JLM Visuals. Albinism--A man with albinism stands with his normally pigmented father. Reproduced by permission--Photo Researchers, Inc. Alcohol--Figure 1. Gale Group. Algae--The life cycle of *Chlorococcum*, a green alga. Gale Group. Allergy--The allergic response. Gale Group. Alluvial systems--This delta formed downstream of a break in a natural levee. Note the marsh growth that developed along the banks of the distributaries. Reproduced by permission--Photo Researchers, Inc. Alternative energy sources--Wind generators in Whitewater, California. Reproduced by permission--JLM Visuals. Alzheimer's disease--Diseased tissue from the brain of an Alzheimer's patient showing senile plaques within the brain's gray matter. Reproduced by permission--Photo Researchers, Inc. Amaranth family--Love-lies-bleeding, a member of the Amaranth family. Reproduced by permission--Photo Researchers, Inc. Amaranth family--Tumbleweed plants growing in dry soil. Photo Researchers, Inc. Amaryllis family (*Amaryllidaceae*)--A Joshua tree (*Yucca brevifolia*). Reproduced by permission--Photo Researchers, Inc. Amaryllis family (*Amaryllidaceae*)--On the left a flowering century plant (*Agave shawii*), and on the right a cirio (*Idria columnaris*), Baja California, Mexico. Some plant taxonomists include agaves in the Amaryllis family, while others place it in its own family, the *Agavaceae*. Reproduced by permission--Photo Researchers, Inc. Amino acid--Figure 1. Gale Group. Amphibians--The life cycle of a frog. Gale Group. Amplifier--The power amplifier for the Antares fusion laser. Reproduced by permission--Phototake. Anesthesia--A 19th century physician administering chloroform prior to surgery (probably an amputation). Ether was one of the earliest anesthetics to be used, but was difficult to administer, as it made the patient choke. For a time it was replaced by chloroform, but made a comeback when chloroform proved even more dangerous. Reproduced by permission--Photo Researchers, Inc. Aneurism--Three aneurisms can be seen in this section of cerebral artery removed from a human brain. Reproduced by permission--Phototake. Anoles--A brown anole (*Anolis sagrei*.) on Estero Island, Florida. Anoles are the largest group of reptiles in the Western Hemisphere. Reproduced by permission--Field Mark Publications. Antarctica--Antarctica. Gale Group. Antarctica--A glacier system in Antarctica. Reproduced by permission--JLM Visuals. Anteaters--A giant anteater (*Myrmecophaga tridactyla*). Reproduced by permission--Field Mark Publications. Antenna--Antenna for a Doppler weather radar site. Doppler radar can be used to detect wind shear and microburst weather conditions. Reproduced by permission--The Stock Market. Antibody and antigen--Diagrams of the other classes of antibody molecules. Gale Group. Antibody and antigen--An IgG molecule (left) is shown schematically (right). Gale Group. Aphids--A scanning electron micrograph (SEM) of a green peach aphid (*Myzus persicae*) on the leaf of a Marvel of Peru (*Mirabilis jalapa*). This aphid winters on peach trees and migrates to other plants for the summer. It is an economic pest when it infests crops such as potatoes. The aphid is also a carrier of plant viruses, which are transmitted when it inserts its stylet into the veins of a leaf in search of sugar-carrying cells. The tubes on the aphid's back are siphons for sending pheromone signals. Reproduced by permission--Photo Researchers, Inc. Apraxia--The area of the brain associated with apraxia. Gale Group. Aqueduct--The Pont du Gard, a Roman aqueduct in Nimes, France, dates from the first century a.d. Reproduced by permission--Photo Researchers, Inc. Arachnids--A Cosmetid harvestman. Reproduced by permission--JLM Visuals. Archaeology--Archaeological excavation, Eldon Pueblo, Coconino National Forest, Arizona. Reproduced by permission--The Stock Market. Armadillos--A nine-banded armadillo (*Dasypus novemcinctus*) in the Aransas National Wildlife Refuge, Texas. Reproduced by permission--Field Mark Publications. Arrow worms--The anatomy of an arrow worm. Gale Group.

Arteriosclerosis--The progression of arteriosclerosis. Gale Group. Arthritis--A close-up of a hand deformed by rheumatoid arthritis; the knuckles are swollen and reddened and the fingers curve away from the thumb. The ends of the middle fingers are swollen with cartilage accretion (called Heberden's nodes) that are an indication of osteoarthritis. Reproduced by permission--Photo Researchers, Inc. Arthritis--The progression of osteoarthritis. Gale Group. Artificial fibers--A scanning electron micrograph (SEM) of fibers of a dacron polyester material used in sleeping bags. Reproduced by permission--Photo Researchers, Inc. Artificial heart and heart valve--Surgical implantation of a Jarvik artificial heart. Reproduced by permission--Photo Researchers, Inc. Arum family (Araceae)--A Jack-in-the-pulpit near St. Mary's, Ontario. Photo Researchers, Inc. Arum family (Araceae)--A field mouse in skunk cabbage. Reproduced by permission--Photo Researchers, Inc. Asexual reproduction--A colored transmission electron micrograph (TEM) of the *Salmonella typhimurium* bacterium reproducing by binary fission. Photo Researchers, Inc. Asexual reproduction--Phases of mitosis. Gale Group. Asia--Asia. Gale Group. Assembly line--The assembly of robots at Renault in France. Reproduced by permission--Phototake. Asthma--A comparison of normal bronchioles and those of an asthma sufferer. Gale Group. Astroblemes--An astrobleme in Arizona. Reproduced by permission--JLM Visuals. Astrolabe--Galileo's astrolabe. Reproduced by permission--Photo Researchers, Inc. Atmospheric optical phenomena--An aurora borealis display. Reproduced by permission--Photo Researchers, Inc. Atmospheric optical phenomena--Sun dogs at sunset on the frozen sea at Cape Churchill, Hudson Bay. Reproduced by permission--Photo Researchers, Inc. Atmospheric temperature--The temperature plot (Figure 3) for June through August (Southern hemisphere winter, Northern summer) shows that the equatorial temperature does not change much with the seasons. The middle and high latitudes have experienced much more change, as the temperature contours have shifted northward. The tropopause over the equator is still extremely cold, surpassed only by the stratosphere over the Antarctic. Gale Group. Atmospheric temperature--Figure 1. Gale Group. Atomic clocks--Repairs completed to an atomic clock. This clock is timed to the resonance frequency of cesium. Reproduced by permission--Photo Researchers, INC. Atomic spectroscopy--Atomic spectroscopy. Gale Group. Atomic theory--The evolution of atomic theory. Gale Group. Atomic theory--Hydrogen isotopes. Gale Group. Auks--Razor-billed auks (*Alca torda*). Photo Researchers, Inc. Australia--Australia. Gale Group. Australia--Ayers rock, central Australia, 1,143 ft (349 m) high. Reproduced by permission--JLM Visuals. Automobile--Henry Ford and his first automobile. (c) Bettmann/CORBIS. Aye-Ayes--A young aye-aye (*Daubentonia madagascariensis*). Photo Researchers, Inc. Baboons--A savanna baboon (*Papio cynocephalus*) in South Luangwa National Park, Zambia. Reproduced by permission--Photo Researchers, Inc. Bacteria--The anatomy of a typical bacterium. Gale Group. Bacteriophage--Colored transmission electron micrograph of a T4 bacteriophage virus. Photo Researchers, Inc. Badgers--A badger at its den hole. Photo Researchers, Inc. Banana--Young green bananas growing in clusters. Photo Researchers, Inc. Bandicoots--Stuffed specimen of a pig-footed bandicoot. Photo Researchers, Inc. Bar code--The parts of the Universal Product Code (UPC). Photo by Kelly A. Quin. Barometer--An aneroid barometer. Reproduced by permission--The Stock Market. Barracuda--A barracuda in its reef habitat. The creature can move with great speed to slash an intended victim to ribbons with its teeth. Photo Researchers, Inc. Barrier islands--A barrier island in the Cape Hatteras National Seashore Park, off the coast of North Carolina. Reproduced by permission--JLM Visuals. Bass--Two striped bass on the ocean floor. Photo Researchers, Inc. Bats--The endangered bumblebee bat (*Craseonycteris thonglongyai*). Unknown source. Bats--Looking up at fruit bats in Tasavo National Park, Kenya. Reproduced by permission--The Stock Market. Battery--A collection of batteries seen from above, with the top of the center battery cut away to show the interior. This type of battery, a dry version of the Leclanche cell, is

called a carbon-zinc primary cell. A carbon rod sits upright in the center and acts as a cathode (negative electrode). The outer vessel is made of zinc, which allows it to serve as both a container and as an anode (positive electrode). The electrodes are in contact with a moist electrolytic paste (the grey material that fills the battery) consisting of ammonium and zinc chlorides, manganese dioxide and carbon particles. Reproduced by permission--Photo Researchers, Inc.

Bears--A polar bear. Reproduced by permission--The Stock Market.

Beavers--An American beaver (*Castor canadensis*) dragging a willow branch over his dam in Denali National Park, Alaska. Reproduced by permission--The Stock Market.

Bee-eaters--A common green bee-eater with its catch. Photo Researchers, Inc.

Beech family (*Fagaceae*)--Sweet chestnuts. The thorny husks split to release the nuts. Photo Researchers, Inc.

Beech family (*Fagaceae*)--A beech forest. Photo Researchers, Inc.

Begonia--Imperfect begonia flowers (*Begonia tuberosa*). Reproduced by permission--Phototake.

Behavior--Among brown bears the highest ranking animals are the large adult males. These bears are fighting to establish dominance. Overt fighting is usually brief, and serious wounds are not usually inflicted. Reproduced by permission--The Stock Market.

Binary star--An x-ray image of the x-ray binary star system LMC X-1 in the Large Magellanic Cloud (LMC). LMC X-1 is seen as the two bright objects at center left and center right. The Tarantula Nebula is at the top of the cloud at left. The picture was taken by the ROSAT x-ray astronomy satellite. ROSAT discovered 15 new x-ray sources in the LMC, which is 163,000 light years from our galactic center and 33,000 light years in diameter. ROSAT was launched on June 1, 1990, and is a collaboration between Germany, UK, and USA. Reproduced by permission--Photo Researchers, Inc.

Bioluminescence--Fireflies have a bioluminescent organ in their abdomen that they use to attract mates. Enzymes within the organ react with oxygen to produce light. The insect controls the flashes by regulating the flow of oxygen. Reproduced by permission--The Stock Market.

Biome--Biomes along 87 degrees west longitude and along 0 degrees longitude. Gale Group.

Biotechnology--An animal cell being microinjected with foreign genetic material. Reproduced by permission--Photo Researchers, Inc.

Birch family (*Betulaceae*)--A birch tree (*Betula pendula*). Reproduced by permission--Photo Researchers, Inc.

Birds of paradise--An Emperor of Germany's bird of paradise in Baiyer River Sanctuary, New Guinea. Reproduced by permission--Photo Researchers, Inc.

Birth--A Holstein calf being born. Unlike a newborn human child it will walk almost immediately. Reproduced by permission--The Stock Market.

Birth--Stage 1: Dilation of the cervix. Gale Group.

Birth--Stage 2: Expulsion of the fetus. Gale Group.

Birth--Stage 3: Expulsion of the placenta. Gale Group.

Birth--A human baby being born. Reproduced by permission--Photo Researchers, Inc.

Bison--Bison (*Bison bison*) in Golden Gate Park, California. Reproduced by permission--Field Mark Publications.

Bitterns--An American bittern in Florida. Reproduced by permission--JLM Visuals.

Bivalves--The life cycle of a typical freshwater clam. For species that don't have the parasitic larval stage, the fertilized eggs develop into young clams within the gills of the mother. Gale Group.

Blackbirds--A male brown-headed cowbird in Kirtland's warbler breeding territory near Mio, Michigan. Reproduced by permission--Field Mark Publications.

Blood--Red blood cells alongside the wall of the blood vessel. Reproduced by permission--Phototake.

Blood--Figure 1. The clotting process. Gale Group.

Blue revolution (aquaculture)--Fish farming. Reproduced by permission--JLM Visuals.

Bluebirds--A male mountain bluebird flying to its nest. Reproduced by permission--Photo Researchers, Inc.

Boas--An anaconda in Venezuela, swimming. Reproduced by permission--The Stock Market.

Boobies and gannets--Blue-footed boobies in the Galapagos Islands . Reproduced by permission--Phototake.

Boolean algebra--Figure 3. Gale Group.

Boolean algebra--Figure 1. Gale Group.

Boolean algebra--Figure 4. Gale Group.

Boolean algebra--Figure 2. Gale Group.

Bowerbirds--A female satin bowerbird (*Ptilonorhynchus violaceus*) visiting a bower. Reproduced by permission--Photo Researchers, Inc.

Boxfish--A male Pacific boxfish (*Ostracion*

meleagris) near Cocos island, Costa Rica. Reproduced by permission--Photo Researchers, Inc. Brachiopods--The anatomy of an articulate brachiopod. Gale Group. Brain--A comparison of the brains of an earthworm, an insect, a bird, and a human. Gale Group. Brewing--A brewmeister and fellow worker inspect the current brew of a local beer in a brewery in the Dominican Republic. Reproduced by permission--The Stock Market. Bridges--Dame Point bridge in Jacksonville, Florida, is a cable-stayed bridge. The deck is supported by cables which transmit the load to the towers. Reproduced by permission--Phototake. Bridges--A bowstring arch bridge in Arizona. The deck is supported from the arch by hangers. The load is transmitted to the abutments by the outward thrust of the arch. Reproduced by permission--JLM Visuals. Bromeliad family (*Bromeliaceae*)--Single swamp cypress covered with spanish moss. Photo Researchers, Inc. Bromeliad family (*Bromeliaceae*)--A bromeliad growing on the bole of a cypress tree in Everglades National Park, Florida. Reproduced by permission--Photo Researchers, Inc. Bubonic plague--The Plague of 1665. Photo Researchers, Inc. Buckminsterfullerene--A supercomputer simulation of the atomic structure of a molecule of Buckminsterfullerene. Carbon molecules appear as small spheres; double bonds between them are darker than single bonds. Reproduced by permission--Photo Researchers, Inc. Buckwheat--Buckwheat (*Fagopyrum esculentum*) flowering. Reproduced by permission--Photo Researchers, Inc. Buds and budding--A hydra, budding. Reproduced by permission--Photo Researchers, Inc. Buoyancy, principle of--The molecular structure of water begins to expand once it cools beyond 4 degrees C (39.4 degrees F) and continues to expand until it becomes ice. For this reason, ice is less dense than water, floats on the surface, and retards further cooling of deeper water, which accounts for the survival of freshwater plant and animal life through the winter. Gale Group. Burn--A patient is treated for burn wounds. Photo Researchers, Inc. Bustards--A Kori bustard (*Ardeotis kori*) in courtship display. Photo Researchers, Inc. Buttercup--Meadow buttercups (*Ranunculus acris*). Reproduced by permission--Photo Researchers, Inc. Butterflies--A monarch butterfly (*Danaus plexippus*) in Livonia, Michigan. The larvae of this butterfly feed on the leaves of the milkweed, ingesting substances that make them toxic to birds and other predators. Reproduced by permission--Field Mark Publications. Buzzards--A common buzzard (*Buteo buteo*) perched in a spruce. Reproduced by permission--Photo Researchers, Inc. Cactus--A prickly pear cactus in Big Bend National Park, Texas. Reproduced by permission--Field Mark Publications. CAD/CAM/CIM--A CAD system used for Boeing airplanes. Reproduced by permission--Phototake. Caddisflies--The life cycle of a caddisfly. Gale Group. Calculator--Figure 1. Gale Group. Calculus--Figure 2. Consider approximating the area under the graph of a function $f(x)$ by drawing a series of rectangles, and summing their areas to arrive at the total area. Gale Group. Calculus--Figure 1. The rate of change in the vicinity of a particular point on the graph of a curve can be approximated by drawing a straight line through two points in the neighborhood of that point, and determining the slope of the line. Gale Group. Camels--A dromedary camel. Photo Researchers, Inc. Camels--A domesticated llama in Peru. Reproduced by permission--JLM Visuals. Canal--Canal in Delft, the Netherlands. The first network of canals was built in the thirteenth and fourteenth centuries in the Netherlands. Reproduced by permission--Photo Researchers, Inc. Cancer--A transmission electron microscopy (TEM) of two spindle cell nuclei from a human sarcoma. Sarcomas are cancers of the connective tissue (bone, nerves, smooth muscle). Reproduced by permission--Photo Researchers, Inc. Canines--A blonde dingo. Photo Researchers, Inc. Canines--The endangered red wolf (*Canis rufus*). Photo Researchers, Inc. Capuchins--A white-fronted capuchin (*Cebus albifrons*). Reproduced by permission--Photo Researchers, Inc. Capybaras--A South American capybara (*Hydrochaeris hydrochaeris*). Reproduced by permission--Field Mark Publications. Carbon cycle--The carbon cycle. Gale Group. Carbon monoxide--Figure 1. Effects of carbon monoxide on humans. Gale Group. Caribou--A reindeer bull in Finnish Lapland.

Photo Researchers, Inc. Carnivore--A cougar (*Felis concolor*). Reproduced by permission--JLM Visuals. Carnivorous plants--A pitcher plant in Isle Royale National Park, Michigan. Reproduced by permission--Field Mark Publications. Carnivorous plants--A venus fly trap with its red jaws open waiting for prey. Photo Researchers, Inc. Carnivorous plants--A slender-leaved sundew (*Drosera linearis*) in Bruce National Park, Ontario. Reproduced by permission--Field Mark Publications. Carp--A carp (*Cyprinus carpio*). Reproduced by permission--Photo Researchers, Inc. Carrot family (*Apiaceae*)--Cow parsnip growing in a field. Photo Researchers, Inc. Carrot family (*Apiaceae*)--Fennel (*Foeniculum vulgare*). Reproduced by permission--Photo Researchers, Inc. Cartesian coordinate plane--Figure 3. Gale Group. Cartesian coordinate plane--Figure 4. Gale Group. Cartesian coordinate plane--Figure 2. Cartesian Plane Gale Group. Cartesian coordinate plane--Figure 1. Gale Group. Cashew family (*Anacardiaceae*)--Maturing pistachio (*Pistacia vera*) nuts on a tree in California. Reproduced by permission--Photo Researchers, Inc. Cashew family (*Anacardiaceae*)--Poison ivy growing on a tree trunk. Reproduced by permission--Phototake. Catfish--A brown bullhead catfish. Reproduced by permission--JLM Visuals. Cats--Two cheetahs in Kenya. Photo Researchers, Inc. Cats--A leopard. Reproduced by permission--The Stock Market. Cattails--Great meadows cattails. Photo Researchers, Inc. Cattle family--A Longhorn bull, heifer, and calf. Reproduced by permission--JLM Visuals. Cattle family--A water buffalo during a monsoon in Nepal. Reproduced by permission--Photo Researchers, Inc. Cauterization--Birthmark removal by cauterization with an argon laser. Reproduced by permission--Photo Researchers, Inc. Cave--Stalactites and stalagmites in the Hams Caves, Spain. Reproduced by permission--The Stock Market. Cell--A mammalian tissue cell. Photo Researchers, Inc. Cell--Figure 1. A plant cell. Reproduced by permission--Phototake. Cellulose--Figure 1. The structure of cellulose. Gale Group. Centrifuge--A centrifuge. Reproduced by permission--Photo Researchers, Inc. Cetaceans--Two Atlantic bottlenosed dolphins. Reproduced by permission--JLM Visuals. Chameleons--A chameleon catching an insect with its tongue. Reproduced by permission--JLM Visuals. Chaos--A head-on collision between two dipolar vortices entering a stratified fluid environment from the right and left sides of the picture. The original vortices have exchanged some of their substance to form two new mixed dipoles which are moving at roughly right angles to the original direction of travel (toward the top and bottom of the photo). Dipolar vortices are relevant to turbulence in large-scale geophysical systems like the Earth's atmosphere or oceans. Turbulence within a fluid is an example of a chaotic system. Reproduced by permission--Photo Researchers, Inc. Chemical warfare--Soldiers at Assaf Harofe Hospital washing "victims" in simulated chemical attack. (c) Jeffrey L. Rotman/CORBIS. Chemoreception--Taste buds on the tongue. Reproduced by permission--Phototake. Chimpanzees--Chimpanzees (*Pan troglodytes*) in Gombe National Park, Tanzania. Reproduced by permission--The Stock Market. Chinchilla--A chinchilla. Photo Researchers, Inc. Chloroplast--A transmission electron micrograph (TEM) of a chloroplast from a tobacco leaf (*Nicotiana tabacum*). The stacks of flattened membranes that can be seen within the chloroplast are grana. The membranes that run between the stacks are stroma. The faint white patches within the chloroplast are nucleoids, where chloroplast DNA is stored. Reproduced by permission--Photo Researchers, Inc. Chromosomal abnormalities--Figure 3. The four types of chromosome structure alterations. Gale Group. Chromosomal abnormalities--Figure 1. Karyotype from a child with trisomy 13 (a) or trisomy 18 (b). Gale Group. Chromosomal abnormalities--Figure 2. Gale Group. Chromosome--A scanning electron micrograph (SEM) of a human X-chromosome. Reproduced by permission--Photo Researchers, Inc. Chromosome--Figure 1. A human karyotype. Gale Group. Chromosome--Figure 2. How DNA is packaged within chromosomes. Gale Group. Cicadas--An adult periodical cicada. Photo Researchers, Inc. Cigarette smoke--A normal lung (left) and the lung of a cigarette smoker (right). Reproduced by permission--Photo Researchers, Inc.

Circulatory system--Colorized image of the main components of the human circulatory system. The heart (placed between the lungs) delivers blood to lungs to pick up oxygen and circulates it throughout the body by means of a system of blood vessels (red). Reproduced by permission--The Stock Market. Citrus trees--Grapefruit ready to pick. Reproduced by permission--Photo Researchers, Inc. Clone and cloning--"Dolly," the sheep clone. Reproduced by permission--Photo Researchers, Inc. Closed curves--Figure 4. Gale Group. Closed curves--Figure 3. Gale Group. Closed curves--Figure 1. Gale Group. Closed curves--Figure 2. Gale Group. Clouds--Cirrus clouds (top) and cumulus clouds (bottom). Reproduced by permission--Photo Researchers, Inc. Coal--A coal seam in northwest Colorado. Reproduced by permission--JLM Visuals. Coast and beach--The coast of Long Island, New York. Reproduced by permission--The Stock Market. Coast and beach--A rocky coastline at Boardman State Park, Oregon. Photo Researchers, Inc. Coatis--A coati. Photo Researchers, Inc. Coca--The leaves and fruit of a coca plant (*Erythroxylum coca*.) in Costa Rica, the plant from which cocaine is extracted. Reproduced by permission--Photo Researchers, Inc. Cocaine--Various forms of cocaine and the addiction risks associated with them. Gale Group. Cockatoos--Cockatoos. Reproduced by permission--The Stock Market. Codfishes--A black cod. Reproduced by permission--The Stock Market. Coelacanth--A coelacanth (*Latimeria chalumnae*) preserved specimen. Photo Researchers, Inc. Coffee plant--The "wet method" of manufacturing coffee. Gale Group. Coffee plant--A coffee plant in Costa Rica. Reproduced by permission--Photo Researchers, Inc. Colobus monkeys--A black and white colobus monkey in Lake Nakuru National Park, Kenya. Reproduced by permission--Photo Researchers, Inc. Coma--The four brain conditions that result in coma. Gale Group. Comets--Optical image of Halley's comet. Photo Researchers, Inc. Compact disc--An atomic force microscope image of marks (data) burned into a write-once optical disc (WORM). Photo by Kelly A. Quin. Complex numbers--Figure 1. Gale Group. Complex numbers--Figure 2. Gale Group. Composite family--Artichokes in Salinas, California. Reproduced by permission--Photo Researchers, Inc. Composite family--Late goldenrod (*Solidago gigantea*). Reproduced by permission--Photo Researchers, Inc. Composting--Backyard composting in Livonia, Michigan. Reproduced by permission--Field Mark Publications. Compound, chemical--A mixture versus a compound. The Gale Group. Computer, digital--A possible future direction for computer technology is the optical computer. Reproduced by permission--Photo Researchers, Inc. Computerized axial tomography--Doctors examining CAT scan x rays. Reproduced by permission--Photo Researchers, Inc. Concrete--Concrete being used to pave a road. Reproduced by permission--The Stock Market. Condors--California condor. Unknown source. Congruence (triangle)--Figures 1-5. Gale Group. Conic sections--Figures 1-11. Gale Group. Connective tissue--A scanning electron micrograph (SEM) of hyaline articular cartilage covering the end of a long bone. Reproduced by permission--Photo Researchers, Inc. Conservation laws--Figures 1-3. Constellation--The constellation Orion, the Great Hunter. Public domain. Constructions--Figure 2. Illustration of Archimedes method for trisecting an arbitrary angle ABC. Gale Group. Constructions--Figure 1. Construction of an equilateral triangle. Gale Group. Continental drift--The Pangaea supercontinent (top) and its break up into Laurasia and Gondwanaland (bottom). Gale Group. Continuity--Figures 1-4. Gale Group. Contour plowing--Contour rice farming in Arkansas. Reproduced by permission--Phototake. Contraception--Variety of contraceptive methods. Reproduced by permission--The Stock Market. Coordination compound--Figures 1-7. Gale Group. Copepods--A copepod (*Diaptomus sp.*). Reproduced by permission--Photo Researchers, Inc. Coral and Coral reef--Kayangel atoll, Belau. Reproduced by permission--Photo Researchers, Inc. Coral and Coral reef--The anatomy of a hard coral (left) and the skeletal corallite that remains after the coral dies (right). Gale Group. Cormorants--Cormorants, like this double-crested cormorant (*Phalacrocorax auritus*), are sometimes mistaken for geese in flight, but unlike geese, which flap steadily and honk as they fly, cormorants flap for a while and

then glide, and they are silent in flight. Reproduced by permission--Field Mark Publications. Cotton--Cotton plants in cultivation in North Carolina. Reproduced by permission--JLM Visuals. Courtship--A male peacock displays his plumage as part of the courtship ritual. Reproduced by permission--The Stock Market. Crabs--A hermit crab. Reproduced by permission--The Stock Market. Cranes--Whooping cranes. U.S. Fish and Wildlife Service, Washington D.C. Crayfish--A crayfish at the Fish Point State Wildlife Area, Michigan. Reproduced by permission--Field Mark Publications. Crocodiles--An American crocodile (*Crocodylus acutus*). Gale Group. Crocodiles--The endangered false gavia (*Tomistoma schlegelii*). Reproduced by permission--Photo Researchers, Inc. Crop rotation--Adjacent fields of rice and wheat, Sacramento Valley, California. Reproduced by permission--JLM Visuals. Crows and jays--A Steller's jay (*Cyanocitta stelleri*) in California. Reproduced by permission--Field Mark Publications. Crustacea--Horseshoe crab. Reproduced by permission--The Stock Market. Cuckoos--A Greater roadrunner. Photo Researchers, Inc. Curve--Figure 1. Gale Group. Cuttlefish--*Sepia latimanus*. a cuttlefish, off Mota Island, Vanuatu. Reproduced by permission--Photo Researchers, Inc. Cycads--A cycad in Hawaii. Reproduced by permission--JLM Visuals. Cyclotron--This domed building houses a cyclotron at the Lawrence Berkeley Laboratory at the University of California, Berkeley. Photo Researchers, Inc. Cystic fibrosis--A cystic fibrosis patient using a nebulizer to loosen and subsequently expectorate the build up of thick mucus in the lungs. Reproduced by permission--Photo Researchers, Inc. Dams--Hoover dam from downstream looking toward the east at the face of the dam. The Colorado River is in the foreground. The dam is 725 ft (221 m) high and impounds enough water in Lake Mead to cover the state of New York to one foot deep. Reproduced by permission--The Stock Market. Dark matter--A composite image of a cluster of galaxies NGC 2300 (seen at optical wavelengths) and the recently discovered gas cloud (seen in x-ray emission) in which they are embedded. The cloud is considered to be strong evidence for the existence of dark matter because the gravitational pull of the cluster is not strong enough to hold it together. Some astronomers have suggested that dark matter (so-called because it does not emit detectable radiation) is preventing the cloud from dispersing into space. Public domain. Dating techniques--Dendrochronology is a dating technique that makes use of tree growth rings. Reproduced by permission--The Stock Market. Deer--A wapiti (*Cervus elaphus*), or red deer, in Yellowstone National Park, Wyoming. Wapiti is a Native American word for "white" and refers to the light colored rump of this species of deer. Reproduced by permission--Field Mark Publications. Deforestation--Deforestation in the jungle in Brazil. Reproduced by permission--Photo Researchers, Inc. Deoxyribonucleic acid (DNA)--The structure of a DNA molecule. The Gale Group. Depth perception--A baby puts to use his/her depth perception by reaching out and touching a toy overhead. Reproduced by permission--The Stock Market. Derivative--Figure 3. Gale Group. Derivative--Figure 1. Gale Group. Derivative--Figure 2. Gale Group. Desertification--The burning of forests, like this one in the Amazon Basin of Brazil, contributes to the process of desertification. National Center for Atmospheric Research. Determinants--Figure 2. Gale Group. Determinants--Figure 1. Gale Group. Determinants--Figure 3. Gale Group. Determinants--Figure 4. Gale Group. Dialysis--Man with damaged kidneys on a dialysis machine. The blood is removed from his arm, passed through the machine, and returned to his body. Reproduced by permission--Phototake. Diesel engine--The combustion cycle of the Diesel engine. Gale Group. Diesel engine--Figure 1. A typical pressure-volume (P-V) diagram for air-standard cycle of diesel engines. Gale Group. Diffusion--Simple diffusion (top) and carrier-facilitated diffusion (bottom) in a red blood cell. Gale Group. Digestive system--The digestive process. Gale Group. Dik-diks--A Kirk's dik-dik. Photo Researchers, Inc. Dinosaur--Dinosaur bones being excavated near Kauchanaburi, Thailand. Reproduced by permission--The Stock Market. Dinosaur--A dinosaur foot print in Tuba City, Arizona. Reproduced by permission--

-JLM Visuals. Dipole--Figure 1. Gale Group. Dipole--Figure 2. Gale Group. Dissociation--Figure 1. Illustration of the solvation process, in which the negative end of a water molecule faces the positive sodium ion and the positive end faces the negative ion. Gale Group. Distillation--A typical laboratory distillation setup. Gale Group. Disturbance, ecological--A forest in Homestead, Florida, that was destroyed by Hurricane Hugo. Reproduced by permission--JLM Visuals. Dogwood tree--A dogwood in bloom, Georgia. Reproduced by permission--JLM Visuals. Dopamine--Figure 1. The chemical structure of dopamine. Gale Group. Dopamine--A representation of how an antipsychotic drug inhibits dopamine released by presynaptic neurons from reaching receptors on postsynaptic neurons. Gale Group. Doppler effect--The Doppler effect. Gale Group. Down syndrome--An older sibling plays with her younger sister who has Down syndrome. Photo Researchers, Inc. Dragonflies--A spotted skimmer dragonfly taking a drink. Photo Researchers, Inc. Drought--Severe drought in Botswana, Africa was the result of an El Niño weather pattern that began in 1989. Reproduced by permission--The Stock Market. Ducks--A lone mallard (*Anas platyrhynchos*) amid a group of black ducks in Castalia, Ohio. Reproduced by permission--Field Mark Publications. Dune--Distant view of red sand dunes in Namibia. Photo Researchers, Inc. Dust devil--A dust devil in Kenya. Reproduced by permission--JLM Visuals. Dyslexia--A student with dyslexia has difficulty copying words. Reproduced by permission--Photo Researchers, Inc. Eagles--The harpy eagle (*Harpia harpyja*) dwells in the forests of southeastern Mexico, Central America, and South America (as far south as Paraguay and northern Argentina), where it hunts monkeys, sloths, porcupines, reptiles, and large birds. Since it prefers virgin forest, its numbers have decreased wherever there is regular human access to forest habitat. Reproduced by permission--Field Mark Publications. Ear--The anatomy of the human ear. Gale Group. Earth--The coastlines of Africa, Antarctica and Arabia are visible in this photo of the Earth taken in December, 1972, by Apollo 17. NASA. Earth's interior--Figure 1. The interior of the earth. Gale Group. Earthquake--Aerial view of Interstate 5, a California highway damaged by the Northridge earthquake in January 1994. Governor's Office of Emergency Services. Eclipses--A total solar eclipse in La Paz, Baja California, Mexico, on July 11, 1991. Reproduced by permission--Photo Researchers, Inc. Ecological pyramids--Ecological pyramids are based on the productivity of organisms. Plants account for 90% of the total productivity of the food web, and herbivores account for most of the rest. Carnivores are responsible for less than 1% of ecological productivity. Gale Group. Ecosystem--A freshwater ecosystem. Gale Group. Edema--Gross lymphoedema in the arm of an elderly woman following radiotherapy treatment for breast cancer. Reproduced by permission--Photo Researchers, Inc. Eland--A bull eland in eastern Africa. Photo Researchers, Inc. Elapid snakes--A Siamese cobra. Photo Researchers, Inc. Electric motor--A cross section of a simple direct-current electric motor. At its center is the rotor, a coil wound around an iron armature, which spins within the poles of the magnet that can be seen on the inside of the casing. Reproduced by permission--Photo Researchers, Inc. Electricity--Electricity arcing over the surface of ceramic insulators. Reproduced by permission--The Stock Market. Electrocardiogram (ECG)--Figure 4. Gale Group. Electrocardiogram (ECG)--Figure 3. Gale Group. Electrocardiogram (ECG)--Figure 2. Gale Group. Electrocardiogram (ECG)--Figure 1. Gale Group. Electromagnetic field--A demonstration of the effect of an electromagnetic field on an electron beam. The dark circles are the coils of wire of an electromagnet. Current flowing in the wire produces a magnetic field along the axis of the coils which deflects the electron beam in a direction perpendicular it. Reproduced by permission--Photo Researchers, Inc. Electromagnetic induction--Figure 4. Gale Group. Electromagnetic induction--Figure 2. Gale Group. Electromagnetic induction--Figure 1. Gale Group. Electromagnetic induction--Figure 3. Gale Group. Electron--Figure 1. Gale Group. Electrophoresis--Figure 1. Gale Group. Electrophoresis--

Figure 3. Gale Group. Electrophoresis--Figure 2. Gale Group. Electrostatic devices--A Van de Graaff generator is a device that is capable of building up a very high electrostatic potential. Reproduced by permission--Photo Researchers, Inc. Electrostatic devices--The Vivitron electrostatic particle accelerator under construction at the Centre des Recherches Nucleaires, Strasbourg, France. Reproduced by permission--Photo Researchers, Inc. Elephant--An African elephant (*Loxodonta africana*) in Amboseli National Park, Kenya Photo Researchers, Inc. Elephant--Wild asiatic elephants (*Elephas maximus*) in Yala National Park, Tissamaharama, Sri Lanka. Reproduced by permission--The Stock Market. Elephant shrews--An elephant shrew (*Elephantulus rozeti*). Reproduced by permission--Photo Researchers, Inc. Elephantiasis--Elephantiasis. Reproduced by permission--Phototake. Emission--A nickel smelting facility emitting pollutants that carry for hundreds of miles in Russian Siberia. Reproduced by permission--The Stock Market. Endangered species--The endangered golden frog, Panama. Reproduced by permission--JLM Visuals. Engraving and etching--A laser etching machine used in computer chip production. Reproduced by permission--Phototake. Enterobacteria--A transmission electron micrograph of *Escherichia coli*. Reproduced by permission--Photo Researchers, Inc. Enzyme--Figure 6. Gale Group. Enzyme--Figure 5. Gale Group. Enzyme--Figure 4. Gale Group. Enzyme--Figure 1. Gale Group. Enzyme--Figure 2. Gale Group. Enzyme--Figure 3. Gale Group. Erosion--Severe soil erosion caused by overgrazing and clearance of vegetation in Eastern Province, Kenya, Africa. Photo Researchers, Inc. Erosion--Dust storms, like this one approaching Springfield, Colorado, occur when soils not properly anchored by vegetation are subjected to dry conditions and winds. This storm hit Springfield at 4:47 P.M. and engulfed the city in total darkness for almost half an hour. The Library of Congress. Europe--The Matterhorn, 14,690 ft (4,480 m), in Switzerland was carved by alpine glaciers. Reproduced by permission--JLM Visuals. Europe--Europe. Gale Group. Evapotranspiration--A comparison of yearly cycles of evapotranspiration and precipitation for two separate biomes. Gale Group. Evolution--The long neck of the giraffe is an adaptation that allows it to survive competition for food resources. Reproduced by permission--The Stock Market. Explosives--A nuclear explosion at sea. Reproduced by permission--The Stock Market. Eye--A cutaway anatomy of the human eye. Gale Group. Falcons--A Peregrine falcon taking flight. Photo Researchers, Inc. Falcons--An American kestrel (*Falco sparverius*) at the Arizona Sonora Desert Museum, Arizona. Not much larger than a blue jay, the kestrel is the smallest of the North American falcons. Reproduced by permission--Field Mark Publications. Fault--Figure 1-4. Gale Group. Fault--The San Andreas Fault extends almost the full length of California. The landscape consists of pressure ridges formed by hundreds of fault movements. Reproduced by permission--JLM Visuals. Ferns--Uluhe ferns (*Dicranopteris emarginata*) in Hawaii. Reproduced by permission--JLM Visuals. Ferrets--A black-footed ferret. Reproduced by permission--JLM Visuals. Fertilization--Magnified image of a human sperm penetrating a female egg (ovum). Photo Researchers, Inc. Fiber optics--Figures 1-10 Gale Group. Finches--A large ground finch (*Geospiza magnirostris*) on Santa Cruz Island in the Galapagos Islands . Reproduced by permission--Photo Researchers, Inc. Flagella--False-color transmission electron micrograph (TEM) of the aerobic soil bacterium *Pseudomonas fluorescens*, flagellae curving behind the orange cell, magnification at x10,000. Photo Researchers, Inc. Flamingos--Lesser flamingos (*Phoenicopterus minor*) in Transvaal, South Africa. Reproduced by permission--Photo Researchers, Inc. Flatfish--A windowpane flounder (*Scophthalmus aquosus*) on the sea floor in the Gulf of Maine. Reproduced by permission--Photo Researchers, Inc. Flax--Flax (*Linum usitatissimum*). Reproduced by permission--JLM Visuals. Flies--The life cycle of a common housefly. Gale Group. Flightless birds--A male Masai ostrich in Amboseli National Park, Kenya. Reproduced by permission--The Stock Market. Flooding--Flooding on the Salt River, Arizona. Reproduced by permission--JLM Visuals. Fluid mechanics--Figure 1. A hydraulic press. Gale Group. Fluorescence--Figure 1. Fluorescence in ruby.

Gale Group. Fold--An exposed fold in New Jersey. Reproduced by permission--JLM Visuals. Food irradiation--Levels of radiation (in rads) for various applications. Ranges shown for food irradiation are approved by the U.S. government. Gale Group. Forestry--Checking the age of a sitka spruce in Gustavus, Alaska. Reproduced by permission--The Stock Market. Forests--A forest of deciduous trees. Reproduced by permission--The Stock Market. Formula, structural--. Illustration of ethanol and dimethyl ether. Gale Group. Fossa--A fossa (*Cryptoprocta ferox*). Reproduced by permission--Photo Researchers, Inc. Fossil and fossilization--One of the most complete early hominid fossils is this *Australopithecus afarensis*. specimen commonly known as "Lucy," which was found by Donald Johanson in the Afar region of Ethiopia. Photo Researchers, Inc. Fossil and fossilization--A fossil trilobite from the Mid-Ordovician period. Reproduced by permission--JLM Visuals. Fossil and fossilization--A fly in amber, 35 million years old. Reproduced by permission--JLM Visuals. Fractal--The construction of a well known self-similar figure (fractal), the triadic Koch curve. Gale Group. Fractal--Benoit Mandelbrot in front of a graphic of a Mandelbrot set. Reproduced by permission--The Stock Market. Freeway--An aerial shot of a freeway system under construction in southern California. Reproduced by permission--Phototake. Freshwater--A freshwater mountain stream in Rocky Mountain National Park. Reproduced by permission--JLM Visuals. Frigate birds--A frigate bird on its nest on Barbuda Island in the West Indies. Reproduced by permission--The Stock Market. Frogs--A lesser gray treefrog (*Hyla versicolor*) at Mahn-Go-Ta-See Camp, Michigan. Reproduced by permission--Field Mark Publications. Frostbite--Frostbite injury of the hand. Reproduced by permission--Photo Researchers, Inc. Fungi--An American fly agaric (*Amanita muscaria formosa*). This mushroom is very common in all of North America, but is more slender, tinged with a salmonlike coloration, and somewhat more rare in the southern states. Reproduced by permission--Field Mark Publications. Galaxy--A photograph of the Andromeda Galaxy (M31). Also seen, as the bright spot below and to the left of Andromeda, is one of its two dwarf elliptical satellite galaxies, M32 (NGC 221). Andromeda is a spiral galaxy some 2.2 million light years from our own galaxy, the Milky Way. It measures some 170,000 light years across, and as the largest of the nearby galaxies is faintly visible even to the naked eye. Reproduced by permission--Photo Researchers, Inc. Gangrene--A close-up of gangrene in the toes of a diabetic patient. Reproduced by permission--Photo Researchers, Inc. Garpike--Longnose gar (*Lepisosteus osseus*). Reproduced by permission--Field Mark Publications. Gases, properties of--The effect of pressure change on the volume of a gas, with temperature being held constant. The Gale Group. Gases, properties of--The effect of temperature change on the volume of a gas, with pressure being held constant. The Gale Group. Gases, properties of--The effect of temperature change on the pressure of a gas, with volume being held constant. The Gale Group. Geckos--A parachute gecko (*Ptychozoon kuhli*). Photo Researchers, Inc. Geese--A Canada goose (*Branta canadensis*) with her goslings in the Ottawa National Wildlife Refuge, Ohio. Reproduced by permission--Field Mark Publications. Gene--Strands of DNA. Reproduced by permission--The Stock Market. Gene therapy--A scientist performing a microinjection of a corrective gene into a human T-lymphocyte (a white blood cell). Reproduced by permission--Photo Researchers, Inc. Genetic disorders--Down's syndrome is a congenital disorder resulting from trisomy (three chromosomes instead of two) in pair 21. Reproduced by permission--Custom Medical Stock Photo, Inc. Genetics--Three generations of female identical twins. Reproduced by permission--Phototake. Genets--A large-spotted genet with a ringed tail. Photo Researchers, Inc. Geocentric theory--The geocentric universe. Gale Group. Geodesic dome--A geodesic radardome at Lowther Hill Civil Aviation Authority Radar Station in Scotland. The dome is made of fiberglass which, unlike concrete, is transparent to radio waves. Reproduced by permission--Photo Researchers, Inc. Geometry--Figure 1. Gale Group. Geometry--Figure 2. Gale

Group. Geometry--Figure 3. Gale Group. Geometry--Figure 4. Gale Group. Geometry--A dodecahedron is one of Plato's five regular polyhedrons (along with the tetrahedron, hexahedron, octohedron, and icosahedron): all of its faces are identically sized regular polygons. Reproduced by permission--Photo Researchers, Inc. Geometry--Figure 5. Gale Group. Gerbils--A gerbil in the Gobi desert, central Asia. Reproduced by permission--JLM Visuals. Gesnerias--Kohleria. a genus of gesneriad. Reproduced by permission--Mr. James Sikkema. Gibbons and siamangs--A hoolock gibbon (*Hylobates hoolock*). Photo Researchers, Inc. Gibbons and siamangs--A siamang yelling. Reproduced by permission--Photo Researchers, Inc. Gila monster--A banded gila monster. Photo Researchers, Inc. Ginger--Cultivated ginger (*Zingiber officinale*) in the Amazon, Peru. Reproduced by permission--JLM Visuals. Ginkgo--A ginkgo tree in Georgia. Reproduced by permission--JLM Visuals. Giraffes and okapi--An adult male okapi grazing. Reproduced by permission--The Stock Market. Giraffes and okapi--Herd of giraffes standing in a field. Photo Researchers, Inc. Glaciers--Muir Inlet, a fiord in Glacier Bay National Park, Alaska, and the glacier creating it. Reproduced by permission--JLM Visuals. Glaciers--Hubbard Glacier calving. Reproduced by permission--Phototake. Glass--Young male glassblower cutting the blow pipe off the globe he has just made. Photo Researchers, Inc. Glycol--Figure 3. Industrial preparation of ethylene glycol. Gale Group. Glycol--Figure 2. Laboratory preparation of a glycol. Gale Group. Glycol--Figure 1. Structures of common glycols. Gale Group. Goats--Markhors (*Capra falconeri*) are found in various mountain ranges in India, Pakistan, Afghanistan, Tajikistan, and Uzbekistan. These goats are considered endangered throughout their range. The primary cause of the markhor's decline is excessive hunting, primarily for its horns, but also for its meat and hide. Photo Researchers, Inc. Gorillas--A nine-year-old male lowland gorilla playing with a two-year-old juvenile. Photo Researchers, Inc. Gourd family--Yellow crookneck squash (*Cucurbita pepo*). Reproduced by permission--JLM Visuals. Grapes--Fredonia grapes. Reproduced by permission--Mr. James Sikkema. Grasses--Grasses grow in virtually any habitat that is capable of supporting plant life. Reproduced by permission--Field Mark Publications. Grasses--Bamboo on Avery Island, Louisiana. Reproduced by permission--JLM Visuals. Grasshoppers--A katydid. Reproduced by permission--JLM Visuals. Grasslands--Lush grassland growth in autumn in the Mallee region of New South Wales, Australia. Reproduced by permission--Photo Researchers, Inc. Gravity and gravitation--The antenna (cylindrical bar, bottom center) of the gravitational wave detector Auriga under construction at Legnaro, Italy. Reproduced by permission--Photo Researchers, Inc. Grebes--Western grebes (*Aechmophorus occidentalis*) displaying across the water. Reproduced by permission--Photo Researchers, Inc. Greenhouse effect--An atmosphere with natural levels of greenhouse gases (left) compared with an atmosphere of increased greenhouse effect (right). Gale Group. Groundhog--A woodchuck sitting on its hind legs to view the surrounding area. Reproduced by permission--Photo Researchers, Inc. Gulls--A laughing gull (*Larus atricilla*) in flight. Laughing gulls have been known to perch on the head of a pelican and steal food when it opens its bill to shift its catch for swallowing. Reproduced by permission--Field Mark Publications. Halley's comet--Halley's comet as seen from Peru on April 21, 1910 Public domain. Hamsters--A golden hamster. Photo Researchers, Inc. Hartebeests--A small herd of hartebeests in Kenya. Reproduced by permission--JLM Visuals. Hawks--A red-tailed hawk (*Buteo jamaicensis*) at the Kellogg Bird Sanctuary, Michigan. The red-tail is North America's most common hawk. Reproduced by permission--Field Mark Publications. Hazardous wastes--A hazardous waste dump site. The barrels are filled with chemical wastes. Photo Researchers, Inc. Hearing--The hearing process. Gale Group. Heart--A scanning electron micrograph (SEM) of the aortic valve. It lies between the left ventricle of the heart and the aortic arch and consists of a fibrous ring with

three semilunar pockets attached to it. Reproduced by permission--Photo Researchers, Inc. Heart--A cutaway view of the anatomy of the heart. Gale Group. Heart diseases--Age-standardized death rate attributed to ischemic heart disease (narrowing or blockage of the coronary arteries) for various countries. Gale Group. Heath family--A rhododendron. Reproduced by permission--JLM Visuals. Heliocentric theory--Figure 1-3. Gale Group. Herbicides--Corn killed by overlapping sprays of herbicide on an Ohio farm. Reproduced by permission--Phototake. Hernia--An illustration of an epigastric (abdominal) hernia in an adult male. Reproduced by permission--Photo Researchers, Inc. Herons--A yellow-crowned night heron (*Nyctanassa violacea*) at the Ding Darling National Wildlife Refuge, Florida. Reproduced by permission--Field Mark Publications. Herons--A snowy egret (*Egretta thula*) on Estero Island, Florida. This species, once hunted to near extinction by the millinery trade, became a symbol for the early conservation movement in the U.S. and remains the emblem of the National Audubon Society. Reproduced by permission--Field Mark Publications. Hertzsprung-Russell diagram--Figure 1-3. Gale Group. Hippopotamuses--A hippopotamus. Photo Researchers, Inc. Hodgkin's disease--A scanning electron micrograph (SEM) image of dividing Hodgkin's cells from the pleural effusions (abnormal accumulations of fluid in the lungs) of a 55-year-old male patient. Reproduced by permission--Photo Researchers, Inc. Holly family (*Aquifoliaceae*)--Blue angel holly. Unknown source. Hologram and holography--A hologram of the Venus de Milo. Reproduced by permission--Photo Researchers, Inc. Homeostasis--Figure 1. A negative feedback loop helps regulate blood pressure. Gale Group. Hornbills--Ground hornbills in Kenya. Reproduced by permission--JLM Visuals. Horse chestnut--An Ohio buckeye (*Aesculus glabra*). Reproduced by permission--JLM Visuals. Horses--A Przewalski's horse (*Equus przewalskii*). Reproduced by permission--Mr. J. Gordon Miller. Horseshoe crabs--A horseshoe crab moving along the waters edge. Reproduced by permission--Photo Researchers, Inc. Horsetails--Field horsetails (*Equisetum arvense*) at the Long Point Wildlife Sanctuary, Ontario. Reproduced by permission--Field Mark Publications. Horticulture--A garden of perennial plants and flowers in bloom. Photo Researchers, Inc. Hummingbirds--A hummingbird sipping nectar from a flower. Reproduced by permission--The Stock Market. Hydrocarbon--Hydrocarbon Gale Group. Hyena--Pack of hyenas feeding on a zebra. Photo Researchers, Inc. Hyperbola--Figure 1-8. Gale Group. Ibises--A white ibis (*Eudocimus albus*) at Estero Island, Florida. Reproduced by permission--Field Mark Publications. Ice ages--Drumlins, like this one near West Bend, Wisconsin, are composed of glacial till. Although their formation is not well understood, some geologists believe they are shaped when a glacier advances over its own end moraine. Reproduced by permission--JLM Visuals. Icebergs--An iceberg in Disko Bay on the western coast of Greenland. Reproduced by permission--The Stock Market. Igneous rocks--Rope-like, twisted lava like this is called pahoehoe. Reproduced by permission--JLM Visuals. Iguanas--A chuckwalla (*Sauromalus obesus*) at the Arizona Sonora Desert Museum, Arizona. This lizard basks in the sun during the day to reach its preferred body temperature of 100degreesF (38degreesC). Reproduced by permission--Field Mark Publications. Immune system--Colored scanning electron micrograph of a white blood cell (pink and white) attacking a *Staphylococcus aureus* bacterium (yellow). Photo Researchers, Inc. Immune system--The antibody-mediated immune response. Gale Group. Immune system--The cell-mediated immune response. Gale Group. Inequality--Figure 2. Gale Group. Inequality--Figure 1. Gale Group. Influenza--A transmission electron micrograph (TEM) of influenza viruses budding from the surface of an infected cell. Reproduced by permission--Photo Researchers, Inc. Insectivore--The endangered Haitian solenodon (*Solenodon paradoxus*.) secretes toxic saliva, which it uses to paralyze its insect prey. Reproduced by permission--Photo Researchers, Inc. Insects--External and internal features of a generalized insect. Gale Group. Integrated circuit--A circular wafer of silicon carrying numerous individual integrated circuits. Multiple circuits are fabricated on one

silicon base and later cut from it. Reproduced by permission--Photo Researchers, Inc. Integrated pest management--Conventional pest control compared to integrated pest management. Gale Group. Integumentary system--A cross section of the skin. Sensory structures are labeled on the right. Gale Group. Interference--Interference patterns created by the waves from several fallen drops of water. Reproduced by permission--Photo Researchers, Inc. Interferometry--Figure 1-5. Gale Group. Interferons--Commercial fermentation units like these are used to grow cultures of microorganisms for biological products like interferon. Reproduced by permission--Photo Researchers, Inc. Introduced species--Growth of introduced kudzu in Tennessee. Reproduced by permission--JLM Visuals. Invertebrates--Invertebrates make up 97% of the animal kingdom, the largest of the five kingdoms of living organisms. Gale Group. Ion exchange--Figure 1. Structure of a synthetic ion exchange resin. Gale Group. Iris family--A Rocky Mountain iris (*Iris missouriensis*). Reproduced by permission--JLM Visuals. Irrigation--Irrigated fields in California's Central Valley. U.S. Geological Survey. Island--An island off the east coast of the Malay Peninsula. Reproduced by permission--The Stock Market. Jellyfish--A jellyfish. Reproduced by permission--The Stock Market. Jet engine--A jet aircraft with the engine cover open. Photo Researchers, Inc. Jupiter--Jupiter's Great Red Spot, a tremendous atmospheric storm twice the size of the Earth, has been visible since the earliest telescopic observations of the planet. Public domain. Kangaroo rats--Ord's kangaroo rat. Reproduced by permission--Photo Researchers, Inc. Kangaroos and wallabies--Red kangaroos in Australia. Photo Researchers, Inc. Karst topography--Tower karst topography like this along the Li River in southern China is formed when karst sinkholes deepen faster than they widen. Reproduced by permission--JLM Visuals. Kingfishers--A common or small blue kingfisher (*Alcedo atthis*). Photo Researchers, Inc. Koalas--A koala (*Phascolarctos cinereus*). The animal has a highly specialized diet that consists of around 2.5 lbs (1.1 kg) daily of about 12 species of eucalyptus leaves. Reproduced by permission--Field Mark Publications. Lagomorphs--A pika. Reproduced by permission--JLM Visuals. Lagomorphs--A black-tailed jackrabbit. Reproduced by permission--JLM Visuals. Lake--Kettle lakes like this one in Dundee, Wisconsin, are formed when blocks of ice buried by moving glaciers melt and leave a depression. Reproduced by permission--JLM Visuals. Lampreys and hagfishes--A single Pacific lamprey with its mouth open. Photo Researchers, Inc. Land use--The Incas used terraces to make optimal use of the limited land areas available for cultivation. These terraces are found near Machu Picchu, Peru. Reproduced by permission--JLM Visuals. Landfill--Fresh Kills Landfill on Staten Island, New York. Reproduced by permission--The Stock Market. Langurs and leaf monkeys--A spectacled langur (*Trachypithecus obscurus*) nursing her young. Photo Researchers, Inc. Laser--The beam of a mode locked, frequency doubled Nd YLF laser is reflected off mirrors and through filters at Colorado State University. Reproduced by permission--The Stock Market. LCD--The passage of light through a twisted nematic (TN) cell type of liquid crystal display (LCD) when the current to the electrodes is off (top) and when it is on (bottom). Gale Group. Leaf--A scanning electron micrograph (SEM) of open stomata on the surface of a tobacco leaf (*Nicotiana tabacum*). Photo Researchers, Inc. Lecithin--Figure 2. Gale Group. Lecithin--Figure 1. Gale Group. LED--LEDs on a circuit board from a radar detector. Reproduced by permission--The Stock Market. LED--This diagram of a typical LED indicator light shows how small the actual LED is. Although the average lifetime of a small light bulb is 5-10 years, a modern LED should last 100 years or more before it fails. Gale Group. Legumes--Red clover (*Trifolium pratense*). Reproduced by permission--JLM Visuals. Lemurs--Two ring-tailed lemurs grooming each other. Photo Researchers, Inc. Lemurs--A ring-tailed lemur sits in a tree at the Lowry Park Zoo in Florida. Reproduced by permission--Photo Researchers, Inc. Lens--Figure 1. Gale Group. Lens--Figure 2. Gale Group. Leprosy--Leprosy. Reproduced by permission--Phototake. Lice--A chewing louse.

Reproduced by permission--JLM Visuals. Lichens--British soldiers (*Cladonia cristatella*), a species of lichen. Reproduced by permission--JLM Visuals. Ligand--Figure 3. Geometric isomers have the same formulas but different symmetry and different properties. Gale Group. Ligand--Figure 2. Geometric symmetry of ligands around metal. Gale Group. Ligand--Figure 4. Two orbitals, A and B, have the same energy in the isolated atom. Ligands (L) approach closer to A than to B, hence the energy of A rises and B falls. Gale Group. Ligand--Figure 5. Ethylenediaminetetraacetic acid (EDTA) is one of the best-known chelating agents. Gale Group. Ligand--Figure 6. The porphyrin molecule surrounds the metal, bonding to it by nitrogen atoms at the four corners of a square. Other ligands may bond above and below the plane of the square. (N = nitrogen, C = carbon, H = hydrogen) Gale Group. Ligand--Figure 1. Two ligands (ammonia) each donate a pair of electrons to bond with a silver ion. (N = nitrogen, H = hydrogen, Ag = silver.) Gale Group. Lilac--A lilac in bloom. Reproduced by permission--Mr. James Sikkema. Lily family (*Liliaceae*)--Greigii tulips. Reproduced by permission--Mr. James Sikkema. Lily family (*Liliaceae*)--Yellow Spanish onions. Reproduced by permission--Mr. James Sikkema. Lithotripsy--A lithotripter directs sound waves at the kidney stones of a patient, causing the stones to break and dissolve. Reproduced by permission--Photo Researchers, Inc. Liverwort--Common liverwort (*Marchantia polymorpha*). Reproduced by permission--JLM Visuals. Livestock--Chickens being grown as broilers for Goldkist inside a large henhouse. Photo Researchers, Inc. Lobsters--An American lobster. Reproduced by permission--JLM Visuals. Lock--Ships in the Miraflores locks on the Panama canal. Reproduced by permission--Photo Researchers, Inc. Locus--Figure 1. Gale Group. Locus--Figure 2. Gale Group. Locus--Figure 3. Gale Group. Logarithms--Logarithmic scale. Gale Group. Loons--A Pacific loon resting in the grass. Photo Researchers, Inc. Lorises--A slender loris (*Loris tardigradus*) in Asia. Photo Researchers, Inc. Lungfish--The evolution of lungfish. Gale Group. Lyrebirds--A male superb lyre bird (*Menura superba*) in Australia. Here the bird is in the rainforest foliage though it is generally seen on the floor of the rainforest where it finds its food. Reproduced by permission--Photo Researchers, Inc. Mölbius strip--Figure 1. Gale Group. Mölbius strip--Figure 2. Gale Group. Macaques--Rhesus monkeys, a mother and infant. Unknown source. Mach number--Figure 1. Gale Group. Mach number--Figure 2. Gale Group. Machine tools--A lathe turns an object on a horizontal axis so it can be cut with a fixed tool. Reproduced by permission--The Stock Market. Machines, simple--A lever being used. Reproduced by permission--Phototake. Mackerel--A painted mackerel (*Scomberomorus regalis*) at Benwood wreck, Key Largo, Florida. The fishes of the *Scomberomorus* genus are the Spanish mackerels, or seerfishes. Reproduced by permission--Photo Researchers, Inc. Magnetic recording/audiocassette--Figure 1. Recording head. Gale Group. Magnetic recording/audiocassette--Figure 2. Cassette and heads. Gale Group. Magnetism--A computer graphic of a horseshoe magnet with iron filings aligned around it. Reproduced by permission--Photo Researchers, Inc. Magnetosphere--The Earth's magnetosphere. Gale Group. Mangrove tree--Red mangroves in Florida. Reproduced by permission--JLM Visuals. Map--Figure 1. Gale Group. Maples--A sugar maple (*Acer saccharum*) on a road near Grandville, Michigan. Reproduced by permission--Mr. James Sikkema. Marlins--A marlin leaping. Reproduced by permission--The Stock Market. Marmosets and tamarins--A pygmy marmoset (*Cebuella pygmaea*). Reproduced by permission--Photo Researchers, Inc. Marmots--A hoary marmot in Mount Rainier National Park, Washington. Reproduced by permission--JLM Visuals. Mars--A photograph of the Martian surface taken by one of the Viking landers. The layer of morning frost that can be seen in the photo is less than one one-thousandth of an inch thick. Public domain. Mars--Mars, as seen from space by Viking 1. The planet is slightly more than one-tenth as massive as the Earth. Public domain. Mars--The largest volcano on Mars, Olympus Mons, is much larger than the largest volcano on Earth. Olympus Mons is over 15.5 miles (25 km) tall, three times as tall as Mt. Everest, and

has a base the size of the state of Arizona. This photo shows how large Olympus Mons is compared to Arizona. Public domain. Mass production--Mass production of chocolate-covered doughnuts. Reproduced by permission--The Stock Market. Mass transportation--A New York city subway train above ground in Brooklyn. Reproduced by permission--The Stock Market. Mass wasting--An avalanche. Reproduced by permission--The Stock Market. Maxima and minima--Figure 1. Gale Group. Maxima and minima--Figure 2. Gale Group. Mayflies--A mayfly. Photo Researchers, Inc. Membrane--Color enhanced scanning transmission electron micrograph of cell membranes of two adjoining cells separated by an intercellular cleft occupied by material mainly consisting of carbohydrates. Photo Researchers, Inc. Mendelian laws of inheritance--Mendel's First Law. Gale Group. Mendelian laws of inheritance--Mendel's Second Law. Gale Group. Menstrual cycle--The menstrual cycle. Gale Group. Mercury (planet)--Figure 2. A comparison of the internal structures of Mercury and Earth. Gale Group. Mercury (planet)--Figure 1. As seen from Earth the angle between the Sun and Mercury, when Mercury is at greatest eastern or greatest western elongation, can be as large as 28° ; if Mercury is near aphelion, and as small as 18° ; if Mercury is near perihelion. Gale Group. Mercury (planet)--This expanse of the surface of Mercury is about 217 mi (350 km) across. These inter-crater plains, located near the south pole, are traversed by numerous ridges and scarps. The crustal fracturing on Mercury is as large in scale as that on Earth. Public domain. Mercury (planet)--Bright rayed craters and large craters, called basins, are prominent in this view of Mercury. Since, unlike Earth and Mars, Mercury has no atmosphere, its landscape is not continuously shaped by erosion and deposition. Although the exterior of Mercury resembles that of the moon, the interior of the planet is probably more similar to that of Earth. Public domain. Metal production--A steel worker sampling the quality of "hot steel" during production. Reproduced by permission--The Stock Market. Metamorphosis--The transformation from larva to adult that a butterfly undergoes during pupation is an example of metamorphosis. Reproduced by permission--Phototake. Meteors and meteorites--Figure 1. Gale Group. Meteors and meteorites--Figure 2. Gale Group. Meteors and meteorites--Meteorites vary greatly in size and so do the craters they make. This tiny crater is the result of a micro-meteor impact on lunar rock. This image, as viewed, is several hundred times the crater's actual size. NASA. Metric system--The first provisional standard scale of a meter. Made of copper in 1793, the scale is housed in the Archives Nationales de France, Paris. Reproduced by permission--The Stock Market. Mice--Harvest mice feasting on wheat grains. Reproduced by permission--Photo Researchers, Inc. Microscopy--A scanning electron microscope at the Billancourt Centre, Boulogne, France. This system is used in the testing of Renault Sport's motor racing engines. The samples on screen are the fracture faces of components subjected to a tensile strength test. Reproduced by permission--Photo Researchers, Inc. Microscopy--An atomic force micrograph of the surface of a thin copolymer film. The atomic force microscope (AFM) is capable of atomic-scale resolution, and works by drawing a very fine probe across the surface of the sample. The vertical motion of the probe is converted into electronic signals which are then processed to give the type of surface map seen here. The advantage the AFM has over the scanning tunneling microscope is that it works for samples that are not electrical conductors. Reproduced by permission--Photo Researchers, Inc. Microscopy--A typical compound microscope. Reproduced by permission--Phototake. Microwave communication--A microwave communications tower in Munich, Germany. Reproduced by permission--Photo Researchers, Inc. Migraine headache--The phases of a typical migraine headache. Gale Group. Milkweeds--Milkweed in seed. Reproduced by permission--JLM Visuals. Milky Way--A fish-eye lens view of the southern Milky Way from the constellation Sagittarius (left) through Scorpius, Centaurus, and Crux (the Southern Cross), to Carina (right). The Milky Way is intersected by dark lanes and clouds of dust, which obscure the stars beyond. The photo was

taken from Ayers Rock, Australia. Reproduced by permission--Photo Researchers, Inc. Mining--Earth movers strip mining for coal in West Virginia. Reproduced by permission--The Stock Market. Mink--An American mink (*Mustela vison*) in Flathead National Forest, in Montana. Reproduced by permission--The Stock Market. Minor planets (asteroids)--Figure 1. Gale Group. Minor planets (asteroids)--Figure 2. Gale Group. Mint family--Basil (*Ocimum basilicum*). Reproduced by permission--JLM Visuals. Mistletoe--Mistletoe in Florida. Reproduced by permission--JLM Visuals. Mites--A scanning electron micrograph (SEM) of a dust mite. Reproduced by permission--Phototake. Mitosis--Figure 1. Stages of mitosis. Gale Group. Mockingbirds and thrashers--A curve-billed thrasher (*Toxostoma curvirostre*) perched near its nest in a cactus at the Arizona Sonora Desert Museum, Arizona. Reproduced by permission--Field Mark Publications. Mole-rats--A mole rat (*Cryptomys hottentotus*) from southern Africa. Reproduced by permission--Photo Researchers, Inc. Molecule--Figure 1. Various ways of depicting molecules. The Gale Group. Molecule--Figure 2. Models of various elements. Gale Group. Molecule--Figure 3. Structural formulas help differentiate between substances that share identical molecular formulas, such as ethyl alcohol and methyl ether. Gale Group. Molecule--Figure 4. The electron sea model, (a) represents an alkali metal with one valence electron and (b) represents an alkaline earth metal with two valence electrons. Gale Group. Moles--The European mole (*Talpa europaea*). Reproduced by permission--The Stock Market. Mongooses--A dwarf mongoose feeding at a termite mound. Photo Researchers, Inc. Monitor lizards--Two Komodo dragons (*Varanus komodoensis*). Photo Researchers, Inc. Monkeys--A young female spider monkey (*Ateles geoffroyi*). Reproduced by permission--Photo Researchers, Inc. Monoculture--A wheat field near Greeley, Colorado. Reproduced by permission--Photo Researchers, Inc. Moon--The first footprint on the moon's surface, made by astronaut Neil A. Armstrong on July 20, 1969, shows the fineness of the lunar soil. The soil is produced when moon rock is weathered by impacting meteors, solar winds and extreme temperature changes. In many areas the soil appears to be a few meters thick. Public domain. Moon--A photo of the full moon taken from Apollo 17. The mare regions, which are relatively flat, appear as dark areas because they reflect less light. The highlands are lighter in color and have a more rugged surface than the mare. About 1/3 of the surface shown in this picture cannot be seen from the Earth. Reproduced by permission--JLM Visuals. Moon--A close-up of the back side of the moon taken from Apollo 13. The large mare area is Mare Moscoviense. The large crater on the horizon is IAU number 221. Public domain. Moose--A moose feeding on pond vegetation in Baxter State Park, Maine. Reproduced by permission--The Stock Market. Mosquitoes--A mosquito withdraws its proboscis after feeding in Alpena, Michigan. Reproduced by permission--Photo Researchers, Inc. Moss--The life cycle of a generalized moss. Gale Group. Moths--A cecropia moth larva (*Hyalophora cecropia*) in Royal Oak, Michigan. Reproduced by permission--Field Mark Publications. Moths--A cecropia moth (*Hyalophora cecropia*) in Royal Oak, Michigan. Adults of this species are seen increasingly in urban areas, and often during the day. Reproduced by permission--Field Mark Publications. Motion--The simple harmonic motion of a pendulum. Reproduced by permission--Phototake. Mountain--Mountain in Banff National Park, Canada. This mountain shows rock folds which are the result of the collision of the Earth's plates. Reproduced by permission--JLM Visuals. Mulberry family (Moraceae)--Common fig (*Ficus carica*). Reproduced by permission--JLM Visuals. Muskoxen--Muskoxen, when threatened, form a defensive circle. Reproduced by permission--JLM Visuals. Muskrat--A muskrat. Photo Researchers, Inc. Mustard family--Skunk cabbage blossoms. Reproduced by permission--Mr. James Sikkema. Mutation--A six-legged green frog. Reproduced by permission--JLM Visuals. Mynah birds--A mynah bird known to the locals as "Martin" on the island of Mauritius in the Indian Ocean. Reproduced by permission--The Stock Market. Myrtle family--Eucalyptus trees near Alice Springs, Australia. Reproduced by permission--JLM Visuals. Nanotechnology--Figure 1. Gale Group. Natural fibers--A

scanning electron micrograph (SEM) of silk fibers from a kimono. Photo Researchers, Inc. Natural gas--An offshore natural gas drilling platform. Reproduced by permission--The Stock Market. Neptune--Two images of Neptune taken 53 hours apart. Reproduced by permission--JLM Visuals. Neptune--The size of Neptune's Great Dark Spot (top) compared to the size of the Earth (bottom). Public domain. Neptune--Figure 2. Diagram of the offset and tilted magnetic field of Neptune. Gale Group. Neptune--Figure 1. The Voyager 2 trajectory through the Neptune system. (A) is a large view of the system showing the projected orbits of Nereid and Triton. Tick marks on the trajectory show Voyager 2's position at one-day intervals. (B) is an enlarged view covering a 10-hour period that includes closest approaches to Neptune and Triton and passage through the Earth and solar shadows (occultation zones). Neptune's ring system is also indicated. Here tick marks along the trajectory are at one-hour intervals. Gale Group. Neptune--Figure 3. Graph of the latitude of the subsolar point on Triton from 1993 to 3000. Gale Group. Neuron--A scanning electron micrograph (SEM) of three neurons of the human cerebral cortex. Reproduced by permission--Photo Researchers, Inc. Neuron--The features of a typical multipolar neuron. Gale Group. Neutron star--Figure 1. Illustration of the relationship between a neutron star's rotation axis and its magnetic axis. Gale Group. Newts--A rough-skinned newt (*Taricha granulosa*). Photo Researchers, Inc. Nightshade--A partially cut field of tobacco in southern Wisconsin. Reproduced by permission--JLM Visuals. Nightshade--A red missile pepper plant. Reproduced by permission--Mr. James Sikkema. Nitrogen cycle--The nitrogen cycle. Gale Group. Non-point source--Non-point sources. Gale Group. North America--Mount Sopris in the Rocky Mountains near Aspen, Colorado. Reproduced by permission--Photo Researchers, Inc. North America--North America. Gale Group. Nuclear fission--A nuclear chain reaction: the successive fissioning of ever-increasing numbers of uranium-235 atoms. The Gale Group. Nuclear fission--The Davis-Besse Nuclear Power Plant on the shore of Lake Erie in Oak Harbor, Ohio. Reproduced by permission--Field Mark Publications. Nuclear fusion--The JET (Joint European Torus) nuclear fusion reactor. Photo Researchers, Inc. Nuclear reactor--Submerged in water, the fuel element is removed from the High Flux Isotope Reactor (HFIR) at the Oak Ridge National Laboratory. Reproduced by permission--Photo Researchers, Inc. Numbat--A numbat (*Myrmecobius fasciatus*). Reproduced by permission--Photo Researchers, Inc. Nuthatches--A white-breasted nuthatch (*Sitta carolinensis*) at Kensington Metropark, Michigan. Reproduced by permission--Field Mark Publications. Nutrition--A healthy diet includes a variety of foods. Reproduced by permission--The Stock Market. Oceanography--Oceanographers emerge from ALVIN, a submersible vessel used for underwater study. Unknown source. Octopus--A gulf longarm octopus off the coast of western Mexico. Reproduced by permission--JLM Visuals. Old-growth forests--An old-growth Douglas fir forest in the Pacific Northwest. Reproduced by permission--Photo Researchers, Inc. Opossums--An immature opossum hanging by its tail. Photo Researchers, Inc. Orchid family--Showy lady-slipper (*Cypripedium reginae*). Reproduced by permission--Field Mark Publications. Oryx--A herd of scimitar-horned oryx. Photo Researchers, Inc. Osmosis--Figure 1. Random collisions with semipermeable membrane. Gale Group. Osmosis--Figure 2. Osmosis equalizes concentration. Gale Group. Otters--A mated pair of sea otters, male (left) and female (right). Photo Researchers, Inc. Owls--Northern spotted owl. U.S. Fish and Wildlife Service, Washington D.C. Ozone layer depletion--An atmosphere with a relatively intact ozone layer (left) compared to one with an ozone layer compromised by chlorofluorocarbon (CFC) emissions. Gale Group. Pacemaker--Pacemakers like these are usually implanted under the skin below the collarbone and connected to the heart by a wire inserted into a major vein in the neck and guided down into the heart. Reproduced by permission--Photo Researchers, Inc. Paleobotany--Fossilized *Alethopteris* a seed fern from the Pennsylvanian period. Reproduced by permission--JLM Visuals. Paleontology--Researchers cleaning dinosaur fossils in a paleontology laboratory in Esperanza,

France. The fossils arrive encased in a protective plaster cast and with some of the original surrounding rock still attached. They are cleaned thoroughly and treated with stabilizing chemicals before being studied or classified. Reproduced by permission--Photo Researchers, Inc. Paleontology--Figure 5. The coelacanth *Latimeria*. Gale Group. Paleontology--Figure 6. *Ichthyostega*. Gale Group. Paleontology--Figure 7. Two advanced pelycosaurs: *Edaphosaurus* (a) and *Dimetrodon* (b). Gale Group. Paleontology--Figure 8. Ancient marine reptiles. Gale Group. Paleontology--Figure 9. Late Jurassic plesiosaurs: *Cryptoclidus* (a & b) and *Liopleurodon* (c). Gale Group. Paleontology--Figure 10. The pterosaur *Ramphorhynchus gemmingi*. Gale Group. Paleontology--Figure 11. The first bird, Archaeopteryx. Gale Group. Paleontology--Figure 2. *Eurypterid*. Gale Group. Paleontology--Figure 1. Trilobite. Gale Group. Paleontology--Figure 3. *Pikaia*, the world's first known chordate; found at Burgess Shale. Gale Group. Paleontology--Figure 4. An ancient jawless fish, *Hemicyclospis*. Gale Group. Palms--Coconut palms in Florida. Reproduced by permission--JLM Visuals. Pandas--A giant panda in China. Reproduced by permission--JLM Visuals. Pangolins--A pangolin. Photo Researchers, Inc. Parabola--Figure 4. Gale Group. Parabola--Figure 3. Gale Group. Parabola--Figure 1. Gale Group. Parabola--Figure 2. Gale Group. Parrots--The endangered hooded parakeet (*Psephotus dissimilis*). Reproduced by permission--Field Mark Publications. Parrots--Double yellow Amazon parrot. Reproduced by permission--Field Mark Publications. Particle detectors--Figure 3. Cerenkov radiation. Gale Group. Particle detectors--Mark I detector at the Stanford Linear Accelerator Center (SLAC), California. The orange box-like structure at the left houses magnets that guide beams of electrons and positrons through the accelerator. The large octagonal structure is formed by the detector's magnet. Within it are two rings of photomultiplier tubes that detect light as it passes through the detector. Reproduced by permission--Photo Researchers, Inc. Particle detectors--Figure 1. Schematic diagram of the Geiger counter. Gale Group. Particle detectors--An electron in a magnetic field spirals some 36 times in a cloud chamber at the Lawrence Berkeley Laboratory in California. The track of the electron, which starts at the bottom of the picture, is some 33 ft (10 m) long. Its spiral becomes tighter half way up the picture because the electron loses energy by radiating a photon. The small irregularities in the spacing between the loops are due to scattering when the electron is deflected slightly by collisions with atoms in the chamber's gas. Reproduced by permission--Photo Researchers, Inc. Particle detectors--Figure 2. A gamma ray scintillation spectrometer. Gale Group. Partridges--Partridges. Reproduced by permission--The Stock Market. Peafowl--A peacock (*Pavo cristatus*). Reproduced by permission--Field Mark Publications. Peccaries--A javelina (*Tayassu tajacu*), or collared peccary, at the Aransas National Wildlife Refuge, Texas. Note the irregular collar (which is yellowish in color) running from shoulder to shoulder. Reproduced by permission--Field Mark Publications. Pelicans--A brown pelican (*Pelecanus occidentalis*) at the Everglades National Park, Florida. Unlike the American white pelican, the brown is nonmigratory, preferring saltwater habitats year round. Reproduced by permission--Field Mark Publications. Penguins--A gentoo penguin with its chick. Reproduced by permission--JLM Visuals. Peninsula--A rocky peninsula in Acadia National Park, Maine. Reproduced by permission--JLM Visuals. Periodic functions--Figure 3. Gale Group. Periodic functions--Figure 1. Gale Group. Periodic functions--Figure 2. Gale Group. Periodic table--The periodic table. Gale Group. Periodic table--Figure 2. Size representation of the atomic radii of the main-group elements. Gale Group. Pests--Eight-spotted forester moth caterpillars devouring poplar. Reproduced by permission--JLM Visuals. Petroleum--The 799–mi (1,286–km) long Trans-Alaska Pipeline is capable of transporting over 1.2 million barrels of oil per day. Reproduced by permission--JLM Visuals. Pheasants--A male ring-necked pheasant (*Phasianus colchicus*) on Pelee Island, Ontario. Reproduced by permission--Field Mark Publications. Phenyl group--Figure

1. Gale Group. Phosphorus removal--The phosphorus cycle. Geological uplift accounts for the presence of the phosphate rocks (upper left). Gale Group. Photography--The world's first photograph, taken by Joseph Nicéphore Niépce in 1826, of the courtyard of his family's estate in France. Reproduced by permission--Corbis Corporation. Phototropism--Plants respond to the direction and amount of light they receive. The seedling at the right was grown in normal, all-around light. The one in the center received no light. The plant at the left grew toward the light that it received on only one side. Reproduced by permission--Photo Researchers, Inc. Photovoltaic cell--A custom-designed solar powered desalination system in Jeddah, Saudi Arabia. It is composed of 210 photovoltaic modules that supply 8 kilowatts of power (peak) for conversion of highly saline water into fresh drinking water. Reproduced by permission--Phototake. Pigeons and doves--A Victoria crowned pigeon (*Goura victoria*). Both sexes of this species possess the crest, but only the male performs the courtship display in which it is shown off. Reproduced by permission--Field Mark Publications. Pigs--A warthog (*Phacochoerus aethiopicus*) in Kenya. Reproduced by permission--JLM Visuals. Pike--A redbfin pickerel. Reproduced by permission--JLM Visuals. Pines--A Scotch pine. Reproduced by permission--Mr. James Sikkema. Pipefish--A pipefish (*Sygnathus sp.*) swimming through the water. Photo Researchers, Inc. Planetary nebulae--The Cat's Eye Nebula (NGC 6543) as seen from the Hubble Space Telescope. The shells of gas were expelled from a dying star (center) during its last stages of life. It has been suggested, in order to explain the intricate features seen in the shells, that another star is orbiting around the dying star. The knots and thin filaments seen along the periphery of the gas (bottom right and top left) might have been formed by a pair of high-speed jets ejected by the companion star interacting with the gas in the shells. Public domain. Planetary nebulae--Figure 4. Gale Group. Planetary nebulae--Figure 3. Gale Group. Planetary nebulae--Figure 2. Gale Group. Planetary nebulae--Figure 1. Gale Group. Plant--Some features common to the roots of monocots can be seen in this cross section of a Smilax root. Reproduced by permission--Phototake. Plastics--A scanning electron micrograph (SEM) of the surface of a sheet of biodegradable plastic. The spherical object that dominates the image is one of many granules of starch embedded in the surface of the plastic. When the plastic is buried in soil the starch grains take up water and expand. This breaks the material into small fragments, increasing the contact area with the soil bacteria that digest plastic. Reproduced by permission--Photo Researchers, Inc. Plate tectonics--A section of the San Andreas Fault south of San Francisco is occupied by a reservoir. Reproduced by permission--JLM Visuals. Plovers--A semipalmated plover. Photo Researchers, Inc. Pluto--Figure 1. The Pluto-Charon system. Gale Group. Pluto--An artist's view of Pluto and its only moon Charon. Public domain. Pneumonia--A chest x ray showing lobar pneumonia in the lower lobe of a patient's right lung. The alveoli (air sacs) of the lung become blocked with pus, which forces air out and causes the lung to become solidified. Reproduced by permission--Photo Researchers, Inc. Point source--A point source. Gale Group. Polar coordinates--Figure 3. Gale Group. Polar coordinates--Figure 2. Gale Group. Polar coordinates--Figure 1. Gale Group. Pollination--A honeybee becomes coated in pollen while gathering nectar and transports the pollen as it goes from flower to flower. Reproduced by permission--. Pollination--A cross section of the anther of a lily, showing open pollen sacs and the release of pollen grains. Reproduced by permission--JLM Visuals. Pollution control--Equipment for the complete recovery and control of air, acids, and oxide emissions. Reproduced by permission--Phototake. Polygons--Figure 1. Gale Group. Poppies--Arctic poppies (*Papaver radicatum*). Reproduced by permission--JLM Visuals. Porcupines--A porcupine (*Hystrix africaeaustralis*) with its quills erect. Photo Researchers, Inc. Prairie--A tall grass prairie during a Montana summer. Reproduced by permission--Photo Researchers, Inc. Prairie chicken--This display by a prairie chicken is sometimes called

`booming.' Reproduced by permission--JLM Visuals. Prairie dog--A black-tailed prairie dog (*Cynomys ludovicianus*) at the Sonora Desert Museum, Arizona. Reproduced by permission--Field Mark Publications. Praying mantis--A praying mantis on a pitcher plant in Bruce National Park, Ontario. The European mantis (*Mantis religiosa*) and the Chinese mantis (*Tenodera aridifolia*) are both common to northern North America and are both introduced species. The only mantids native to the continent are in the south. Reproduced by permission--Field Mark Publications. Precession of the equinoxes--Figure 1. The precessional motion of a top. Gale Group. Precession of the equinoxes--The precessional motion of the Earth. Gale Group. Precious metals--Over one ton of gold bars. Photo Researchers, Inc. Precipitation--Hailstones are often composed of concentric layers of clear and opaque ice. This is thought to be the result of the stone traveling up and down within the cloud during its formation. Opaque layers would be created in the upper, colder parts of the cloud, where the water droplets are small and freeze rapidly, forming ice with numerous air enclosures. In the warmer, lower parts of the cloud the water droplets would spread over the surface of the hailstone so that little air is trapped and the ice is transparent. Reproduced by permission--Photo Researchers, Inc. Predator--A cheetah and her cubs at a kill in the Kalahari, South Africa. Reproduced by permission--The Stock Market. Prenatal surgery--Preparation for prenatal surgery. Gale Group. Prenatal surgery--A specific surgical procedure to correct a defect in the diaphragm of a developing fetus. Gale Group. Prescribed burn--Use of controlled burning for prairie management in South Dakota. Reproduced by permission--Photo Researchers, Inc. Primroses--Bloom of the shooting star, a member of the primrose family. Reproduced by permission--Field Mark Publications. Projective geometry--Figure 2. Gale Group. Projective geometry--Figure 1. Gale Group. Prokaryote--Two typical prokaryotic cells: a blue-green alga and a bacteria. Gale Group. Prosthetics--An artificial knee joint as used in replacement surgery (seen fitted to human bone samples). Reproduced by permission--Photo Researchers, Inc. Prosthetics--A typical above-the-knee prosthesis. The flesh-colored foam cover is worn over the working prosthesis on the right. Gale Group. Puffer fish--An inflated blowfish. Photo Researchers, Inc. Pyramid--Pyramids at Giza, Egypt. Reproduced by permission--The Stock Market. Pythons--A green tree python. Reproduced by permission--JLM Visuals. Quadrilateral--Quadrilateral figures. Gale Group. Quadrilateral--Quadrilateral figures. Gale Group. Quail--A Gambel's quail (*Lophortyx gambelii*) in the Arizona Sonora Desert Museum, Arizona. Reproduced by permission--Field Mark Publications. Quantum mechanics--Figure 1. Gale Group. Quasar--Hubble Space Telescope (HST) views of the distant quasar 120+101 indicate that its image has been split by gravitational lensing, a phenomenon by which the pull of a massive object, such as a galaxy, can bend the light of another object when the light passes near or through the massive object. Reproduced by permission--Photo Researchers, Inc. Rabies--An engraving showing antirabies vaccination at the Pasteur Institute in Paris. Louis Pasteur (1822-1895) developed a rabies virus that was milder and had a shorter incubation period than the wild virus. A person bitten by a rabid animal would be inoculated with the Pasteur virus and rapidly develop immunity to the wild strain. The first human patient was successfully treated in 1885. Reproduced by permission--Photo Researchers, Inc. Raccoons--A northern raccoon (*Procyon lotor*) in Flathead National Forest in northwestern Montana. Reproduced by permission--The Stock Market. Radar--A computer generated 3D perspective view of Death Valley, California, constructed from radar data from the Shuttle Imaging Radar-C (SIR-C) combined with a digital elevation map. Reproduced by permission--Photo Researchers, Inc. Radial keratotomy--Radial keratotomy scars on the cornea of an eye. Reproduced by permission--Phototake. Radiation detectors--A handheld Geiger counter. Reproduced by permission--Photo Researchers, Inc. Radio--Radio towers on Elden Mountain above Flagstaff, Arizona. Each transmitting antenna has a size that

matches the wavelength of the signal it transmits. Reproduced by permission--The Stock Market. Radioactive tracers--Figure 1. Schematic diagram of an Anger Scintillation Camera. Gale Group. Rainforest--Mountain rainforest in Kenya. Reproduced by permission--The Stock Market. Rats--A brown rat scavenging in a garbage can. Photo Researchers, Inc. Rays--Giant 6 ft (1.8 m) stingrays come to divers for handouts at Stingray City, Grand Cayman. Reproduced by permission--The Stock Market. Real numbers--Real numbers. Gale Group. Rectangle--A rectangle. Gale Group. Recycling--Curbside collection of recyclable household wastes in Livonia, Michigan. This municipality, and many others, mandates the recycling of glass, newsprint, steel cans, and certain kinds of plastics. Recyclable wastes are collected in bins provided by the city and placed outside for pickup. Reproduced by permission--Field Mark Publications. Red giant star--Figure 1-3. Gale Group. Reflections--Figure 1-4. Gale Group. Refrigeration--An industrial food refrigeration unit. Reproduced by permission--The Stock Market. Relation--Figure 2. Gale Group. Relation--Figure 1. Gale Group. Respiratory system--The human respiratory system. Gale Group. Retrograde motion--Figure 2. Gale Group. Retrograde motion--Figure 1. Gale Group. Rh factor--Rh disease. Gale Group. Rhesus monkeys--A mother Rhesus monkey with her infant. Photo Researchers, Inc. Rhinoceros--A white rhinoceros. There are two subspecies of white rhinoceros in Africa. The northern white rhinoceros is found only in Zaire and is a critically endangered subspecies. The southern subspecies is found in South Africa, Botswana, Zimbabwe, Namibia, Swaziland, Kenya, Mozambique, and Zambia. Reproduced by permission--Field Mark Publications. Rivers--The Parana River in Brazil. Reproduced by permission--Photo Researchers, Inc. Robotics--A police robot handling a live bomb by remote control. Reproduced by permission--Photo Researchers, Inc. Rockets and missiles--First flight of the Ariane 4 rocket. Photo Researchers, Inc. Rodents--A mole rat, *Cryptomys hottentotus*. from southern Africa. Reproduced by permission--Photo Researchers, Inc. Root system--Figure 2. The root cap shown in relation to root hairs and emerging lateral roots. Gale Group. Root system--Figure 1. Early stages in the development of a root tip, illustrating its four regions. Gale Group. Rose family--A dwarf apple tree. Reproduced by permission--Mr. James Sikkema. Rose family--Ornamental rose. Reproduced by permission--Field Mark Publications. Rotation--Figure 1. Gale Group. Rotation--Figure 2. Gale Group. Rushes--Spike rushes. Reproduced by permission--JLM Visuals. Rusts and smuts--Smut on corn. Reproduced by permission--Photo Researchers, Inc. Saiga antelope--A male saiga antelope (*Saiga tatarica*). Reproduced by permission--Photo Researchers, Inc. Salamanders--A salamander (*Tylototriton verrucosus*). Photo Researchers, Inc. Salmon--Sockeye salmon (*Oncorhynchus nerka*). Reproduced by permission--The Stock Market. Sandpipers--A red-backed sandpiper (*Calidris alpina*) at the Ottawa National Wildlife Refuge, Ohio. This bird feeds by probing or rapidly "stitching" with its bill (like the needle of a sewing machine), leaving a line of tiny holes in the mud. Reproduced by permission--Field Mark Publications. Satellite--Intelsat VI. floating over the Earth. Public domain. Saturn--Saturn, the second largest planet in the solar system, and its system of rings. Public domain. Saturn--Enceladus, one of Saturn's seven intermediate moons, is the most reflective body in the solar system, largely because its surface is a thin crust of always new ice. Reproduced by permission--JLM Visuals. Saturn--Figure 1. Main ring features visible from Earth. Gale Group. Savanna--Zebras on the savanna in Masai Mara, Kenya. Reproduced by permission--JLM Visuals. Saxifrage family--Red currant. Reproduced by permission--JLM Visuals. Scavenger--Vultures feeding on a giraffe in Kenya. Reproduced by permission--JLM Visuals. Scorpionfish--A lionfish (*Pterois volitans*) in the Coral Sea. Reproduced by permission--JLM Visuals. Sculpins--A mottled sculpin. Reproduced by permission--JLM Visuals. Sea anemones--A sea anemone. Reproduced by permission--JLM Visuals. Sea horses--A common seahorse (*Hippocampus ingens*). Photo Researchers, Inc. Sea level--These wave-cut marine terraces in Iran are evidence of a historic lowering of the sea

level. Reproduced by permission--JLM Visuals. Sea lions--South American sea lions on the edge of the beach. Photo Researchers, Inc. Seals--Northern elephant seals (*Mirounga angustirostris*) at the Ano Nueva Reserve, California. Reproduced by permission--Field Mark Publications. Seals--Northern fur seal with his harem of female cows. Photo Researchers, Inc. Seasons--The seasons. Gale Group. Secretary bird--A secretary bird. Standing nearly 4 ft (1.2 m) high, the bird can kill the most venomous of snakes by striking them repeatedly with its taloned feet. Photo Researchers, Inc. Sedges--Cottongrass in the Yukon. Reproduced by permission--JLM Visuals. Sediment and sedimentation--Figure 1. Table of names for sedimentary particles based on grain size. Gale Group. Sediment and sedimentation--Figure 2. This graph illustrates that consolidated, fine-grained clay deposits subjected to stream erosion can be nearly as difficult to erode as gravel and boulders. Gale Group. Sediment and sedimentation--Sorted sediment in a gravel pit south of West Bend, Wisconsin. Reproduced by permission--JLM Visuals. Sedimentary rock--A sample of limestone. Photo Researchers, Inc. Seeds--A close-up of grass seed on grass. Reproduced by permission--The Stock Market. Sequoia--The General Sherman tree in Sequoia National Park, California. Reproduced by permission--JLM Visuals. Set theory--Figure 2c. Gale Group. Set theory--Figure 2b. Gale Group. Set theory--Figure 2a. Gale Group. Set theory--Figure 1b. Gale Group. Set theory--Figure 1a. Gale Group. Sextant--A sextant. Reproduced by permission--The Stock Market. Sexually transmitted diseases--The progression of a sexually transmitted disease (STD). Gale Group. Sharks--A sand tiger shark (*Odontaspis taurus*). Photo Researchers, Inc. Sheep--Sheep grazing in a field. Photo Researchers, Inc. Shrews--A common, or masked shrew. Photo Researchers, Inc. Shrikes--A Northern shrike perched on a branch. Photo Researchers, Inc. Shrimp--A peppermint shrimp. Reproduced by permission--JLM Visuals. Sickle cell anemia--A scanning electron microscopy (SEM) scan of red blood cells taken from a person with sickle cell anemia. The blood cells at the bottom are normal; the diseased, sickle-shaped cell appears at the top. Reproduced by permission--Photo Researchers, Inc. Silk cotton family (*Bombacaceae*)--Baobab trees in western Australia. Reproduced by permission--JLM Visuals. Skates--A winter skate. Photo Researchers, Inc. Skeletal system--A frontal view of the human skeleton. Reproduced by permission--Photo Researchers, Inc. Skeletal system--A scanning electron micrograph (SEM) of normal human cancellous (spongy) bone. The shafts of long bones such as the femur are comprised of two types of bone of differing densities: compact bone forms the outer region, and cancellous bone forms the core. In living cancellous bone, the cavities of the open structure contain bone marrow. Reproduced by permission--Photo Researchers, Inc. Skinks--A juvenile 5-lined skink (*Eumeces fasciatus*). Reproduced by permission--JLM Visuals. Slash-and-burn agriculture--Slash-and-burn agriculture in Peru. Reproduced by permission--Photo Researchers, Inc. Sleep disorders--A patient with acute sleep apnea is hooked up for a night's sleep at a Stanford University Lab. Reproduced by permission--Photo Researchers, Inc. Sloths--A three-toed sloth. Reproduced by permission--Photo Researchers, Inc. Smallpox--Smallpox on the arm of a man in India. Reproduced by permission--Phototake. Smell--The process by which olfactory information is transmitted to the brain. Gale Group. Snails--A land snail. Reproduced by permission--JLM Visuals. Snapdragon family--Indian paintbrush (*Castilleja sp.*). Reproduced by permission--Field Mark Publications. Soil--The layers of soil are called horizons. Together they make up the soil profile. Reproduced by permission--Field Mark Publications. Solar activity cycle--Figure 1. Annual mean sunspot numbers from 1610-1980. Gale Group. Solar flare--A solar flare erupting from the chromosphere of the Sun. Photo Researchers, Inc. Solar system--An illustration showing the orbits of the planets in the Solar system (top) and their comparative sizes (bottom). Public domain. Solar system--Figure 1. Gale Group. Solar system--Figure 2. Schematic of present-day solar system. Gale Group. Solar system--Figure 3. Condensation sequence and temperature versus distance relation

in the young solar nebula. Gale Group. Solubility--Figure 1. Gale Group. South America--South America. Gale Group. Space probe--Figure 2. Gale Group. Space probe--Figure 1. Gale Group. Space shuttle--The space shuttle Discovery being moved by crawler to the top of pad 39B at the Kennedy Space Center. Public domain. Spacecraft, manned--The liftoff of Apollo 11 from pad 39A at Kennedy Space Center on July 16, 1969 at 9:32 A.M. Crewmen Neil A. Armstrong, Michael Collins, and Edwin E. Aldrin Jr. achieved the first successful manned lunar landing on the Apollo 11 mission. Public domain. Spacecraft, manned--The Salyut 7 space station photographed in orbit. Attached to the space station at the bottom, with the separate solar panels, is the Soyuz T14 ferry spacecraft. Soyuz T14 was launched on September 17, 1985 and carried cosmonauts Vladimir Vasyutin, Alexander Volkov, and Georgi Grechko to Salyut 7. Their mission was terminated when Vasyutin became seriously ill, and they returned to Earth on November 22, 1985. Reproduced by permission--Photo Researchers, Inc. Sparrows and buntings--A song sparrow (*Melospiza melodia*) at Isle Royale National Park, Michigan. Reproduced by permission--Field Mark Publications. Species--Two lesser earless lizards, *Holbrookia maculata*. They are genetically the same species, but the upper one is from White Sands. Reproduced by permission--JLM Visuals. Spectroscope--Figure 1. A simple grating spectroscope. Gale Group. Spectrum--Figure 3. Schematic of the absorption spectrum of atomic hydrogen recorded on a photographic plate. Gale Group. Spectrum--Figure 2. Black body emission spectra for sources at three different temperatures, corresponding to the Sun, a 500-watt incandescent light bulb and a candle. Gale Group. Spectrum--Figure 1. A diagram of Newton's 1666 spectrum experiment. Gale Group. Spider monkeys--A spider monkey. Photo Researchers, Inc. Spiderwort family--Wandering jew. Reproduced by permission--JLM Visuals. Spina bifida--An infant with spina bifida. Reproduced by permission--Photo Researchers, Inc. Spiny anteaters--A short-nosed echidna (*Tachyglossus aculeatus*), or spiny anteater, wading through mud to drink at a drying-up waterhole in Little Desert, Victoria, Australia. Photo Researchers, Inc. Spiral--This famed spiral staircase in the Loretto Chapel (Chapel of Our Lady of Light) in Santa Fe, New Mexico, has no central support. Reproduced by permission--The Stock Market. Spirometer--A diagram of a water seal spirometer. Gale Group. Sponges--A vase sponge with a resident brittle star and a small blenny. Reproduced by permission--Photo Researchers, Inc. Spore--Close up of spores on a fern leaf. Photo Researchers, Inc. Spruce--A blue spruce. Reproduced by permission--Mr. James Sikkema. Spurge family--A castor bean plant. Reproduced by permission--Mr. James Sikkema. Squid--A Caribbean reef squid. Photo Researchers, Inc. Squirrel fish--A school of squirrel fish in the Caribbean. Reproduced by permission--The Stock Market. Squirrels--A red squirrel (*Tamiasciurus hudsonicus*) at Kensington Metropark, Michigan. This squirrel eats the seeds of conifers, as well as mushrooms, buds, sap, and bird eggs and nestlings. There may be four pairs per acre in good habitat. Reproduced by permission--Field Mark Publications. Star--Figure 2. Hydrostatic equilibrium dictates that the pressure in each layer must balance the weight on that layer. Consequently, pressure and temperature must increase from the surface of a star to its center. Gale Group. Star--Figure 3. Pulsating stars produce a light curve like this one, compiled from the variable star Mira during 1964-65. Gale Group. Star--Figure 4. The light curve of Algol, one of the most famous variable stars in the sky. Gale Group. Star--Antares (Alpha Scorpionis) is the bright star dominating this photograph. It is a conspicuous red supergiant, the brightest star in the constellation Scorpius. The bright object to the right of Antares is the M4 (NGC 6121) globular star cluster. Reproduced by permission--Photo Researchers, Inc. Star--Figure 1. Gale Group. Star cluster--The Pleiades open star cluster (M45), which is situated in the constellation Taurus. The Pleiades cluster is about 400 light years from Earth and is young (only about 50 million years old) on a galactic time scale. The cluster is still embedded in a cloud of cold gas and interstellar dust, material

left over from its formation. Reproduced by permission--Photo Researchers, Inc. Star formation--An infrared image of the molecular cloud and region of star formation NGC 7538. The bright areas (just below center, and left of bottom center) are sites where stellar formation is taking place. Giant clouds of dust are fragmenting and forming new protostar systems; the ultraviolet radiation of the newborn stars is lighting up the surrounding dust. The larger hazy glow (right of top center) is radiation from the protostars pouring out from a gap in the dust clouds. Reproduced by permission--Photo Researchers, Inc. Starfish--An ochre sea star (*Pisaster ochraceus*) on the California coast. Reproduced by permission--Field Mark Publications. Starlings--A flock of starlings swarming telephone poles. Photo Researchers, Inc. States of matter--A piece of SEAgel sitting on soap bubbles. SEAgel (Safe Emulsion Agar gel) is a material claimed to be the first lighter-than-air solid. It is made from agar, a seaweed derivative used as a thickening agent in the food industry, and is biodegradable. SEAgel could be used as a thermal insulator instead of plastic foam or balsa wood. High density SEAgel could be used instead of plastic packaging. The substance is soluble in water above 122°F (50°C). Reproduced by permission--Photo Researchers, Inc. States of matter--Gallium melts at 86°F (30°C). Reproduced by permission--Phototake. Steam pressure sterilizer--The structure of a steam pressure sterilizer. Gale Group. Stereochemistry--Figure 4. Gale Group. Stereochemistry--Figure 1. Gale Group. Stereochemistry--Figure 2. Gale Group. Stereochemistry--Figure 3. Gale Group. Stereochemistry--Figure 5. Gale Group. Stilts and avocets--A black-winged stilt. Photo Researchers, Inc. Storks--A white stork and its nest in Turkey. Reproduced by permission--JLM Visuals. Storm--Multiple lightning strikes over Tucson Mountain, Arizona. Reproduced by permission--Photo Researchers, Inc. Strata--Visible strata in the Grand Canyon, Arizona. Unknown source. Stroke--A hemorrhagic stroke (left) compared to a thrombotic stroke (right). Gale Group. Stromatolite--Stromatolites at Hamelin Pool in western Australia. Reproduced by permission--Photo Researchers, Inc. Sturgeons--A lake sturgeon (*Acipenser fulvescens*). Photo Researchers, Inc. Subatomic particles--An electronic display of the decay of an u quark, a particle made of a bottom quark and an antiquark, in the CLEO detector at the CESR collider at Cornell University. An electron and a positron have met and annihilated (center); their energy produces an excited u quark, which lives too briefly to show. It decays into a lower energy state by emitting a photon which converts into a positron (curves away tightly to the left) and an electron (curves to the right). The lower-energy u quark then decays to its ground state by emitting another photon (detected in the bottom right sector of the grid). The ground-state u quark finally decays into a high energy electron-positron pair (seen as the two long paths that cut diagonally across the grid in opposite directions from the center). Reproduced by permission--Photo Researchers, Inc. Submarine--A Trident submarine under construction in Groton, Connecticut. Reproduced by permission--Phototake. Sulfur cycle--The sulfur cycle. Gale Group. Sun--A photograph of the Sun taken with a coronagraph, a telescope that creates an artificial eclipse, so the solar corona is visible. The shape of the corona varies with time and in some areas is nearly absent. Much of its radiation is in the x-ray and extreme UV range, and the corona is many times hotter than the surface of the Sun itself. Public domain. Sun--An ultraviolet image of the Sun showing a massive prominence. NASA. Sunspots--A visible light image of the Sun, showing large sunspots. Public domain. Superconductor--Figure 1. The curve of resistance $R(\Omega)$ versus temperature T (K) of a mercury filament (after H. Kamerlingh Onnes, 1911). Gale Group. Superconductor--Figure 2. A type-II superconductor in various states under the application of magnetic field. Gale Group. Superconductor--Figure 3. Increase in T_c with time since superconductivity was discovered. Gale Group. Superconductor--A small cube magnet hovering over a nitrogen-cooled specimen of a superconducting ceramic demonstrates the Meissner

effect. Walther Meissner observed in 1933 that a magnetic field does not penetrate a superconductor. Magnetic lines of force loop around them, so the magnet is neither attracted nor repelled but instead floats above. Because the effect is so distinctive, it is used as a test for identifying superconducting materials. Reproduced by permission--Phototake. Surface tension--The long legs of a waterstrider (*Gerris paludum*) allow it to distribute its weight across the water and be supported by surface tension. Reproduced by permission--Photo Researchers, Inc. Surgery--A neurosurgeon using a computer-controlled robot arm (called a "magic-wand") during an operation to remove a brain tumor. In the background, a screen shows a number of computer tomography (CT) scans of the patient's head. With the CT scan data being fed into the robot's computer, even a small tumor can be found and removed with minimal damage to surrounding tissue. Reproduced by permission--Photo Researchers, Inc. Swallows and martins--Barn swallows (*Hirundo rustica*) at Point Pelee National Park, Ontario. Reproduced by permission--Field Mark Publications. Swamp cypress family--Redwoods in Jediah Smith State Park, California. Reproduced by permission--JLM Visuals. Swans--A tundra swan (*Cygnus columbianus*) at the Kellogg Bird Sanctuary, Michigan. Reproduced by permission--Field Mark Publications. Symbiosis--A cape buffalo with an oxpecker on its back in Kenya. The relationship between the oxpecker and the buffalo is a type of symbiosis called mutualism; the oxpecker feeds from the supply of ticks on the buffalo, which in turn benefits from tick removal. Reproduced by permission--JLM Visuals. Tanagers--Scarlet tanager (*Piranga olivacea*). Reproduced by permission--Field Mark Publications. Tapirs--A mountain tapir. Photo Researchers, Inc. Tarsiers--A tarsier clinging to a narrow tree branch. Photo Researchers, Inc. Tartaric acid--Figure 1. The D, L, and meso forms of tartaric acid. Gale Group. Tasmanian devil--A Tasmanian devil. Reproduced by permission--JLM Visuals. Taste--Taste regions of the tongue (left) and taste bud anatomy (right). Gale Group. Tea plant--A tea plantation in east central China. Reproduced by permission--JLM Visuals. Tectonics--Rift valleys like this one in Thingvellir, Iceland, are formed when an area of the earth's crust is warped upward by pressure from magma below and cracked into sections. The sections sink back lower than before as the adjacent areas of intact crust are drawn away from the fractures. Reproduced by permission--JLM Visuals. Telephone--Figure 3. Cellular network. Gale Group. Telephone--Alexander Graham Bell on the telephone at the formal opening of telephone service between New York and Chicago in 1892. NASA. Telephone--Figure 2. Telephone network. Gale Group. Telephone--Figure 1. Telephone set simplified circuit. Gale Group. Telescope--Figure 1. Gale Group. Telescope--Figure 2. Gale Group. Telescope--Figure 3. Gale Group. Telescope--The Clark telescope at Lowell Observatory in Arizona. Courtesy of Lowell Observatory. Telescope--The Anglo-Australian telescope (AAT) in New South Wales, Australia. The principal mirror of this optical telescope has a diameter of 12.8 ft (3.9 m) and lies at the bottom of the white frame. During the day it is protected by an array of steel petals that are seen here in open position. The larger horseshoe shaped frame is part of the supporting structure. AAT was one of the first electronically controlled telescopes. Reproduced by permission--Photo Researchers, Inc. Temperature regulation--Canines, like this North American timber wolf, use panting as a means of temperature regulation. Reproduced by permission--The Stock Market. Tenrecs--A striped tenrec. Photo Researchers, Inc. Terns--Royal terns (*Thalasseus maximus*) on Estero Island, Florida. Reproduced by permission--Field Mark Publications. Terracing--Rice terraces in Bali, Indonesia. Reproduced by permission--JLM Visuals. Territoriality--Walrus battling over a hauling-out spot, Bristol Bay, Alaska. Reproduced by permission--JLM Visuals. Textiles--A computer controlled textile mill. Reproduced by permission--Phototake. Thermal expansion--Joints like this one are used in bridges to accommodate thermal expansion. Reproduced by permission--JLM Visuals. Thermal expansion--Figure 2. Mercury and alcohol thermometers function because of the expansion difference

between liquids and solids. Because the liquid expands at a different rate than the tube, it rises as the temperature increases and drops as the temperature decreases. Gale Group. Thermal expansion--Figure 1. Representation of thermally induced change in a bimetallic strip made of iron and aluminum. The strip bends because the two materials do not expand or contract equally. Gale Group.

Thermometer--A digital thermometer measuring the temperature of boiling water. Pure water boils at 212°F (100°C) in standard atmospheric conditions, but the boiling point may be elevated by increased atmospheric pressure and the presence of impurities in the water. Reproduced by permission--Photo Researchers, Inc.

Thistle--Prairie thistle (*Cirsium undulatum*). Reproduced by permission--Field Mark Publications.

Thrombosis--A scanning electron micrograph (SEM) of a thrombus (clot) completely occluding a major pulmonary blood vessel in a human lung. At center is the blood clot. The thick wall of the pulmonary vessel surrounds it. On the outside is the fibrous tissue and alveoli of the lung. Reproduced by permission--Photo Researchers, Inc.

Thrushes--An American robin (*Turdus migratorius*) on Oakland University campus, Michigan. Reproduced by permission--Field Mark Publications.

Thunderstorm--Lightning over Tamworth, New South Wales, Australia. Reproduced by permission--Photo Researchers, Inc.

Tides--Low tide at Big Pine Key, Florida. Reproduced by permission--JLM Visuals.

Tides--High tide at Big Pine Key, Florida. Reproduced by permission--JLM Visuals.

Time--A sundial in Death Valley, California. Sundials were the first devices used to measure time. Reproduced by permission--JLM Visuals.

Toads--An American toad, *Bufo americanus*, perched in the grass. Photo Researchers, Inc.

Tonsillitis--The palatine, lingual, and pharyngeal tonsils. Gale Group.

Topology--Figure 5. A Klein bottle. Gale Group.

Topology--Figure 2. Gale Group.

Topology--Figure 4. A Möbius strip. Gale Group.

Topology--Figure 1. Gale Group.

Topology--Figure 3. Gale Group.

Tornado--An approaching tornado with its distinctive funnel visible. Photo Researchers, Inc.

Toucans--A toucan at Lake Arenal, Costa Rica. Reproduced by permission--The Stock Market.

Trains and railroads--A steam locomotive. Reproduced by permission--JLM Visuals.

Transformer--A high voltage transformer. Reproduced by permission--The Stock Market.

Translations--Figure 3. Gale Group.

Translations--Figure 1. Gale Group.

Translations--Figure 2. Gale Group.

Transplant, surgical--A comparison of the old and new hearts of Dylan Stork, the smallest heart transplant recipient in the world. Dylan weighed 5.5 lbs (2.5 kg) at the time of the operation. Reproduced by permission--Photo Researchers, Inc.

Trapezoid--Figure 1. Gale Group.

Tropical cyclone--Overhead view of the eye of a tropical cyclone. Gale Group.

Tropical cyclone--A computer enhanced image of Hurricane Diana at its strongest on September 11, 1984. The hurricane was just off the coast of South and North Carolina at the time, and winds within it were 130 mph (209 kph). NASA.

Tropical diseases--The life cycle of *Schistosoma japonicum*, one of three species of parasitic blood flukes that cause schistosomiasis. Gale Group.

Tropical diseases--A skin lesion from *cutaneous leishmaniasis*. Reproduced by permission--Photo Researchers, Inc.

True eels--A green moray eel (*Gymnothorax funebris*). The eel has blue skin covered with a yellow mucus that renders its apparent color green. It can reach a maximum length of 6 ft (1.8 m). Photo Researchers, Inc.

Tumor--A comparison of benign and malignant tumor characteristics. Gale Group.

Tuna--A tuna. Reproduced by permission--Photo Researchers, Inc.

Tundra--Rocky tundra on Bear Island in the Barents Sea. Reproduced by permission--Photo Researchers, Inc.

Tunneling--Figure 1. A particle before and after tunneling. It approaches from the left with far less energy than it would need to pass over the energy barrier. Gale Group.

Tunneling--Figure 2. Rutherford's potential energy map (dark curve) and the theoretical other side of the barrier (dashed curve), which serves to contain the pieces of the nucleus; (a) shows an alpha particle as part of the nucleus and (b) shows its troublesome appearance outside the uranium atom. Gale Group.

Turacos--A Ross's turaco. Reproduced by permission--Photo Researchers, Inc.

Turbine--Gas turbine manufacturing in South Carolina. Reproduced by permission--The Stock Market. Turbulence--Turbulence in the water below Niagara Falls. Reproduced by permission--JLM Visuals. Turkeys--Wild turkeys (*Meleagris gallopavo*) at the Arizona Sonora Desert Museum, Arizona. Reproduced by permission--Field Mark Publications. Turtles--The endangered Kemp's Ridley sea turtle (*Lepidochelys kempii*). Photo Researchers, Inc. Tyrant flycatchers--A least flycatcher (*Empidonax minimus*). Reproduced by permission--Field Mark Publications. Ulcers--A clinical photograph of a large duodenal ulcer after surgical resection (removal). The ulcer is the prominent triangular crater at center. Reproduced by permission--Photo Researchers, Inc. Ultrasonics--An ultrasound image of Anabelle Ashlyn Longe at 20 weeks. Reproduced by permission--Ms. Jackie Longe. Ultraviolet astronomy--ROSAT (Roentgensatellit) satellite prior to its launch on June 1, 1990. This German/United Kingdom/NASA satellite is capable of detecting both x rays and extreme ultraviolet (EUV) light. Reproduced by permission--Photo Researchers, Inc. Uplift--Stratified rock in Glacier National Park, Montana. The rocky crust has uplifted in isostatic rebound from the weight of glaciers. Reproduced by permission--JLM Visuals. Uranium--Nine-and-a-half pound button of uranium-235, which will be manufactured into a nuclear weapons component. U.S. Department of Energy. Uranus--Figure 1. Trajectory of Voyager 2 through the Uranus system in January 1986. Gale Group. Uranus--Figure 2. Diagram of offset and tilted magnetic field of Uranus. Gale Group. Uranus--The surface of Titania, the largest of the Uranian satellites at 980 mi (1580 km) in diameter, is marked by both impact craters and past geologic activity. The deep fault valley visible in this image near the terminator (day-night boundary) is the result of at least one episode of tectonic activity, and the basin-like feature near the top of the image appears to be the result of a heavy impact on Titania's surface. Public domain. Uranus--Unlike the other gas giants, Uranus reveals few atmospheric features in visible light. However, latitudinal atmospheric bands do exist, as can be seen in the enhanced image on the right; because Uranus has such an inclined axis of rotation (which is pointing almost directly down into this image), atmospheric bands that cross the surface of the planet (in the same way that atmospheric bands cross Jupiter's surface) appear as concentric circles in the photo. Public domain. Urea--Figure 1. Structural formula of urea. Gale Group. Van Allen belts--The Van Allen belts. Gale Group. Venus--The surface of Venus is obscured by a dense layer of clouds composed of sulfuric acid droplets. The cloud cover creates a greenhouse effect that results in surface temperatures over 860°F (460°C), higher than that of Mercury. Public domain. Venus--An artist's impression of one of the three continent-sized highland regions of Venus, Beta Regio, which consists of two huge shield volcanoes rising above the plains. Both are about 2.5 miles (4 km) high, and appear to be on a north-south fault line connecting them with other possibly volcanic features in the south. They have smooth surfaces and are shaped like Hawaiian volcanoes. The Russian spacecrafts Veneras 9 .and 10. landed directly east of Beta Regio and determined that the surface rock was volcanic basalt. Public domain. Video recording--Figure 1. A schematic diagram of a recording head. Gale Group. Video recording--Figure 2. (A) A schematic representation of the rotating drum and moving tape. (B) A schematic diagram of a magnetic tape that has recorded signals. Gale Group. Vipers--A Pope's pit viper. Photo Researchers, Inc. Vireos--A red-eyed vireo (*Vireo olivaceus*). Reproduced by permission--JLM Visuals. Virtual reality--A virtual reality system. Reproduced by permission--The Stock Market. Virus--Figure 1. In addition to the capsid, some viruses are surrounded by an envelope, consisting of protein and lipid, which is acquired as the virus exits the host cell. Viruses that have an envelope exit host cells by exocytosis, in which they "bud out" from the host cell. As they bud out, they take pieces of the host cell's plasma membrane with them and use these pieces as the protective envelope. Gale Group. Virus--Figure 2. First, the virus docks with the host cell. The genetic material of the virus

then enters the host cell and the virus loses its capsid. Once inside the host cell, the viral RNA or DNA takes over the cellular machinery to make more viruses. Viral subunits are produced, which are then assembled to make whole viruses. Finally, the new viruses leave the host cell, either by exocytosis or by destroying the host cell. Gale Group. Virus--A transmission electron micrograph (TEM) of Human Herpes Virus type 6 (HHV6). infecting a human cell. --Photo Researchers, Inc. cell was isolated from an AIDS patient suffering a secondary infection with the virus. HHV6. is now known to be the cause of the childhood disease roseola infantum. which produces sudden fever, irritability, and a skin rash. Reproduced by permission--Photo Researchers, Inc. Viscosity--Liquids of different viscosities. Reproduced by permission--Phototake. Vision--Figure 2. If you were to draw a line down the center of this scene, what you observe left of that line is your "left visual field," and to the right is your "right visual field." Images from the left visual field project to the right half of each retina, and images from the right visual field project to the left half of each retina. Gale Group. Vision--Figure 1. Gale Group. Vision disorders--Suturing of a donor's cornea onto the eye of a transplant recipient. The transplant replaces the patient's own damaged cornea, which was impairing his vision. Reproduced by permission--Phototake. Volcano--The July 22, 1980 eruption of Mount St. Helens in southern Washington. Reproduced by permission--Professor John McCann. Volcano--A volcanic cinder cone and lava flow in northern Arizona. Reproduced by permission--The Stock Market. Vulcanization--Figure 1. The process of vulcanization. Gale Group. Vultures--Black vultures on a dead alligator in Florida. Reproduced by permission--JLM Visuals. Walkingsticks--A walking stick. Reproduced by permission--Photo Researchers, Inc. Walnut family--Pecans growing on a tree (above). Ripened pecans showing nut meat (below). Reproduced by permission--JLM Visuals. Walruses--Walruses (*Odobenus rosmarus*) on Round Island, Alaska. Reproduced by permission--The Stock Market. Warblers--A male black-throated green warbler (*Dendroica virens*) at Metropolitan Beach Metropark, Michigan. Usually found high in trees, this warbler was in the grass feeding on grounded insects after a cold snap. Reproduced by permission--Field Mark Publications. Wasps--This female wasp of the family Mutillidae mimics the appearance of dangerous species of ants to ward off predators. Gale Group. Waste management--A household hazardous waste disposal day sponsored by the city of Livonia, Michigan. Residents are asked to bring toxic materials, such as paint, petroleum products, insecticides, and antifreeze, to a central location where they are combined and placed in barrels for disposal. Reproduced by permission--Field Mark Publications. Waterwheel--The waterwheel of an old mill at Stone Mountain Park, Georgia. Reproduced by permission--The Stock Market. Wave motion--Transverse waves produced by a water droplet penetrating the surface of a body of liquid. Reproduced by permission--Photo Researchers, Inc. Waxwings--Cedar waxwing (*Bombycilla cedrorum*). Reproduced by permission--Field Mark Publications. Weasels--A long-tailed weasel (*Mustela frenata*). Reproduced by permission--Phototake. Weathering--Bryce Canyon National Park, Utah, where weathering caused the exposed rock to erode into a system of canyons. Unknown source. Weaver finches--A yellow and black village weaver. Photo Researchers, Inc. Wetlands--Sunset on a wetland near Lake Erie in Crane Creek State Park. During low water periods, mud flats are exposed providing nesting platforms for waterfowl like the Canada goose in the photo. Reproduced by permission--Field Mark Publications. Wildfire--A climax forest (1) destroyed by wildfire (2) and its recovery (3, 4). Gale Group. Willow family--Willow in bloom. Reproduced by permission--Field Mark Publications. Wind chill--Table 1. Gale Group. Wind shear--A typical microburst wind shear scenario involving a descending aircraft. Gale Group. Wolverine--A wolverine in the snow. Reproduced by permission--The Stock Market. Wombats--A southern hairy-nosed wombat. Photo Researchers, Inc. Woodpeckers--A male Gila woodpecker (*Melanerpes uropygialis*). Reproduced by permission--JLM Visuals. Wrens--A marsh wren (*Cistothorus palustris*) perched in

cattail stalks at Stoney Point, Ontario, Canada. Reproduced by permission--Field Mark Publications. Yeast--Yeast (*Anthrocobia muelleri*). Reproduced by permission--Phototake. Zebras--A Cape mountain zebra of South Africa. Reproduced by permission--The Stock Market. Zooplankton--The planktonic ecosystem; arrows show the movement of biomass through the food chain. Gale Group. Fax machine--Sharp fax machine. Reproduced by permission--Photoedit. Continent--Diagram illustrating formation of continental margins. (a) Materials in the earth's mantle move up (often through volcanos) expanding the continental crust and causing rifting. (b) As it divides, the continental crust thins, and continues to separate. (c.) New oceanic crust forms from the mantle materials that have surfaced. (d) The oceanic crust is further widened by sea floor spreading. The Gale Group. Bariatrics--Nutrition counseling. Reproduced by permission--Custom Medical Stock Photo. Arc Lamp--Arc lamp. Gale Group. Oil drilling--Deep drilling oil rig at Naval Petroleum Reserve's Elk Hills site near Bakersfield, CA. Unknown source. Mars Pathfinder--Mars Pathfinder Lander and Rover in operation on the Martian surface, July 1997. Reproduced by permission--AP/Wide World Photos. Excavation methods--Dinosaur dig site, where it is thought that approximately 10,000 animals were buried by cretaceous volcanic ash flows. (c) James L. Amos/CORBIS. Dentistry--Figure 1. Teeth damaged by dental caries. Gale Group. Mitosis--Cell division by mitosis. Gale Group. Old Growth Forest--Old growth forest diagram. Gale Group. Protists--Marine plankton. Reproduced by permission--Corbis Corporation. Ribosomes--Ribosomes translating mRNA strand to produce proteins. Reproduced by permission--Photo Researchers, Inc. Ecology--New land development, Germantown, PA. Reproduced by permission--JLM Visuals. Herbal Medicine--Woman herbalist preparing Chinese herbal medication. Reproduced by permission--Custom Medical Stock Photo. Barley--Harvesting barley with a combine tractor. Photo Researchers, Inc. Decomposition--Fungus creates circular patterns on decomposing maple leaves. Reproduced by permission--Corbis Corporation. Potato--Idaho potato assembly line. Reproduced by permission--Stock Boston, Inc. Sugar cane--Harvesting sugar cane. Photo Researchers, Inc. Fuel cell--Ford Motor Company zero emission fuel cell vehicle. Reproduced by permission--Ford Motor Company (Environment and Safety Public Affairs). Microscope--Researcher in biochemistry lab using a transmission electron microscope (TEM). Reproduced by permission--Photo Researchers, Inc. Woolly Mammoth--Woolly mammoth. Reproduced by permission--Corbis Corporation. Tomatoes--Tomatoes in the field. Reproduced by permission--Field Mark Publications. Cell division--Cell dividing by mitosis. Gale Group. Diatoms--Diatom Plankton. Reproduced by permission--Corbis Corporation. Corn--Corn piled high outside of grain elevators, Magnolia, MN. Reproduced by permission--AP/Wide World Photos. Food Pyramid--Food Guide Pyramid Gale Group. Ball bearings--Chair castor showing ball bearings made of palladium alloys. Reproduced by permission--Field Mark Publications. Delta--Aerial view of Mississippi River Delta (bird's foot delta). National Oceanic and Atmospheric Administration. Obesity--List of ideal height and weight. Reproduced by permission--Stanley Publishing. Biosphere Project--Exterior of Biosphere 2, Oracle, AZ. Reproduced by permission--Corbis-Bettmann. Sink hole--Vanishing Lake, a large sinkhole. Photo Researchers, Inc. Adaptation--A boojum tree in Mexico during the dry season. The plant has adapted to seasonal changes in precipitation by restricting the growth of its foliage in the dry season. Reproduced by permission--JLM Visuals. Amniocentesis--A physician uses an ultrasound monitor (left) to position the needle for insertion into the amnion when performing amniocentesis. Reproduced by permission--Photo Researchers, Inc. Anthrax--A case of anthrax. Reproduced by permission--Custom Medical Stock Photo. Antibiotics--Penicillin culture. Reproduced by permission--Custom Medical Stock Photo, Inc. Embryo and embryonic development--A human embryo at 5-6 weeks of development. Reproduced by permission--Photo Researchers, Inc. Embryology--A human two-cell embryo 24 hours after fertilization. Reproduced by permission--Custom Medical Stock Photo. Hypertension--Hypertension, on the heart and kidney.

Reproduced by permission--Photo Researchers, Inc. Lactic acid--Lactic acid. Gale Group. Laser surgery--Lasers being used to perform cosmetic surgery. Reproduced by permission--Photo Researchers, Inc. Legionnaires' disease--*Legionella pneumophila*. Reproduced by permission--Custom Medical Stock Photo. Lyme disease--Reported cases of Lyme disease, 1996 (16,455 total). Electronic Illustrators Group. Magnetic resonance--A patient undergoing a magnetic resonance imaging test. Reproduced by permission--FPG International, LLC. Ornithology--This ovenbird's legs are being banded, or ringed, for tracking purposes. Reproduced by permission--Fiedl Mark Publications. Paleontology--Figure 12. Gale Group. Pollution--Pollution over the New Jersey turnpike. The Library of Congress. Positron emission tomography--Positron Emission tomography (PET) scan control study. Reproduced by permission--Custom Medical Stock Photo. Primates--Chimpanzees are the only primates whose genetic material closely matches that of humans. World Wide Fund for Nature. Protozoa--Protozoa. Reproduced by permission--Photo Researchers, Inc. Ribonucleic acid--Molecular structure of RNA. Gale Group. RNA function--A computer-generated model of ribonucleic acid (RNA). Reproduced by permission--Photo Researchers, Inc. Water pollution--Garbage washed up on the shore of the Hudson River. Reproduced by permission--Phototake. DDT--DDT sperulites magnified 50 times. Reproduced by permission--Photo Researchers, Inc. Starling--Golden-breasted starling perched on a branch. Photo Researchers, Inc. Lampreys and hagfishes--Group of Pacific lampreys. Photo Researchers, Inc. Isostasy--Establishing isostatic balance. (a) The weight of the ice covering Greenland pushes the land below sea level. (b) As the ice melts, the land mass rises as the pressure is removed but remains below the recently elevated sea level. (c) Normal isostatic balance is restored when the land mass is raised above sea level. The Gale Group. Barrier Island--Diagram of the barrier island system. The Gale Group. Geologic map--A simplified geologic map. The Gale Group. Metamorphic grade--An interior view of the earth showing the metamorphic grade. The Gale Group. Plate tectonics--Types of plate convergence. (a) Oceanic-continental. (b) Oceanic-oceanic. (c) Continental-continental. The Gale Group. Astronomy--A view of the inner dome and CFHT (Canada-France-Hawaii) telescope at the Mauna Kea Observatory in Hawaii. Photo Researchers, Inc. Organic Farming--Organic farming compared to industrial farming. Gale Group. Eutrophication--The structure of a eutrophic lake. Gale Group. Electron--Electron cloud. Reproduced by permission--Photo Researchers, Inc.