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BOOKS

Book consists of written or printed sheets of paper or some other material fastened together along one edge so it can be opened at any point. Most books have a protective cover. Books are a reasonably inexpensive and convenient way to store, transport, and find knowledge and information. The book thus ranks as one of humanity's greatest inventions.

People have used books in some form for more than 5,000 years. In ancient times, people wrote on clay tablets, strips of wood, or other materials. The term book comes from the early English word *boc*, which means tablet or written sheets. The first printed books in Europe appeared during the mid-1400's. Since then, millions of books have been printed on almost every subject and in every written language. Young readers are familiar with storybooks, textbooks, workbooks, and comic books. We often consult almanacs, dictionaries, encyclopedias, and telephone books for reference.

We read novels, books of poetry, and printed versions of plays for entertainment.

The pages of a book are glued or sewed together along one side, called the spine or back. Two covers are joined by hinges to the spine. Books are either hardbound or softbound, depending on the cover. Most hardbound books have covers made of cloth, plastic, or leather over cardboard. A paper dust jacket is often added to protect the cover. Softbound books, called paperbacks, have paper covers. Usually, the book title and other information appear on a book's spine and front cover as well as on its dust jacket.

Inside the front cover of a typical book is a collection of pages called the preliminary material. The material begins with a blank or decorated end paper, followed by the half-title page. The recto (front side) of this page carries the book's title. The verso (back of the page) may be blank, or may carry a list of other books by the same author. Throughout the book, the verso is always an even-numbered page and the recto is always odd-numbered.

The title page carries the full title of the book and the author's name on the recto. It also carries the imprint, which is the place and date of publication and the name of the publisher or company issuing the book. The verso of the title page contains additional publication information and a statement of copyright, which is a notification that the book's contents are the property of the author or publisher. In the earliest printed books, the information now carried on the title page appeared at the end of the book in a statement called the colophon. The illustration that faces the title page is called the frontispiece.

The preface follows the title page. In the preface, the author discusses various aspects of the creation of the book. The table of contents usually comes at the end of the preliminary material. It lists in order the book's main topics or the headings of the individual units and their page numbers. The text is the main part of the book. The text is usually divided into separate parts called chapters or books. The text may also include illustrations. In many books, several sections follow the text. The appendix contains notes, charts, tables, lists, or other detailed information discussed in the text. Many books have an index, which lists in alphabetical order important subjects, names, and places in the text. The index gives the page number where the reader can find these items in the text. Finally, some books have a bibliography that lists sources used by the author in writing the book. The bibliography also lists additional sources on subjects in the text.

CAPITAL PUNISHMENT

Capital punishment is punishment by death for committing a crime. Since the early 1800's, most executions have resulted from convictions for murder. The death penalty has also been imposed for such serious crimes as armed robbery, kidnapping, rape, and treason. People disagree about whether capital punishment is moral or is effective in discouraging crime.

In the late 1990's, 38 states of the United States had laws that allowed the death penalty. These laws were influenced by a 1972 U.S. Supreme Court decision. The court had banned the death penalty as it was then imposed. It ruled that "the imposition and carrying out of the death penalty" was cruel and unusual punishment in violation of the 8th and 14th amendments to the Constitution. But the court left open the possibility that the death penalty might be constitutional--if imposed for certain crimes and applied according to clear standards.

After the 1972 decision, many state legislatures passed new capital punishment laws designed to satisfy the Supreme Court's requirements. These laws limit the death penalty to murder and to other specified crimes that result in a person's death. Such crimes include armed robbery, hijacking, and kidnapping. The laws of several states specify the circumstances under which a judge or jury may

impose the death penalty.

In 1976, the court upheld death sentences for three men convicted of murder under new laws in Florida, Georgia, and Texas. It ruled that capital punishment for murder was "not unconstitutionally severe." But the court struck down laws that made the death penalty mandatory (required) for certain crimes. In addition to state laws on capital punishment, the death penalty may be imposed under federal laws or military laws.

Capital punishment was widely used during the Middle Ages, especially for crimes against the state and church. In the 1700's, England had more than 200 capital offenses. Most were abolished in the 1800's. The United Kingdom abolished capital punishment in 1969. Canada did so in 1976. The United States is the only Western industrialized nation where executions still take place.

According to the organization Amnesty International, about 100 nations either have formally abolished capital punishment or have done so in effect. These countries include most European and Latin American nations. About 90 countries still permit capital punishment, including most developing nations.

Many people oppose the death penalty, chiefly because they consider it cruel. Critics also warn against the risk of executing mistakenly convicted people. Supporters of capital punishment believe that, in certain circumstances, people who take human life deserve to lose their own lives. Many supporters argue that the threat of death discourages crime more effectively than the threat of prison does. But studies have shown no unusual increase in murders when the death penalty is abolished. Hundreds of people have been executed in the United States since the Supreme Court upheld the death penalty in 1976. In addition, several thousand have been sentenced to death and are awaiting the outcome of legal appeals.

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CRITICISM

Criticism is the analysis and judgment of works of art. It tries to interpret and to evaluate such works and to examine the principles by which they may be understood. Criticism attempts to promote high standards among artists and to encourage the appreciation of art. It also helps society remain aware of the value of both past and present works of art.

Criticism plays an important part in every art form. This article emphasizes literary criticism.

Kinds of literary criticism. Criticism can be divided into four basic types. They differ according to which aspect of art the critic chooses to emphasize. Formal criticism examines the forms or structures of works of art. It may also compare a work with others of its genre (kind), such as other tragic plays or other sonnets. Formal criticism is sometimes intrinsic--that is, it may seek to treat each work of art as complete in itself. Rhetorical criticism analyzes the means by which a work of art affects an audience. It focuses on style and on general principles of psychology. Expressive criticism regards works as expressing the ideas or feelings of the artist. It examines the artist's background and conscious or unconscious motives. Mimetic criticism views art as an imitation of the world. It analyzes the ways that artists show reality, and their thoughts about it.

The four types of criticism can also be combined. For example, a critic who looks at the form of a work might also study the way this form affects an audience.

History of literary criticism. The ancient Greek philosopher Plato was the first known literary critic. He accused poetry of imitating the mere appearance of things. Aristotle, his pupil, defended epic poetry and tragic drama. In his *Poetics*, Aristotle said that poetry is an instructive imitation, not of things but of actions. Other essays on criticism tended to be rhetorical handbooks that taught writers how to achieve certain effects. They included *Art of Poetry* by the Roman poet Horace and *On the Sublime* by the Greek writer Longinus.

During the late 1500's, such critics as the English poet Sir Philip Sidney praised literature as the image of an ideal world. During the 1600's and 1700's, critics turned their attention to defining the rules by which they thought works should be written and judged. The three most important English critics during this period were John Dryden, Samuel Johnson, and Alexander Pope.

In the early 1900's, the poet T. S. Eliot argued for a criticism that would be the servant of poetry, not of society. I. A. Richards, an English critic, developed methods of close reading. He asked readers to pay attention to the exact meaning of the text, not to impose their own ideas on it. In the mid-1900's, a movement called the New Criticism was popular in the United States. Such New Critics as Cleanth Brooks and John Crowe Ransom analyzed a work of literature as a self-contained whole, without reference to its historical period, the author's life, or other external influences.

6

STONE AGE

Stone Age is a term used to designate the period in all human cultures when people used stone, rather than metal, tools. The Stone Age began about 2 1/2 million years ago, when small stones were first made into crude chopping tools. It ended in the Near East about 3000 B.C., when bronze replaced stone as the chief material from which tools were made.

Scientists have divided the Stone Age on the basis of toolmaking techniques into Paleolithic, Mesolithic, and Neolithic phases. But only the term paleolithic (Old Stone Age) is still commonly used. This phase includes the prehistory of all human beings until about 8000 B.C. Paleolithic people were hunters and gatherers. After 8000 B.C., hunting and gathering became more specialized.

Some people mainly gathered wild vegetables, while others fished or hunted large game. Many early farmers in the Near East, Asia, and the Americas had no metals and lived in the Stone Age. They used polished stone axes and flint sickles to harvest crops.

Many peoples were still using Stone Age technology when Europeans began their voyages of exploration and discovery in the A.D. 1400's. The Aborigines of Tasmania and Australia were making Stone Age tools when white explorers discovered them in the 1700's. Europeans found groups in southern Africa living like their Stone Age ancestors. Islanders of the South Pacific Ocean and most American Indians lacked metal farming tools when they first met Europeans. A few groups in New Guinea and Australia are still in the Stone Age.

7

IMAGINATION

Imagination is the capacity to consider objects or events in their absence or as they might be.

Imagination may refer to many things, such as fantasy, ingenuity, daydreaming, and make-believe. But it often involves the use of mental imagery, which is the ability to call to mind the sensations of sights, sounds, tastes, smells, and touches that have been experienced.

Through mental imagery, people can also create mental sensations of situations or conditions they have not actually experienced. Imagination plays an important role in creativity, including the formation of abstract ideas. Mental images can substitute for the real thing, allowing a person to plan how to paint a picture, compose a song, and so on.

Mental imagery is produced by the same parts of the brain used in actual perception. This fact sometimes leads people to mistake objects in their mental images for real objects. Brain damage can also disrupt mental imagery and perception in the same ways.

People differ widely in their abilities and tendencies to use different aspects of imagery. For example, some people are better than others at moving objects in images. They can visualize an N changing into a Z when rotated to a certain point. In addition, some people are better than others at picturing more objects in their images or at creating new objects in images.

Imagination plays an important role in a child's life. Children tend to use imagery in thinking more than adults do. But children have more difficulty than adults in using imagery effectively. This difficulty contributes to the problems that children experience in reasoning about objects and ideas.

8

COOKING

Cooking is the preparation of food for eating by applying heat. Cooking makes food more appetizing and easier to digest. It also kills harmful bacteria that could otherwise cause illness. Many people enjoy cooking. Skillful cooks take great care in preparing delicious, attractive, and nutritious meals. Some people use the term cooking to refer to preparation of all foods, not just those that are heated. Most people can prepare lettuce salad or other foods without written directions. But many foods, including cakes and sauces, turn out well consistently if prepared according to a recipe. Many cookbooks with a wide variety of recipes are available. Recipes also appear on food packages and in many magazines and newspapers.

This article discusses basic principles of planning meals and preparing food. Some cookbooks give general tips on both topics in addition to providing recipes. A beginner should first try simple recipes and meals and then go on to more difficult ones.

Planning meals

Meal planning involves several factors. The food should be nutritious and appealing, and its cost should be within a family's budget. A cook also must consider the time required to prepare certain meals.

Planning nutritious meals requires a basic knowledge of the body's nutritional requirements and the nutrients in different foods. Nutritionists divide foods into basic groups and recommend a certain

number of daily servings from each group. The NUTRITION article describes these food groups and lists the recommended number of servings. Meals planned according to these guidelines provide the nutrients a person needs without adding extra calories or dietary fat.

Planning appealing meals. An appealing meal includes foods that have contrasting colors, shapes, textures, flavors, and temperatures. The selection of vegetables and fruits can be especially important in adding color to a meal. For example, a meal of sliced turkey, cauliflower, mashed potatoes, white bread, and milk would look unappetizing. A green vegetable and an orange one, instead of cauliflower and potatoes, would make the meal more colorful and appealing. Cutting carrots, beets, and other vegetables into contrasting shapes can also help create variety. The textures of solid foods range from soft to firm, and a meal should include foods that vary in chewiness. Most meals also should include at least one hot food and one cold dish. In addition, a person should serve foods that differ in flavor.

Foods called garnishes can make a dish more attractive. They usually are arranged around the food after it has been cooked. Common garnishes include parsley sprigs, tomato slices, and lemon wedges.

9

DANCE

Dance is the movement of the human body in a rhythmic way. Dance serves many functions in human society. It is an art form, a social activity, a type of communication, and a form of recreation. People can dance by themselves, in couples, or in large groups. The dance can be spontaneous or performed in established movements. It can tell a story, explore an emotion, or serve as a form of self-expression. Many people dance as a career, but anyone can dance simply by moving in rhythm. Dance is among the oldest human art forms. Dancing extends beyond the human species itself. For example, many animals perform complex dances during courtship.

Dance differs from other kinds of rhythmic movement, such as dribbling a basketball, because in dance the movement itself is the goal of the activity. Music usually accompanies dance, providing the rhythm, tempo, and mood for the movements.

In modern societies, many people enjoy dancing simply for entertainment. Each generation creates new dances as an expression of its own sense of life and fun. For example, rock dancing arose about 1960 with the popularity of rock music. This type of dance was created primarily by and for young people. Rock dances such as the twist did not require partners to touch each other while they danced. The dancing was free-spirited and individual, allowing each dancer to create his or her own steps spontaneously. Rock dancing stressed pure emotion underscored by the strong beat of the music.

Why people dance

Religious reasons. For thousands of years, human beings have danced for religious reasons. Many religions involve some form of dance. Many religious dances are forms of prayer. Believers dance as they pray for rain, for the fertility of crops, and for success in war or in hunting. Such dances often imitate or pantomime some movement. For example, dancers may imitate the movement of the animal to be hunted, or a hunter's actions in stalking it. They may wear elaborate costumes and masks or makeup to depict deities or animals.

Religious dance also may attempt to create a state of ecstasy (intense joy) or trance in the worshiper. Dance may also be used as one part of a religious occasion or ritual. One example is the dancing of Jews at the festival of Simhat Torah. Another example is the dancing and whirling of members of a Muslim religious order called dervishes. Dancing was a formal element in Christian worship until the A.D. 1100's, when religious leaders began to prohibit it because they believed it was too worldly an activity. However, spontaneous dance has become a common element of worship among some Protestant denominations.

Social reasons. Dancing plays an important role in social functions. All societies have characteristic forms of dance. Such dancing may take place at ceremonial occasions or at informal gatherings. Like traditional foods and costumes, dance helps members of a nation or ethnic group recognize their connection to one another and to their ancestors. By dancing together, members of a group express their sense of common identity or belonging.

10

DRAMA

Drama is an art form that tells a story through the speech and actions of the characters in the story. Most drama is performed by actors who impersonate the characters before an audience in a theater.

Although drama is a form of literature, it differs from other literary forms in the way it is presented. For example, a novel also tells a story involving characters. But a novel tells its story through a combination of dialogue and narrative, and is complete on the printed page. Most drama achieves its greatest effect when it is performed. Some critics believe that a written script is not really a play until it has been acted before an audience.

Drama probably gets most of its effectiveness from its ability to give order and clarity to human experience. The basic elements of drama--feelings, desires, conflicts, and reconciliations--are the major ingredients of human experience. In real life, these emotional experiences often seem to be a jumble of unrelated impressions. In drama, however, the playwright can organize these experiences into understandable patterns. The audience sees the material of real life presented in meaningful form--with the unimportant omitted and the significant emphasized.

No one knows exactly how or when drama began, but nearly every civilization has had some form of it. Drama may have developed from ancient religious ceremonies that were performed to win favor from the gods. In these ceremonies, priests often impersonated supernatural beings or animals, and sometimes imitated such actions as hunting. Stories grew up around some rites and lasted after the rites themselves had died out. These myths may have formed the basis of drama.

Another theory suggests that drama originated in choral hymns of praise sung at the tomb of a dead hero. At some point, a speaker separated from the chorus and began to act out deeds in the hero's life. This acted part gradually became more elaborate, and the role of the chorus diminished.

Eventually, the stories were performed as plays, their origins forgotten.

According to a third theory, drama grew out of a natural love of storytelling. Stories told around campfires re-created victories in the hunt or in battle, or the feats of dead heroes. These stories developed into dramatic retellings of the events.

DRAMA/Forms of drama

Among the many forms of Western drama are (1) tragedy, (2) serious drama, (3) melodrama, and (4) comedy. Many plays combine forms. Modern dramatists often disregard these categories and create new forms.

11

PAINTING

Painting is one of the oldest and most important arts. Since prehistoric times, artists have arranged colors on surfaces in ways that express their ideas about people, the world, and religion. The paintings that artists create have great value for humanity. They provide people with both pleasure and information.

Sometimes artists paint primarily for their own enjoyment or self-expression, choosing their own subjects. Artists may also paint for a supporter called a patron, who commissions (orders and pays for) a work. A patron may be a private individual or a ruler who wants to decorate a palace or give the painting as a gift. A patron also may be an organization or institution. Religious groups have commissioned works of art to help believers worship and understand their faith. Rulers use art to assert their importance. Governments use painting to teach people about the history and ideals of their country.

Even when artists paint primarily for themselves, they want others to see their work and understand and enjoy it. People enjoy paintings for a number of reasons. Many viewers take pleasure in the artistic qualities of a painting, such as its colors or composition. Some paintings interest viewers because of the way the artists have expressed some emotion, such as fear, grief, happiness, love, hero worship, or faith. Such paintings, in turn, can inspire similar emotions in people looking at them. Other paintings are enjoyable because they skillfully portray nature or illustrate the daily lives of people who lived long ago.

Paintings can also teach. Some paintings reveal what the artists, their patrons, or their society felt about important subjects, including death, love, religion, and social justice. Many paintings tell about the history of the period in which they were created. They provide information about the customs, ideals, and interests of people of past societies. Much of our knowledge about prehistoric and ancient times comes from paintings and other works of art because many early cultures left few or no written records. For example, paintings can tell about such things as the architecture, clothing, recreation, and tools of a particular society or historical period.

What painters paint

It would be very difficult to find a subject that no one has ever tried to paint. Artists paint the things they see around them--people, animals, nature, and objects. They also paint dreamlike scenes that

exist only in the imagination. An artist can reach back into the past and paint a historical event, a religious story, or a myth. Some artists paint pictures that show no recognizable subject matter at all.

Instead, they arrange the paint in some way that expresses feelings or ideas that are important to them.

Since prehistoric times, many artists have painted the subjects that were most important to their societies. For example, religion was particularly important in Europe during the Middle Ages, and most of the paintings created then had religious themes.

All great paintings, regardless of subject matter, share a common feature. They do more than just reproduce with paint something that exists, existed, or can be imagined. They also express the painter's special view about a subject.

12

ACID RAIN

Acid rain is a term for rain, snow, sleet, or other wet precipitation that is polluted by such acids as sulfuric acid and nitric acid. Acid rain harms thousands of lakes, rivers, and streams worldwide, killing fish and other wildlife. It also damages buildings, bridges, and statues. High concentrations of acid rain can harm forests and soil.

Acid rain forms when water vapor in the air reacts with certain chemical compounds. These compounds, including sulfur dioxide and nitrogen oxides, come largely from the burning of coal, gasoline, and oil. Most automobiles, factories, and power plants burn such fuels for energy. Regions affected by acid rain include large parts of eastern North America, Scandinavia and central Europe, and parts of Asia. Since about the 1950's, the problem has increased in rural areas. This has occurred because the use of taller smokestacks in urban areas has enabled the winds to transport pollutants farther from their sources.

Scientists and engineers have developed ways to reduce the acidity of rain. For example, several kinds of devices remove sulfur and nitrogen compounds from fuels or industrial emissions before they reach the atmosphere. Adding lime to lakes and rivers and their drainage areas temporarily neutralizes their acidity. But the neutralization may have harmful side effects.

In 1990, the United States Congress amended the Clean Air Act of 1970 to reduce acid rain in the United States and Canada. The amendments tightened standards for emissions, required fuels that burn more cleanly, and called for power plants to cut their sulfur dioxide emissions.

13

SUBWAY

Subway is an electric, underground railway designed to move large numbers of people quickly to their destinations. Many systems include railways that are elevated or at ground level. Subways are most useful in crowded urban areas, where heavy traffic often slows down travel by bus or car.

Many of the world's largest cities have or are planning extensive subway systems.

London was the first city to have a subway. Today, London has 10 lines that provide quick, cheap transportation to all parts of the city and suburbs. This subway system is often called the tube or the underground. Some of its subway lines are so far underground that passengers go down on elevators. London's first underground passenger line opened in 1863. It used steam locomotives. The first deep-level line opened in 1890 and had electric locomotives. All subways since then have used electricity.

Several large cities in the United States have subway systems. Boston was the first American city to have a subway. It opened a line of 11/2 miles (2.4 kilometers) in 1897. The subway in New York City is one of the largest in the world. A person can travel from the New Jersey shore, under the city, beneath two rivers, and into Long Island without seeing daylight. The first sections of New York's subway were opened in 1904. In the United States, subways also operate in Atlanta, Baltimore, Chicago, Los Angeles, Philadelphia, San Francisco, and Washington, D.C. In Canada, subways operate in Montreal and Toronto.

There are three types of subways. One is called the open cut. The construction crew tears out the streets and builds the subways in deep ditches. If two lines are going to cross, the crew digs one roadbed deeper than the other. If the crew lays a pavement or other type of cover over the cut in the ground, the subway is called a cut and cover subway. The third form of subway, which is called a tube, is constructed by boring through the earth at the desired depth without disturbing the surface. This type of construction is for one or two tracks. The tunnels of an open-cut subway have a rectangular shape. The tunnels of a tube subway are usually circular or semicircular. New York City's subway is mainly rectangular. Much of the London subway is semicircular.

SEWAGE

Sewage is water that contains waste matter produced by human beings. It is also called wastewater. It contains about a tenth of 1 per cent solid matter. Sewage comes from the sinks and toilets of homes, restaurants, office buildings, and factories. It contains dissolved material that cannot be seen, plus bits of such solid matter as human waste and ground-up garbage. Some sewage may also contain ground and surface water runoff that occurs after storms or floods. Most sewage also includes harmful chemicals and disease-producing bacteria.

Most sewage eventually flows into lakes, oceans, rivers, or streams. In the United States, almost all sewage is treated in some way before it goes into the waterways as a semiclear liquid called effluent. Untreated sewage looks and smells foul, and it kills fish and aquatic plants.

Even treated sewage can harm water. For example, most methods used to treat sewage convert organic wastes into inorganic compounds called nitrates, phosphates, and sulfates. Some of these compounds may serve as food for algae and cause large growths of these simple aquatic organisms. After algae die, they decay. The decaying process uses up oxygen. If too much oxygen is used, fish and plants in the water will die.

A system of pipes that carries sewage from buildings is called a sanitary sewerage system. There are two main types of sanitary sewerage systems: (1) urban sewerage systems and (2) rural sewerage systems.

TRANSPORTATION

Transportation is the act of moving people or goods from one place to another. Transportation takes people where they need or want to go, and it brings them the goods they need or want. Without transportation, there could be no trade. Without trade, there could be no towns and cities. Towns and cities are traditionally the centers of civilization. Therefore, transportation helps make civilization possible.

Throughout most of history, transportation was extremely slow and difficult. In prehistoric times, people traveled mainly on foot. They transported goods on their backs or heads or by dragging them along the ground. About 5000 B.C., people began to use animals to haul loads. By 3000 B.C., wagons and sailing vessels had been invented. The use of animals, wagons, and sailing vessels enabled people to transport loads farther and more easily than before. But the speed of transportation improved only slightly over the centuries.

Inventors produced the first engine-powered vehicles during the late 1700's and the early 1800's. This development marked the beginning of a revolution in transportation that has continued to the present. Today, jet airliners carry travelers nearly as fast as, or faster than, the speed of sound. Trains, trucks, and giant cargo ships haul goods to buyers in almost all parts of the world. Automobiles provide convenient transportation for millions of people.

Although engine-powered transportation has benefited people in many ways, it has also created several difficult problems. For example, the engines use great quantities of fuel and so strain the world's energy supplies. Automobiles jam many streets and highways, making travel slow. In addition, their exhaust fumes pollute the air. Such problems are so difficult to solve that governments have become increasingly involved in transportation.

This article discusses the kinds of transportation, the history of their development, and today's systems of engine-powered transportation. The article also discusses the transportation industry and current developments in transportation. Vehicles are also used for recreation, warfare, and space exploration.

TRANSPORTATION/Kinds of transportation

There are three main kinds of transportation: (1) land, (2) water, and (3) air. Land transportation depends mainly on wheeled vehicles, especially automobiles, trains, and trucks. Ships and boats are the most important water vehicles. Air transportation depends almost entirely on airplanes.

METROPOLITAN AREA

Metropolitan area consists of a central city and the developed area that surrounds it. The developed area may be made up of such jurisdictions as cities, boroughs, towns, townships, or villages.

In the United States, a metropolitan area is officially called a Metropolitan Statistical Area. Two or more adjacent metropolitan statistical areas form a Consolidated Metropolitan Statistical Area. U.S.

metropolitan areas have at least one city or urban area with a population of 50,000 or more, and include the entire county in which the city is located. Adjacent counties may be considered part of the area, depending on their population density and the number of workers who commute to jobs in the central county. The term greater applied to a city refers to a metropolitan area, such as Greater Paris. In England, clusters of small cities around a large city are called metropolitan counties. In developed countries, most people live in metropolitan areas. In the United States, about 80 percent of the people live in the nation's 268 metropolitan statistical areas. In Canada, about 60 percent of the people reside in 25 metropolitan areas.

The development of suburbs

As cities grow, people move beyond official city boundaries, creating suburbs. This process of suburbanization has been going on since the late 1800's. Several factors contributed to the development of metropolitan areas. Originally, large numbers of people came from rural areas to central cities in search of employment. This population shift produced overcrowded cities, causing other people to move to outlying areas. The use of automobiles, together with the improvement of roads and highways, increased tremendously following the end of World War II in 1945. As a result, more and more people have settled in communities outside of central cities since the late 1940's.

By 1970, more people in U.S. metropolitan areas lived in suburbs than in central cities. But by the early 1980's, the rate of suburban growth had decreased for a number of reasons. For example, many people moved to the suburbs to avoid such problems of big cities as crime, housing shortages, and racial conflicts. However, as the suburbs grew larger, they developed the same problems.

Urban revitalization programs drew some people back to central cities.

People who live in the suburbs of a central city have traditionally considered the city as their workplace because of its commercial and industrial activities. Suburbanites also use the city's cultural, professional, and recreational facilities and services. Since the 1950's, however, many businesses and industries have moved to the suburbs. Today, many suburbanites who once commuted to and from work in the city work, shop, and enjoy various recreational activities in the suburbs.

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YOGA

Yoga is a term that has two meanings. It is both (1) a school of thought in the Hindu religion and (2) a system of mental and physical exercise developed by that school. Followers of the yoga school, who are called yogis or yogins, use yoga exercise to achieve their goal of isolation of the soul from the body and mind. Many non-Hindus in Western countries practice some form of yoga exercise in hope of improving their health and achieving peace of mind. The word yoga means discipline in Sanskrit, the classical language of India.

According to the yoga school, every human being consists of prakrti and purusha. Prakrti includes a person's body, mind, and ego (conscious self). Purusha is pure, empty consciousness--the soul. The yoga school teaches that the soul is completely separate from the rest of a person, but that the person does not realize it. Human beings suffer because they wrongly believe that their soul is bound to their body and mind. The yoga school, through yoga exercise, aims to give people prajna (understanding) of the meaning of their soul. After a person has obtained this understanding, his or her soul will gain moksha (release) from the samsara (cycle of rebirth) in which Hindus believe.

A yogi, under the guidance of a guru (teacher), goes through eight stages of training on the way to moksha. The yogi learns: (1) disciplined behavior, called yama; (2) positive values (niyama); (3) bodily postures, such as the lotus position (asana); (4) control of breathing (pranayama); (5) control of the senses (pratyahara); (6) fixing of the mind on a chosen object (dharana); and (7) meditation (dhyana). The eighth stage, called samadhi, is a state of concentration in which yogis realize that their soul is pure and free, and empty of all content. A yogi who has completed these eight stages has reached kaivalya. Kaivalya is total isolation of the soul from the body, from all other souls, and from all of nature.

Various forms of yoga have become popular in the United States and Europe. Transcendental Meditation is a simplified version of the yoga of Hinduism. Bhakti-yoga involves the dedication of all actions and thoughts to a chosen god. Members of the Hare Krishna movement practice bhakti-yoga by dedicating themselves to the god Krishna. Hatha-yoga, which stresses difficult bodily postures and breathing techniques, has become popular as a method of gaining better health. People also study hatha-yoga for the unusual control some yogis develop over such functions as metabolism and blood flow.

DAY CARE

Day care is a service in which children or dependent adults are cared for while the person who normally cares for them cannot do so. In the United States and Canada, women have traditionally cared for their children and for other dependent relatives. But in recent years, more and more women have begun working outside the home. The number of families with only one parent has also increased. Because of these changes, many families no longer have an adult at home during the day, and the demand for day care has risen.

Types of day care for children. Many working parents enroll their children in a day-care center. This is a nonhome site where a group of children receive adult care and supervision. Day-care centers are sometimes called child-care centers. Parents may also place their children in a family day-care home. In family day care, an adult cares for a small group of children in his or her own home. Usually, this adult is a mother with her own children. Some parents obtain day care by hiring a sitter or nanny. This is a person who comes to, or lives in, the family home. Other parents rely on relatives to care for their children during the day.

Day care for school-age children. Some working parents who have school-age children can be home when the children go to school and when they come home. But many parents are unable to do so, and their children may need day care before and after school.

Before- and after-school day-care programs may be located in the school the child attends. Such day care may also occur in a day-care center, a family day-care home, or the home of a relative or neighbor. In many areas, day care for school-age children is hard to find or expensive. For this reason, numerous children care for themselves before or after school.

Government support of day care. Most day-care programs in the United States and Canada are run by individuals or nongovernment organizations. In the United States, only a few programs are fully funded by state governments or federal agencies. In Canada, many programs are partly or fully funded by the provinces.

Employer-supported day care. In both countries, many employers offer benefits to help working parents care for their children and other dependents. The most common benefits include part-time working hours, flexible schedules, and unpaid leave. Some employers have day-care centers at the workplace. Others help working parents find and pay for day care outside the workplace.

In the United States, companies with 50 or more employees are required by law to offer at least 12 weeks of unpaid leave to employees with a sick family member, a newborn infant, or a recently adopted child. **In Canada,** federal law allows mothers a 15-week, partially paid maternity leave and a 2-week unpaid leave. In addition, either the mother or the father may take an additional 10 weeks of partially paid leave.

Choosing a day-care provider for children. Experts recommend that parents select a day-care provider that is licensed or regulated by the state or province--if the state or province requires licensing or regulation. Many states and provinces do not regulate or license all types of day-care providers. Experts also recommend that the caregivers have special training in childcare and that there be enough of them to provide each child with individual attention.

HOBBY

Hobby can be any type of activity that people do during their leisure time. Most people take up a hobby for relaxation, pleasure, or friendships, or to develop new interests. A hobby can also lead to additional income.

People of almost any age can enjoy hobbies. A hobby offers a way to relax after periods of hard work. Hobbies offer broadened areas of interest and ways to pass the time pleasantly. Hobbies can be important in helping patients recover from physical or mental illness because they provide distractions from the patients' problems. For people who are ill or bedridden, hobbies offer fascinating ways to pass the time. Hobbies can also be an important form of occupational therapy. In the past, hobbies were largely limited to the wealthy. The average person was too busy earning a living to find time to pursue a hobby. People today generally have more leisure time because of higher incomes and improvements in working conditions. In addition, most people also live longer and retire from their jobs at an earlier age. To fill their free time, they often develop interests in hobbies.

Kinds of hobbies

Almost any kind of leisure activity can become a hobby. Most hobbies fall into one of four general

categories, which may overlap. They are (1) the arts, (2) collecting, (3) handicrafts, and (4) games and sports.

The arts provide outlets for hobbyists with a special interest in such art forms as dancing, drama, painting, graphic arts, and music. Each art form has many separate possibilities for a hobby. For example, music may include singing or playing an instrument. Painting offers the hobbyist a wide choice of materials, such as oil paints or water colors.

Collecting is probably the most widespread kind of hobby because almost anything can be collected. Stamps and coins are probably the most popular collected items. Hobbyists also collect such things as autographs, comic books, costumes, and baseball cards.

Handicrafts attract hobbyists who can work skillfully with their hands. Many hobbyists engage in needlework activities, notably crocheting, needlepoint, knitting, and sewing. Hobbyists use kits to make model airplanes, boats, and trains. Using woodworking tools, they can create carvings, furniture, and bowls. Other handicrafts include ceramics, metalworking, jewelry making, weaving, batik, and leatherworking.

Games and sports are popular with many hobbyists who enjoy competition, physical activity, and healthful exercise. Thousands of hobbyists take part in sports, such as bowling, fishing, mountain climbing, skiing, and tennis. These sports give hobbyists the opportunity to display their individual skills and sportsmanship. Popular indoor games include bridge and other card games, backgammon, chess, and Monopoly.

Other hobbies. Electronics-related hobbies are becoming increasingly popular. Many hobbyists enjoy flying model airplanes by remote control or assembling and operating ham radios. Both young people and adults have taken up computers as a hobby, frequently assembling computers from kits. Some people raise pets as a hobby. For many people, gardening and photography are rewarding hobbies.

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BUTTERFLY

A butterfly begins its life as a tiny egg, which hatches into a caterpillar. The caterpillar spends most of its time eating and growing. But its skin does not grow, and so the caterpillar sheds it and grows a larger one. It repeats this process several times. After the caterpillar reaches its full size, it forms a protective shell. Inside the shell, an amazing change occurs--the wormlike caterpillar becomes a beautiful butterfly. The shell then breaks open, and the adult butterfly comes out. The insect expands its wings and soon flies off to find a mate and produce another generation of butterflies.

Butterfly caterpillars have chewing mouthparts, which they use to eat leaves and other plant parts.

Some kinds of caterpillars are pests because they damage crops. One of the worst pests is the caterpillar of the cabbage butterfly. It feeds on cabbage, cauliflower, and related plants.

Adult butterflies may have sucking mouthparts. The adults feed mainly on nectar and do no harm.

In fact, they help pollinate flowers. Many flowers must have pollen from other blossoms of the same kind of flower to produce fruit and seeds. When a butterfly stops at a flower to drink nectar, grains of pollen cling to its body. Some of the pollen grains rub off on the next blossom the butterfly visits.

Kinds of butterflies

Scientists group the thousands of species of butterflies into families, according to various physical features the insects have in common. The chief families include (1) skippers; (2) blues, coppers, and hairstreaks; (3) brush-footed butterflies; (4) sulphurs and whites; (5) metalmarks; (6) satyrs and wood nymphs; (7) swallowtails; (8) milkweed butterflies; and (9) snout butterflies. Each of these families has species in North America.

The life cycle of butterflies

The life of an adult butterfly centers on reproduction. The reproductive cycle begins with courtship, in which the butterfly seeks a mate. If the courtship proves successful, mating occurs. Butterflies use both sight and smell in seeking mates. Either the male or the female may give signals, called cues, of a certain kind or in a particular order. If a butterfly presents the wrong cue, or a series of cues in the wrong sequence, it will be rejected.

In courtship involving visual cues, a butterfly reveals certain color patterns on its wings in a precise order. Many visual cues involve the reflection of ultraviolet light rays from a butterfly's wing scales. The cues are invisible to the human eye, but butterflies see them clearly. The visual cues help the insects distinguish between males and females and between members of different species.

Usually, a butterfly that presents an appropriate scent will be immediately accepted as a mate. The scent comes from chemicals, called pheromones, that are released from special wing scales. A

pheromone may attract a butterfly a great distance away. In most cases, the male butterfly dies soon after mating. The female goes off in search of a place to lay her eggs. She usually begins laying the eggs within a few hours after mating.

Every butterfly goes through four stages of development: (1) egg, (2) larva, (3) pupa, and (4) adult. This process of development through several forms is called metamorphosis.

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SUPPLY AND DEMAND

Supply and demand are economic forces that determine the amount of a product that is produced and its price. The supply of a product is the amount of it that businesses are willing and able to offer for sale at alternative prices. Generally, the higher the price is, the greater the amount supplied will be. Similarly, the demand for a product is the amount of it that users can and would like to buy at alternative prices. Demand also depends on the price, but in the opposite way. Usually, the quantity demanded is lower at high prices than at low ones. Because the amount that producers actually sell must be the same as the amount that users actually buy, the only price at which everyone can be satisfied is the one for which supply equals demand. This is called the equilibrium price.

The supply and demand diagram with the Supply and demand article in the print version of The World Book Encyclopedia shows how these economic forces operate. Using the market for onions as an example, the supply curve SS' shows the number of pounds produced each month at every possible market price. Higher prices encourage farmers to produce more onions, and low prices discourage production. Consumers' reactions are shown by the demand curve DD', which shows how many pounds of onions customers want to buy each month at every possible price. At low prices, they want many onions. At high prices, the customers use other vegetables.

Supply and demand curves cross at a certain price (20 cents a pound in the example). When this is the market price, suppliers will offer just the quantity that users wish to buy. At any higher price, farmers will produce more onions than consumers are willing to buy, and competition among farmers will force the price down. At prices lower than equilibrium, purchasers will demand more onions than are available, and the scarcity of onions will drive the price up.

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CAPITALISM

Capitalism is an economic model that calls for control of the economy by individual households and privately owned businesses. It is one of two main economic models. The other is central planning, which calls for government control of the economy.

No purely capitalist or completely centrally planned economy has ever existed. The economic systems of all nations use some government control and some private choice. But economies that rely mostly on private decisions are usually described as capitalist. Such economies include those of the United States and Canada. The former Soviet Union and many nations of Eastern Europe once relied heavily on central planning. Such economies are sometimes called socialist or Communist. Many other nations rely less on capitalism than the United States does but more than the Soviet Union did.

How capitalism differs from central planning

In basically capitalist systems, private decision-makers determine how resources will be used, what mix of goods and services will be produced, and how goods and services will be distributed among the members of society. Capitalism is frequently known as free enterprise or modified free enterprise because it permits people to engage in economic activities largely free from government control.

Other names sometimes applied to basically capitalist systems are free market systems, laissez faire systems, and entrepreneurial systems. In systems based on central planning, the government makes most major economic decisions. Government planners tell managers what to produce, whom to sell it to, and what price to charge. Centrally planned economies are often called command economies.

The root of the word capitalism is capital. Capital has several meanings in economics and business. In business, it refers to the money needed to hire workers, buy materials, and pay bills. In economics, capital includes buildings, equipment, machinery, roads, and other assets used to produce things. In basically capitalist systems, most land, factories, and other capital is privately owned. In systems based on central planning, the government owns most of the capital used in production.

Capitalism in its ideal form

The Scottish economist Adam Smith, in a landmark book called *The Wealth of Nations* (1776), laid out the basic argument for capitalism. Smith maintained that a government should not interfere with a nation's economy but instead should let individuals act as "free agents" who pursue their own selfinterest.

Such free agents, he argued, would naturally act in ways that would bring about the greatest good for society "as if guided by an invisible hand."

Private choices. An example of how an ideal capitalist economy would work is an arrangement called perfect competition, also known as pure competition. In perfect competition, privately owned businesses, driven by a desire for profits, decide what goods or services to produce, how much to produce, and what methods to employ in production. These choices determine how much labor and capital a business will need. In other words, private firms "supply" goods and services and "demand" labor and capital.

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INFLATION

Inflation is a continual increase in prices throughout a nation's economy. The rate of inflation is determined by changes in the price level, an average of all prices. If some prices rise and others fall, the price level may not change. Therefore, inflation occurs only if most major prices go up.

Inflation reduces the value--also called the purchasing power--of money. During an inflationary period, a certain amount of money buys less than before. For example, a worker may get a salary increase of 10 percent. If prices remain stable, the worker can buy 10 percent more goods and services. But if prices also increase 10 percent, the worker's purchasing power has not changed. If prices rise more than 10 percent, the worker cannot buy as much as he or she previously could.

Inflation has many causes. It may result if consumers demand more goods and services than businesses can produce. Inflation may also occur if employers grant wage increases that exceed gains in productivity. The employers pass most or all of the cost of the wage increase along to consumers by charging higher prices. A government can try to control inflation by increasing taxes, raising interest rates, decreasing the money supply, reducing government spending, and setting limits on wages and prices. But the government's task is difficult, chiefly because it may trigger a recession when it attempts to reduce inflation.

The opposite of inflation is deflation, a decrease in prices throughout a nation's economy. Deflation tends to occur during periods of economic depression but may also happen at other times. For a discussion of the economic conditions sometimes associated with deflation.

Kinds of inflation

Mild inflation occurs when the price level increases from 2 to 4 percent a year. If businesses can pass the increases along to consumers, the economy thrives. Jobs are plentiful, and unemployment falls. If wages rise faster than prices, workers have greater purchasing power. But mild inflation usually lasts only a short time. Employers seek larger profits during periods of economic growth, and unions seek higher wages. As a result, prices rise even further--and inflation increases.

Moderate inflation results when the annual rate of inflation ranges from 5 to 9 percent. During a period of moderate inflation, prices increase more quickly than wages, and so purchasing power declines. Most people purchase more at such times because they would rather have goods and services than money that is declining in value. This increased demand for goods and services causes prices to rise even further.

Severe inflation occurs when the annual rate of inflation is 10 percent or higher. This type of inflation is also called double-digit inflation. During a period of severe inflation, prices rise much faster than wages, and so purchasing power decreases rapidly.

When inflation is severe, debtors benefit at the expense of lenders. If prices increase during the period of a loan, the debtor repays the debt with dollars less valuable than those that were borrowed. In terms of purchasing power, the lender does not get back as much money as was lent.

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INTEREST

Interest is the price paid to lenders for the use of their money. Interest is figured as a percentage of the amount of money borrowed. For example, a borrower who is charged 12 percent interest would pay \$12 a year in interest for every \$100 of the loan. Interest is based on the idea that lenders are entitled to a return on their investment. This pays them for giving up their right to use the money for a period of time or to make a profit in other ways.

Interest plays an essential part in commerce. Businesses, governments, and consumers borrow and lend money, and thus they pay and receive interest. Businesses borrow money to buy new machinery or to build new factories. They also raise money by selling bonds to the public. Investors who purchase the bonds are paid interest by the businesses that sold them. Businesses pay interest with higher earnings made possible by the borrowed money. At times, one business invests in

another and receives interest on its loan. Governments borrow to make up the difference between the money they spend and the funds they collect in taxes. A government receives interest on money it lends, such as on loans to people who want to establish a business. Consumers pay interest if they borrow to buy a home or an automobile. When people deposit money in a savings account, they are lending funds to a bank or a savings and loan association. Therefore, they receive interest.

People or businesses who lend money have incomes greater than their expenditures, so they let others use their money. Instead of hoarding their surplus funds, lenders use it to earn more money through interest.

Borrowers pay interest so they can make purchases that they could not afford if they had to pay immediately. Suppose that a family wishes to buy a house but has not saved enough to pay the entire cost at once. Instead of waiting until the total amount has been saved, the family can take out a mortgage from a bank or another lending institution. The family can then live in the house while repaying the loan in monthly installments. When consumers buy goods or services on credit, they actually are borrowing money by promising to pay by a future date. If the purchase is made on a revolving charge account, the consumer pays in monthly installments and is charged interest on the unpaid balance on the account.

Wise consumers learn about the interest rates they agree to pay. A few merchants may try to make a profit by selling items at low prices but charging a high rate of interest on credit payments. In some cases, consumers pay a higher interest rate for credit from a store than they would for a loan from a bank.

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MARKET RESEARCH

Market research is the process of gathering and analyzing information to help business firms and other organizations make marketing decisions. Business executives use market research to help them identify markets (potential customers) for their products and decide what marketing methods to use. Government officials use such research to develop regulations regarding advertising, other sales practices, and product safety.

Market research services are provided by several kinds of companies, including advertising agencies, management consultants, and specialized market research organizations. In addition, many large business companies have their own market research department.

Market researchers handle a wide range of tasks. They estimate the demand for new products and services, describe the characteristics of probable customers, and measure potential sales. They determine how prices influence demand, and they test the effectiveness of current and proposed advertising. Market researchers also assess a company's sales personnel and analyze the public "image" of a company and its products.

A market research study begins with a statement of the problem that the client wants to solve. This statement leads to a detailed definition of the information to be gathered. There are two types of market research information, secondary data and primary data.

Secondary data are statistics and other information that are already available from such sources as government agencies and universities. To save time and money, market researchers use secondary sources as much as they can. Primary data are data that must be obtained through research. The chief techniques for gathering such data include mail questionnaires, interviews, retail store shelf audits, use of electronic scanners at retail checkout counters, and direct observation in stores. The researchers design and test research materials, such as questionnaires or guides for interviewers. Finally, they collect the data, analyze the information, and report the results of their study. The computer is an important tool in analyzing market research data.

Market research can reduce the risk involved in many business decisions, but some risk always remains. Expenditures for market research must be carefully controlled so that the costs do not exceed the probable benefits from reduced risk.

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GROSS DOMESTIC PRODUCT

Gross domestic product (GDP) is the value of all goods and services produced in a country during a given period. It is one of the most widely used measures of a nation's total economic performance in a single year.

Measuring the GDP. One way to determine the GDP is to add up the sum of spending on four kinds of goods and services in any year.

(1) Personal consumption expenditures include private spending on durable goods, such as

automobiles and appliances; nondurable goods, such as food and clothing; and services, such as haircuts and motion-picture tickets. In the United States, these expenditures make up about two-thirds of the GDP each year.

(2) Private investment expenditures include spending by business companies for new buildings, machinery, and tools. They also include spending for goods to be stored for future sale. These expenditures average about 20 percent of the annual GDP of the United States.

(3) Government purchases of goods and services include spending for new highways, missiles, and the wages of teachers, fire fighters, and government employees. Such spending amounts to about 20 percent of the United States GDP each year.

(4) Net exports represent the value of domestically produced goods and services sold abroad, less the value of goods and services purchased from abroad during the same period. Currently, the value of U.S. exports is exceeded by that of U.S. imports. Net exports thus show a negative percentage in the U.S. GDP. The negative percentage accounts for percentages in the other three major parts of the U.S. GDP totaling more than 100 percent.

Real GDP. A nation may produce the same amount of goods and services this year as it did last year. Yet this year's GDP may be 5 percent higher than last year's. Such a situation would occur if prices of goods and services had risen by an average of 5 percent. To adjust for such price changes, economists measure the GDP in constant dollars. They determine what each year's GDP would be if dollars were worth as much during the current year as in a certain previous year, called the base year. In other words, they calculate the value of each year's production in terms of the base year's prices. When GDP measured in current dollars is divided by GDP in constant dollars, the result is an index of inflation called the GDP deflator.

GDP figures do not tell everything about a nation's economy. For example, they tell little about the well-being of individuals and families. Even the GDP per capita does not tell who uses various goods and services. It cannot show, for example, how much of the GDP goes to the poorest 20 percent of the population and how much goes to the wealthiest 20 percent. Nor does the GDP per capita tell anything about the quality of a country's goods and services.

GDP excludes production by facilities that are owned by a nation's citizens if the facilities are in another country, and it includes production by foreign-owned facilities within the country. Some economists believe another figure, the gross national product (GNP), is a better measure than GDP. GNP includes all production by a nation's firms regardless of the firms' location and does not include production by foreign-owned facilities within the country. For many years, the U.S. Commerce Department used GNP to measure the country's economic performance. It switched to GDP in 1991.

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VALUE-ADDED TAX

Value-added tax is a tax imposed by a government at each stage in the production of a good or service. The tax is paid by every company that handles a product during its transformation from raw materials to finished goods. The amount of the tax is determined by the amount of the value that a company adds to the materials and services it buys from other firms.

Suppose that a company making scratch pads buys paper, cardboard, and glue worth \$1,000. The company adds \$500 in labor costs, profits, and depreciation, and sells the scratch pads for \$1,500. The value-added tax is calculated on the \$500. The companies that had sold the paper, cardboard, and glue to the scratch pads company would also pay a tax on their value added. In this way, the total value added taxed at each stage of production adds to the total value of the final product. Most firms that pay a value-added tax try to pass this expense on to the next buyer. As a result, most of the burden of this tax in time falls on the consumer. In this sense, the final effect is equal to that of a retail sales tax. The tax is levied at a fixed percentage rate and applies to all goods and services. However, many nations use different rates. In these nations, the less necessary a product is, the higher the rate will be.

In 1954, France became the first nation to adopt a value-added tax. Today, this tax is growing in popularity, and Canada and about 40 nations use it. It is not used by the United States on the federal level. But most of the other large industrial nations use it.

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TAXATION

Taxation is a system of raising money to finance government services and activities. Governments at all levels--local, state, and national--require people and businesses to pay taxes. Governments use the tax revenue to pay the cost of police and fire protection, health programs, schools, roads,

national defense, and many other public services.

Taxes are as old as government. The general level of taxes has varied through the years, depending on the role of the government. In modern times, many governments--especially in advanced industrial countries--have rapidly expanded their roles and taken on new responsibilities. As a result, their need for tax revenue has become great. Through the years, people have frequently protested against tax increases. In these situations, taxpayers have favored keeping services at current levels or reducing them. Voters have defeated many proposals for tax increases by state and local governments.

Kinds of taxes

Governments levy many kinds of taxes. The most important kinds include property taxes, income taxes, and taxes on transactions.

Property taxes are levied on the value of such property as farms, houses, stores, factories, and business equipment. The property tax first became important in ancient times. Today, it ranks as the chief source of income for local governments in the United States and Canada. Most states of the United States and provinces of Canada also levy property taxes. Property taxes are called direct taxes because they are levied directly on the people expected to pay them.

Income taxes are levied on income from such sources as wages and salaries, dividends, interest, rent, and earnings of corporations. There are two main types of income taxes--individual income taxes and corporate income taxes. Individual income taxes, also called personal income taxes, are applied to the income of individuals and families. Corporate income taxes are levied on corporate earnings. Income taxes may also be levied on the earnings of estates and trusts. Income taxes generally are considered to be direct taxes.

Most nations in the world levy income taxes. In the United States, income taxes are levied by the federal government, most state governments, and some local governments. Many people and businesses in the United States also pay special income taxes that help fund Social Security programs. These taxes are known as Social Security contributions or payroll taxes. In Canada, income taxes are levied by the federal government and by the country's 10 provincial governments. Taxes on transactions are levied on sales of goods and services and on privileges. There are three main types--general sales taxes, excise taxes, and tariffs. General sales taxes apply one rate to the sales of many different items. Such taxes include state sales taxes in the United States and the federal sales tax in Canada. The value-added tax is a general sales tax levied in France, the United Kingdom, and other European countries. It is applied to the increase in value of a product at each stage in its manufacture and distribution.

Excise taxes are levied on the sales of specific products and on privileges. They include taxes on the sales of such items as gasoline, tobacco, and alcoholic beverages. Other excise taxes are the license tax, the franchise tax, and the severance tax. The license tax is levied on the right to participate in an activity, such as selling liquor, getting married, or going hunting or fishing. The franchise tax is a payment for the right to carry on a certain kind of business, such as operating a bus line or a public utility. The severance tax is levied on the processing of natural resources, such as timber, natural gas, or petroleum.

Tariffs are taxes on imported goods. Countries can use tariffs to protect their own industries from foreign competition. Tariffs provide protection by raising the price of imported goods, making the imported goods more expensive than domestic products.

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PROFIT

Profit is the amount of money a company has left over from the sale of its products after it has paid for all the expenses of production. These expenses include costs of such things as raw materials, workers' salaries, and machinery. They also include a reasonable return on the owner's investment, a salary for the labor the owner supplies to the firm, and other costs that are hard to calculate. A main task of accounting is to define and measure profits accurately.

Profits are vital to the economic system of the United States, Canada, and other countries where private enterprise is encouraged. In such countries, profits belong to the owners of companies or the stockholders of corporations. One of the chief reasons for operating a business is to make a profit. The desire for profits motivates companies to produce their goods efficiently. This is because the lower a company's costs are, the greater its profits can be.

A business can earn a profit only by producing goods and services whose selling price is greater than the cost of producing them. Therefore, business executives seek to use labor and raw materials to

produce and sell things for which customers will pay a price that is greater than the cost of production. Thus, the search for profits is also the search for the uses of a country's labor and raw materials that will satisfy consumers most completely.

Some business executives constantly lower prices to capture sales and profits from their competitors. However, there are several reasons why competition does not eliminate profits. For one thing, at any one time, there will be many firms that have discovered profitable opportunities their competitors cannot yet match. Sometimes, new firms cannot duplicate a profitable product because of patents or trademarks, or for other reasons. Sometimes, new firms cannot produce goods as cheaply as established ones. The bother and risk of entering an unfamiliar industry also keeps some new firms from competing with a product that is not especially profitable. The established firms can then enjoy reasonable profits without fear of new competition.

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BANK

Bank is a financial firm that accepts people's deposits and uses them to make loans and investments. People keep their savings in banks for several reasons. Funds are generally safer in a bank than elsewhere. A bank checking account provides a convenient way to pay bills. Also, funds deposited in most bank accounts earn interest income for the depositor. People who deposit money in a bank are actually lending it to the bank, which typically pays interest for the use of the funds.

Banks help promote economic growth. Nonfinancial firms borrow from banks to buy new equipment and build new factories. People who do not have enough savings to pay immediately the full price of a home, an automobile, or other products also borrow from banks. In these ways, banks help promote the production and sale of goods and services, and so help create jobs.

Like all businesses, banks try to earn profits. They have traditionally done so by accepting deposits at one rate of interest and then lending and investing those funds at a higher rate. But large banks also earn fees from other activities, such as brokerage (buying and selling securities for other investors) or selling insurance.

Banking is nearly as old as civilization. The ancient Romans developed a relatively advanced banking system to serve their vast trade network, which extended throughout Europe, Asia, and much of Africa.

Modern banking began to develop during the 1200's in Italy. The word bank comes from the Italian word banco, meaning bench. Early Italian bankers conducted their business on benches in the street. Large banking firms were established in Florence, Rome, Venice, and other Italian cities, and banking activities slowly spread throughout Europe. By the 1600's, London bankers had developed many of the features of modern banking. They paid interest to attract deposits and loaned out a portion of their deposits to earn interest themselves. By the same date, individuals and businesses in England began to make payments with written drafts on their bank balances, similar to modern checks.

This article discusses banks throughout the world. Because U.S. banks have unique features, however, this article also includes sections on the regulation and the history of banks in the United States. Banks in the United States have been more strictly regulated than banks in many countries as a result of the numerous bank failures that occurred in the United States during the Great Depression of the 1930's. The United States also has more banks and banking assets than any other country in the world.

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BANK SERVICES

Safeguarding deposits. Deposits in a bank are relatively safe. Banks keep cash and other liquid assets available to meet withdrawals. Liquid assets include securities that can be readily converted to cash. Banks are also insured against losses from robberies. But the most important safeguard is the fact that in most countries, governments have established deposit insurance programs. The insurance protects people from losing their deposits if a bank fails.

A bank not only keeps savings safe but also helps them grow. Funds deposited in a savings account earn interest at a specified annual rate. Many banks also offer a special account for which they issue a document called a certificate of deposit (CD). Most CD accounts pay a higher rate of interest than regular savings accounts. However, the money must remain in the account for a certain period, such as one or two years, to earn the higher rate of interest. Banks also offer money market accounts.

These accounts pay an interest rate based on the prevailing rates for short-term corporate and government securities.

Providing a means of payment. People who have funds in a bank checking account can pay bills by simply writing a check and mailing it. A check is a safe method of settling debts, and the canceled check provides proof of payment. Customers may also ask a bank to automatically pay recurring bills, such as telephone and mortgage payments, by a process called direct deposit deduction. Many banks allow people to pay bills electronically by telephone or through the Internet computer network. Many banks offer credit cards. People can use the cards to pay for their purchases at stores and other businesses. The bank then pays the businesses directly and sends the customer a monthly bill for the amount charged. The cardholder can usually choose to pay only part of the bill immediately. If so, he or she must pay a finance charge on the unpaid balance.

Banks may also issue debit cards, which resemble credit cards. When a cardholder uses a debit card, the amount of the purchase is deducted directly from the cardholder's checking account. Some cards can be used as either credit or debit cards.

Making loans. Banks receive funds from people who do not need them at the moment and lend them to those who do. For example, a couple may want to buy a house but have only part of the purchase price saved. If one or both of them have a good job and seem likely to repay a loan, a bank may lend them the additional money they need. To make the loan, the bank uses funds other people have deposited.

A major obligation of a bank is to permit depositors to withdraw their funds upon demand. But no bank has enough cash readily available to satisfy its depositors if all were to demand their funds at the same time. Banks know from experience, however, that such a demand--called a run--rarely occurs. If people are confident they can withdraw their funds at any time, they will leave them on deposit at the bank until needed. As a result, banks can loan and invest a large percentage of the funds deposited with them. In most countries, the government limits the percentage of a bank's funds that can be used for loans and investment. The government simultaneously sets a minimum percentage that must be kept on reserve for meeting withdrawals.

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TRADE

Trade is buying and selling goods and services. Trade occurs because people need and want things that others produce or services others perform.

People must have such necessities as food, clothing, and shelter. They also want many other things that make life convenient and pleasant. They want such goods as cars, books, and television sets. They want such services as haircuts, motion pictures, and bus rides. As individuals, people cannot produce all the goods and services they want. Instead, they receive money for the goods and services they produce for others. They use the money to buy the things they want but do not produce.

Trade that takes place within a single country is called domestic trade. International trade is the exchange of goods and services between nations. It is also called world trade or foreign trade. For detailed information on international trade. Trade has contributed greatly to the advance of civilization. As merchants traveled from region to region, they helped spread civilized ways of life. These traders carried the ideas and inventions of various cultures over the routes of commerce. The mixing of civilized cultures was an important development in world history.

The development of trade

Early trade. For thousands of years, families produced most of the things they needed themselves. They grew or hunted their own food, made their own simple tools and utensils, built their own houses, and made their own clothes. Later, people learned that they could have more and better goods and services by specializing and trading with others. As civilization advanced, exchanges became so common that some individuals did nothing but conduct trade. This class became known as merchants. The most famous early land merchants were the Babylonians and, later, the Arabs. These traders traveled on foot or rode donkeys or camels. The Phoenicians were the chief sea traders of ancient times.

Trade was very important during the hundreds of years the Roman Empire ruled much of the world. Roman ships brought tin from Britain, and slaves, cloth, and gems from the Orient. For more than 500 years after the fall of the Roman Empire in A.D. 476, little international trade took place. The expansion of trade began in the 1100's and 1200's, largely because of increased contacts between people. The crusades encouraged European trade with the Middle East. Marco Polo and other European merchants made the long trip to the Far East to trade for Chinese goods. Italians in Genoa, Pisa, and Venice built great fleets of ships to carry goods from country to country.

A great period of overseas exploration began in the 1400's. Trade routes between Europe and Africa, India, and Southeast Asia were established as a result of the explorations. In the 1500's and 1600's, private groups formed companies, usually with governmental approval, to trade in new areas.

Trade between Europe and America was carried on by the chartered companies that established the earliest American colonies. The colonists sent sugar, molasses, furs, rice, rum, potatoes, tobacco, timber, and cocoa to Europe. In return, they received manufactured articles, luxuries, and slaves. Trade also pushed American frontiers westward. Trading posts sprang up in the wilderness. Many of these posts later grew into cities.

Trade today affects the lives of most people. Improved transportation permits trade between all parts of the world. Through specialization, more and better goods and services are produced. Increased production has led to higher incomes, enabling people to buy more of these goods and services.

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GAME THEORY

Game theory is a method of studying decision-making situations in which the choices of two or more individuals or groups influence one another. Game theorists refer to these situations as games and to the decision makers as players. An example of such a situation is one in which the decision of each of several countries about whether to acquire nuclear weapons is affected by the decisions of the other countries. Game theory has become important in such fields as economics, international relations, moral philosophy, political science, social psychology, and sociology. Its roots are generally traced back to the book *The Theory of Games and Economic Behavior* (1944), by Hungarian-born mathematician John von Neumann and Austrian economist Oskar Morgenstern.

Game theorists have identified many types of games. In zero-sum games, the players have opposite interests. In nonzero-sum games, also called mixed-motive games, they have some interests in common. When the players can agree on a plan of action, they are in a cooperative game. In a noncooperative game, the players cannot coordinate their choices. Coordination may be impossible if the players cannot communicate, if no institution exists to enforce an agreement, or if coordination is forbidden by law, as in the case of antitrust laws.

Game theory's most famous game is called Prisoner's Dilemma, a noncooperative game that involves the following imaginary situation: The police arrest two suspects and keep them isolated from each other. Each prisoner is told that if only one of them confesses, the one who confesses will go free but the one who remains silent will receive a severe sentence. They are also told that if they both confess, each will receive a moderate sentence, and if neither confesses, each will receive an even milder sentence. Under these conditions, each prisoner is better off confessing no matter what the other one does. Yet by pursuing their own advantage and confessing, both get harsher sentences than they would have received if they had trusted each other and kept quiet.

Prisoner's Dilemma highlights and summarizes a conflict between individual and group interests that lies at the heart of many important real-life situations. For example, when farmers maximize their production, prices fall and all the farmers suffer. Collectively, the farmers would be better off restricting the amount they plant. Nonetheless, it is to each farmer's individual advantage to plant as much as possible. Decisions about paying taxes, protecting the environment, or acquiring nuclear weapons may also reflect this tension between what is good for the decision maker and what is good for the group.

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DEFLATION

Deflation is a decline in the general level of prices in an economy. It is the opposite of inflation, in which prices rise. Deflation is rarer than inflation, but its consequences can be more severe.

Each year, about 5 percent of all countries experience deflation. Most of them are less developed nations, and the deflation they experience is brief. However, many industrialized countries, including the United States, the United Kingdom, Japan, Australia, and Canada, have experienced periods of deflation.

Deflation sometimes occurs when an economy undergoes a depression or a recession. During depressions and recessions, the total output of an economy declines. Depressions are more severe than recessions. The United States experienced sharp deflation during the Great Depression of the 1930's.

Deflation can be caused by competition among producers of goods and services to increase sales by reducing their prices. But weak demand for goods and services is the chief cause of almost all

periods of deflation. In the United States during the Great Depression, several forces acted simultaneously to reduce demand. Banks had little money to lend to qualified individuals and businesses. The Federal Reserve System, the nation's central bank, failed to stimulate the economy by increasing the amount of money in circulation. Also, the federal government sought a balanced budget, which prevented it from cutting taxes or increasing its own spending. All of these factors contributed to a decline in demand and thus to deflation.

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PETROLIUM

Petroleum is one of the most valuable natural resources in the world. Some people call petroleum black gold, but it may be better described as the lifeblood of industrialized countries. Fuels made from petroleum provide power for automobiles, airplanes, factories, farm equipment, trucks, trains, and ships. Petroleum fuels also generate heat and electricity for many houses and business places. Altogether, petroleum provides nearly half the energy used in the world.

In addition to fuels, thousands of other products are made from petroleum. These products range from paving materials to drip-dry fabrics and from engine grease to cosmetics. Petroleum is used to make such items in the home as aspirins, carpets, curtains, detergents, phonograph records, plastic toys, and toothpaste.

Although we use a huge variety of products made from petroleum, few people ever see the substance itself. Most of it comes from deep within the earth as a liquid called crude oil. Different types of crude oil vary in thickness and color, ranging from a thin, clear oil to a thick, tarlike substance. Petroleum is also found in solid form in certain rocks and sands.

The word petroleum comes from two Latin words meaning rock and oil. People gave it this name because they first found it seeping up from the earth through cracks in surface rocks. Today, petroleum is often referred to simply as oil, and most of it is found in rocks beneath the earth's surface.

People have used petroleum for thousands of years. But few people recognized its full value until the 1800's, when the kerosene lamp and the automobile were invented. These inventions created an enormous demand for two petroleum fuels, kerosene and gasoline. Since about 1900, scientists have steadily increased the variety and improved the quality of petroleum products.

Petroleum, like other minerals, cannot be replaced after it has been used. People are using more and more petroleum each year, and the world's supply is rapidly running out. If present rates of consumption continue, petroleum may become scarce sometime in the mid-2000's.

Most industrialized nations depend heavily on imported petroleum to meet their energy needs. As a result of this dependence, oil-exporting countries have been able to use petroleum as a political and economic weapon by restricting exports to some of these nations. Oil exporters have also strained the economies of a large number of countries, particularly the poorer ones, by drastically increasing the price of petroleum.

To prevent a full-scale energy shortage, scientists are experimenting with artificial forms of oil and with other sources of fuel. But even if new energy sources appear quickly, people will have to rely on petroleum for many years. Conservation of oil has thus become urgent for every country. People now need to be just as inventive in finding ways to conserve petroleum as they have been in finding ways to use it.

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ASTRONOMY

Astronomy is the study of the universe and the objects in it. Astronomers observe the sky with telescopes that gather not only visible light but also invisible forms of energy, such as radio waves. They investigate nearby bodies, such as the sun, planets, and comets, as well as distant galaxies and other faraway objects. They also study the structure of space and the past and future of the universe.

Astronomers seek answers to such questions as: How did the universe begin? What processes release energy deep inside stars? How does one star "steal" matter from another? How do storms as big as Earth arise on Jupiter and last for hundreds of years?

To answer such questions, astronomers must study several subjects besides astronomy. Almost all astronomers are also astrophysicists because the use of physics is essential to most branches of astronomy. For example, some parts of cosmology, the study of the structure of the universe, require an understanding of the physics of elementary particles, such as the bits of matter called quarks that make up protons and neutrons. Astronomers use chemistry to analyze the dusty,

gaseous matter between the stars. Specialists in the structure of planets use geology.

Astronomy is an ancient science. Like today's researchers, ancient scholars based their ideas of the universe on what they observed and measured and on their understanding of why objects move as they do. However, the ancients developed some incorrect ideas about the relationships between Earth and the objects they saw in the heavens. One reason for their errors was that they did not understand the laws of motion. For example, they did not know that a force--which we know as gravitation--controls the movements of the planets. Another reason was that their measurements did not reveal the movements of the planets in sufficient detail.

The ancients noted that the positions of the sun, moon, and planets change from night to night. We know that these movements are a result of the revolution of the moon about Earth and the revolution of Earth and the other planets about the sun. The ancients, however, concluded that the sun, moon, and planets orbit a motionless Earth. In many places, religious teachings supported this conclusion until the 1600's.

Although ancient people misinterpreted much of what they saw in the heavens, they put their knowledge of astronomy to practical use. Farmers in Egypt planted their crops each year when certain stars first became visible before dawn. Many civilizations used the stars as navigational aids. For example, the Polynesians used the positions of the stars to guide them as they sailed from island to island over thousands of miles or kilometers of the Pacific Ocean.

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ISRAEL

Israel is a small country in southwestern Asia. It occupies a narrow strip of land on the eastern shore of the Mediterranean Sea. Israel was founded in 1948 as a homeland for Jews from all parts of the world, and more than 4 out of 5 of its people are Jews. Even Jews who live elsewhere consider Israel their spiritual home. Almost all the non-Jews in Israel are Arabs. Jerusalem is Israel's capital and largest city.

Israel makes up most of the Biblical Holy Land, the place where the religious and national identity of the Jews developed. According to the Bible, Abraham, the father of the Jewish people, established a Semitic population in the Holy Land. Many scholars believe this happened sometime between 1800 and 1500 B.C.

Eventually this land fell to a series of conquerors, including--in 63 B.C.--the Romans. Following unsuccessful Jewish revolts against Roman rule in A.D. 66-70 and A.D. 132-135, the Romans forced most of the Jews to leave. The Romans then began to call this region by the word that became Palestine in English. Palestine was ruled by the Roman and then the Byzantine empires until the A.D. 600's, when Arabs conquered the region. From that time until the mid-1900's, the majority of people in Palestine were Arabs.

In the late 1800's, European Jews formed a movement called Zionism, which sought to establish a Jewish state in Palestine. Jewish immigrants began arriving in Palestine in large numbers, and by the early 1900's friction had developed between the Jewish and Arab populations. In 1947, the United Nations (UN) proposed dividing the region into an Arab state and a Jewish state.

On May 14, 1948, the nation of Israel officially came into being. The surrounding Arab nations immediately attacked the new state, in the first of several Arab-Israeli wars. In 1967, at the end of one of the wars, Israeli troops occupied the Gaza Strip and the West Bank--territories that are home to more than 1 million Palestinian Arabs. Israel's occupation of these territories further inflamed Arab-Israeli tensions. In 1994, Israeli troops withdrew from the Gaza Strip, and by 1996, they had withdrawn from most cities and towns of the West Bank. The withdrawals were part of 1993 and 1995 agreements with the Palestine Liberation Organization (PLO), which represents Palestinian Arabs. For more details, see the Recent developments section of this article.

Israel has few natural resources and imports more goods than it exports. Still, it has achieved a relatively high standard of living. Almost all of its adults can read and write, and the level of unemployment is low. Jewish settlers have established major industries, drained swamps, and irrigated deserts.

Although it is a small country, Israel has a diverse terrain that includes mountains, deserts, seashores, and valleys. Israel has a pleasant climate, with hot, dry summers, and cool, mild winters.

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TENSIONS BETWEEN ISRAEL AND THE PALESTINIANS

Recent developments. From the mid-1980's to the early 1990's, thousands of Ethiopian Jews moved to Israel. Also, hundreds of thousands of Soviet Jews moved there. The influx of newcomers led to

problems in housing and employment. Israel continued to build new settlements in occupied territories, in part to accommodate the immigrants. Despite protests from Palestinians, Shamir and Likud backed these construction projects.

In August 1990, Iraq invaded Kuwait. In early 1991, the United States and other countries defeated Iraq in the Persian Gulf War. During the war, Iraq fired missiles at Israel. In October 1991, peace talks began between Israel, Syria, Lebanon, and a joint Jordanian-Palestinian delegation. Israel's Labor Party gained control of the government in June 1992 parliamentary elections. In July, Labor Party leader Yitzhak Rabin replaced Shamir as prime minister. Rabin agreed to limit construction of new Jewish settlements in the occupied territories as a step toward a peace agreement.

The PLO was not a participant in the peace talks that began in October 1991. But in September 1993, Israel and the PLO recognized each other and signed an agreement that included steps to end their conflicts. As a result of this agreement and another signed in September 1995, Israel withdrew its troops from the Gaza Strip and most cities and towns of the West Bank by early 1996.

Palestinians took control of these areas. In October 1994, Israel and Jordan signed a peace treaty that formally ended the state of war that had technically existed between the countries since 1948. Not all Israelis agreed with the peace process, and some protested it. Some opponents argued, for example, that Israel was giving away land that should historically belong to it. On Nov. 4, 1995, Rabin was assassinated in Tel Aviv by a right-wing Israeli university student who was opposed to his policies. Following the assassination, Peres, who had been foreign minister, became prime minister. In May 1996, Israel held its first elections in which the people directly voted for the prime minister. Benjamin Netanyahu, the Likud leader and a critic of the Israeli-PLO peace agreements, defeated Peres in the elections. Netanyahu claimed that the peace agreements do not include enough provisions for Israel, such as guaranteed security and allowance for its population growth.

Tensions between Israel and the Palestinians grew after the 1996 elections. In 1996 and 1997, Israel announced plans to expand Israeli settlements in the West Bank and to build new Israeli housing in East Jerusalem. Both decisions met with angry and violent protests from the Palestinians. Also in 1997, however, Israel completed an agreement with the PLO over the withdrawal of Israeli troops from most of the West Bank city of Hebron.

In October 1998, Israel and the Palestinians signed another agreement, called the Wye River Memorandum. The accord called for Israel to turn over more land in the West Bank to Palestinian control, and it allowed a Palestinian airport in the Gaza Strip to open. Also as a result of the agreement, the PLO revised its charter to remove language calling for the destruction of Israel. Many conservative members of the Israeli parliament and in Netanyahu's Cabinet opposed the accord. In December 1998, Netanyahu, claiming that the PLO was not fulfilling its security commitments, suspended Israeli troop withdrawals. That same month, the Israeli parliament voted to dissolve itself and scheduled new elections.

In May 1999, Ehud Barak, leader of the Labor Party, was elected prime minister of Israel. Barak favored renewing the peace process with the Palestinians. In September, Barak and Palestinian leader Yasir Arafat signed a new agreement that revived and expanded on the previous Wye River Memorandum. Israel resumed its troop withdrawals from the West Bank shortly after the agreement was signed.

In May 2000, Israel withdrew its troops from the security zone it had established in southern Lebanon. Hezbollah guerrillas then took control of the area. Hezbollah, also spelled Hizbollah, is a movement that opposed the Israeli occupation of Lebanon. Guerrillas from the group had often clashed with the Israelis and the Israeli-backed South Lebanon Army.

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BILL GATES

Gates, Bill (1955-...), is a cofounder and the chairman and chief software architect of Microsoft Corporation. From 1975 until 2000, he also served as Microsoft's chief executive officer. Microsoft is the world's largest developer and publisher of software programs for personal computers.

William Henry Gates was born in Seattle. He set up his first software company at age 15 with a schoolmate named Paul Allen. In 1975, he and Allen began to design programs for personal computers, which had just entered the marketplace. The two founded Microsoft that year. In 1980, International Business Machines Corporation (IBM) chose Microsoft to develop the operating system for its first personal computer, the PC. An operating system is a special type of program that contains instructions for the operation of the computer. Gates devised the Microsoft Disk Operating System (MS-DOS) for IBM. Millions of copies of MS-DOS were sold for use in IBM and IBM-compatible PC's.

Microsoft continued to grow under Gates's guidance. In 1985, the company introduced the first of a series of PC programs called Windows. These programs enable users to perform multiple tasks through "windows" on the computer screen and to issue commands by pointing at onscreen symbols rather than by typing instructions. Microsoft has sold millions of copies of Windows.

Microsoft Corporation is the world's largest developer and publisher of software programs for personal computers. In addition, Microsoft operates online services and a cable-television news channel. The company also produces software for the operation of electronic devices other than computers.

Microsoft began in 1975 as an informal business partnership between former schoolmates Bill Gates and Paul Allen. The two men adapted the programming language BASIC (Beginner's All-purpose Symbolic Instruction Code) for use with the earliest home computer, the MITS (Micro Instrumentation and Telemetry Systems) Altair 8800. They were soon writing programs for other manufacturers' computers. In 1980, International Business Machines Corporation (IBM) chose Microsoft to develop the operating system for its first personal computer, the PC. An operating system is software that contains instructions for all of a computer's functions. Millions of copies of the Microsoft Disk Operating System (MS-DOS) were sold for use in IBM computers and IBM-compatible PC's.

In 1985, Microsoft introduced the first of a series of operating systems called Windows. These programs employ a graphical user interface (GUI), which allows people to issue commands by pointing to on-screen symbols and clicking a mouse rather than by typing instructions. The program also enables people to perform multiple tasks, each in a different "window" on the computer screen. Microsoft has sold millions of copies of Windows. The company also produces other software products for business and consumer use. These products include Excel, a spreadsheet program; FoxPro, a database-management program; and Word, a word-processing program.

In 1998, the United States Department of Justice, along with 20 state attorneys general and the corporation counsel for the District of Columbia, filed an antitrust suit against Microsoft. Later that year, one of the states, South Carolina, withdrew from the suit. The lawsuit charged that the company used unfair practices to destroy its competitors. Following a 1999 trial, a federal district court judge, Thomas Penfield Jackson, found that the Microsoft Corporation is a monopoly that has harmed competitors and consumers. He appointed a judge of the U.S. Court of Appeals to help the company and the government negotiate a settlement. In April 2000, settlement talks broke down, and Jackson found Microsoft guilty of violating U.S. antitrust laws. In June 2000, Jackson ordered the corporation to be split into two different companies--one that would produce only operating systems and another that would produce and manage other products and services. Microsoft officials appealed the order.

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GREECE

Greece is a small country where Western civilization started about 2,500 years ago. In those days, Greece controlled much of the land bordering the Mediterranean and Black seas. Athens is the capital and the largest city of Greece. In Athens and other parts of Greece, magnificent ruins stand as monuments to the nation's glorious past.

About one-fourth of the workers in Greece earn their living by farming, and agriculture is an important economic activity. But mountains cover most of Greece, and the land is rocky with little fertile soil. A Greek legend tells that God sifted the earth through a strainer while making the world. He made one country after another with the good soil that sifted through, and threw away the stones left in the strainer. According to the legend, these stones became Greece.

No part of Greece is more than 85 miles (137 kilometers) from the sea. The Greeks have always been seafaring people. About a fifth of Greece consists of islands. The mainland makes up the southern tip of the Balkan Peninsula, extending into the Mediterranean Sea. Many ancient Greek legends, including those about Ulysses and Jason, center on sea voyages. Today, Greece has one of the largest merchant fleets in the world.

The Greeks came under the control of invaders for more than 2,000 years. They lost their independence to the Macedonians in 338 B.C. The Greeks did not regain their independence until A.D. 1829, from the Ottoman Empire. Since then, Greece has had many serious political problems, largely because of weak or undemocratic governments.

In ancient times, the Greeks established the traditions of justice and individual freedom that are basic to democracy. Their arts, philosophy, and science became foundations of Western thought and culture.

World War I began in 1914. Venizelos urged that Greece fight with the Allies against Germany and its partners. But King Constantine, whose wife was a sister of Kaiser Wilhelm II of Germany, kept Greece neutral. Venizelos started a revolutionary movement. It was supported by the Allies, who had established a military base at Thessaloniki. In 1917, Constantine was forced to give the throne to his son, Alexander I. Greece entered the war on the side of the Allies on July 2, 1917.

Thousands of Greek troops joined the British, French, and Serbians at their Thessaloniki base, from which they attacked the Bulgarians and Turks. In September 1918, the Greeks and other Allied forces moved north. They defeated the Bulgarians, who signed an armistice at Thessaloniki. The entire war ended on November 11.

The peace treaties that followed World War I gave Greece most of the territories it had long sought. From the Ottoman Empire, Greece got eastern Thrace; some islands in the Aegean Sea, including two at the entrance to the Dardanelles; and temporary control of the Smyrna (now Izmir) region in Asia Minor. The Greeks gained western Thrace from Bulgaria.

King Alexander died in 1920, and Constantine I returned to the throne. In 1921, Constantine renewed the war against the Ottoman Empire by sending Greek forces into Asia Minor. The Ottomans dealt the Greeks a crushing defeat in 1922, and a military revolt forced Constantine from the throne. His son, George II, replaced him. A revolution ended the Ottoman Empire in 1922. It became the Republic of Turkey the next year.

In 1923, under the Treaty of Lausanne, Greece returned the Turkish territories it had gained after World War I. The treaty also provided for ending the tensions produced by Turkish rule over Greeks. It required over 1,250,000 Greeks in Turkey to move to Greece and 400,000 Turks in Greece to move to Turkey. After the Greek migration, the only Greeks under foreign rule were in northern Epirus in Albania, British-held Cyprus, and the Italian-held Dodecanese Islands.

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WORLD

World is the planet earth viewed especially as the home of human beings and other living things. The earth is just one of countless heavenly bodies in the universe. But it is the only one known to support life.

From the very beginning of their life on the earth, people have had to adapt to conditions in the world to survive. The earliest human beings lived by hunting and gathering wild plants. They made clothing from animal hides and furs and used branches and other natural materials to build shelters. About 10,000 years ago, some people began to raise plants and animals after food became scarce. People who farmed could settle in one place and produce enough food to feed many others. Villages grew up, and people developed methods of living in large groups. New occupations and forms of government became necessary. Over the years, people created more advanced technology and increasingly complicated forms of social life. They built great cities, developed civilizations, and found ways to control many powerful natural forces.

The world's surface consists of water and land. Air surrounds the surface and extends to outer space. Water--chiefly the great oceans--covers about 70 percent of the world's surface. All living things must have water to live, just as they must have air. People also use water for irrigation, industry, power, and transportation. In addition, the oceans, lakes, and rivers provide fish and other foods.

The oceans separate huge land masses called continents. Most of the world's countries lie on the continents. Others are on islands. Each country has its own political and economic systems.

However, countries cooperate with one another in many ways. For example, they make trade agreements and sign treaties designed to reduce the likelihood of war.

The physical features of a country strongly influence where the people of that country live. People can most easily grow food on plains or in river valleys, where the soil is rich and deep. Mountainous regions generally are not suitable for crop farming because the soil is thin and easily washed away by rainfall. Many of the world's biggest cities began as important trading centers on seacoasts, lakeshores, and riverbanks. Thus, the majority of the world's people live on flat, fertile plains and in large cities that border major water transportation routes.

About 6 billion people live in the world. They are distributed unevenly over the land. Many areas are heavily populated. Other areas have no people at all. The population is increasing far more rapidly in some countries than in others. World is the planet earth viewed especially as the home of human beings and other living things. The earth is just one of countless heavenly bodies in the universe. But it is the only one known to support life.

About 6 billion people live in the world. They are distributed unevenly over the land. Many areas are heavily populated. Other areas have no people at all. The population is increasing far more rapidly in some countries than in others. All the world's people belong to the same species, *Homo sapiens*, which means they have a common ancestry. But many groups of people have lived apart for such a long time that they have developed certain physical variations.

Nations of the world

The world has 192 independent countries and about 40 dependencies. An independent country controls its own affairs. Dependencies are controlled in some way by independent countries. In most cases, an independent country is responsible for the dependency's foreign relations and defense, and some of the dependency's local affairs. However, many dependencies have complete control of their local affairs.

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ENCYCLOPEDIA

Encyclopedia is a collection of information about people, places, events, and things. It may deal with all areas of knowledge or it may confine itself to just one area. A general encyclopedia, such as World Book, includes information on topics in every field of knowledge. Specialized encyclopedias provide more detailed and technical information on specific areas of knowledge, such as art, medicine, or the social sciences.

In ancient times, scholars found that the information they needed was scattered in manuscripts and scrolls in various parts of the world. Some scholars made their own reference works by copying long quotations from the works of other authors. Others copied items of information from a variety of sources. These ancient reference works were the ancestors of the encyclopedia. But they differ from encyclopedias in many ways. Early scholars presented information in any order they chose, and they had few ways to check its accuracy. In addition, they wrote only for themselves or other scholars. Encyclopedia editors, on the other hand, carefully organize their material and demand accuracy. They also present information to a large, diverse audience.

The word encyclopedia comes from the Greek words *enkyklios paideia*, meaning general or wellrounded education. The word did not come into common use until the 1700's.

A well-planned general encyclopedia presents facts about humanity; about beliefs, ideas, and achievements; about the world people live in; and about the universe of which they are a part. It presents these facts without prejudice, using language that is easy to understand.

An encyclopedia is concerned with the who, what, when, where, how, and why of things. For example, an article on radar tells what radar is and who developed it, as well as when and where. It also describes how radar operates and why it is important in everyday life.

No one person can create a general encyclopedia. Such an enterprise calls for the combined talents of scholars and specialists, of editors and educators, of researchers and librarians, and of artists, mapmakers, and production specialists. It also calls for a large investment of money by the publisher. To keep an encyclopedia abreast of events in all fields of knowledge, the publisher must revise it on a regular basis.

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IMMIGRATION

Immigration is the act of coming to a foreign country to live. The act of leaving one's country to settle in another is called emigration. Immigrants who flee their country because of persecution, war, or such disasters as famines or epidemics are known as refugees or displaced persons (DP's). Most people find it very hard to pull up roots in their native land and move to a strange country. But throughout history, countless millions of people have done so. The heaviest immigration worldwide took place from the early 1800's to the Great Depression--the economic hard times of the 1930's. In that period, about 60 million people moved to a new land. Most came from Europe. More than half emigrated to the United States. Other destinations included Canada, Argentina, Brazil, Australia, New Zealand, and South Africa. Today, the availability of fast, safe, and cheap transportation helps make migration easier. Asia is replacing Europe as the major immigrant-sending area. The United States remains the chief receiving nation.

Causes of immigration

People forsake their homeland and move to another country for various reasons. Some people emigrate to avoid starvation. Some seek adventure. Others wish to escape unbearable family situations. Still others desire to be reunited with loved ones. However, the main reason for immigration has long been economic opportunity--the lure of better land or a better job. During the

1800's, for example, the rich prairie land of the United States and Canada attracted many European farmers. Today, professional people commonly emigrate because of better opportunities elsewhere. Such emigration has sometimes been called brain drain. For example, many Philippine doctors and nurses and numerous Indian engineers and scientists have moved to the United States and Australia. Religious persecution has led many people to move to a new land for the freedom to practice their faith. Such immigrants include Jews expelled from England in the 1200's and Baha'is fleeing Iran in the 1980's. Wars, revolutions, and political unrest have driven innumerable people to find new homes. In the 1990's alone, millions of refugees fled from warfare in Iraq, Rwanda, Liberia, and Bosnia-Herzegovina. Some immigrants were brought to a new land against their will. From the 1500's to the 1800's, Europeans shipped black Africans to the Western Hemisphere as slaves. The United Kingdom transported convicts to Australia from the late 1700's to the 1860's to relieve overcrowding in British jails. Before that time, the United Kingdom sent convicts to the American Colonies.

Effects of immigration

Many immigrants to a new country first settle in a community made up of people from their native land or even their native village. They keep their old customs and acquire a limited knowledge of their new country's culture, language, and values. In time, however, most immigrants begin to assimilate (adapt to a new culture). Immigrants who adapt most quickly usually have a background similar to the new cultural environment and much contact with the new society. They also plan to remain permanently in the new country. Most immigrants find a job and strive to buy a home. They try to provide their children with the education and opportunities not available in the immigrants' native land. They become citizens of the new country and take part in politics and government. Immigrants have made enormous contributions to the culture and economy of such nations as Australia, New Zealand, Israel, Argentina, Brazil, Canada, and the United States. But their accomplishments have been made with great difficulty. Many of the receiving countries have restricted immigration to maintain a homogeneous society in which all the people shared the same ethnic, geographic, and cultural background. Although some immigration laws have been relaxed, many newcomers of different backgrounds still face challenges in gaining acceptance.

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HUMAN BEING

Human being has the most highly developed brain of any animal. The human brain gives people many special abilities, the most outstanding of which is the ability to speak. Language has enabled human beings to develop culture, which consists of ways of behaving and thinking. These ways are passed on from generation to generation through learning. Culture also includes technology--that is, the tools and techniques invented by people to help satisfy their needs and desires. The richness and complexity of human culture distinguish human beings from all other animals.

The human brain helps make people the most adaptable of all creatures. They behave with the most flexibility and in the greatest variety of ways. The human body is highly adaptable because it has few specialized features that could limit its activities. In contrast, a seal has a body streamlined for swimming, but it has difficulty moving about on land. People cannot swim as well as a seal, but they can also walk, run, and climb. Human adaptability enables people to live in an extremely wide variety of environments--from the tropics to the Arctic.

People are inquisitive and have long sought to understand themselves and their place in the world. Throughout much of human existence, religion has helped provide such understanding. All societies have assumed one or more gods influence their lives and are responsible for their existence. Since ancient times, philosophy (the study of truth and knowledge) has also provided definitions of what it means to be human.

Today, religion and philosophy remain important parts of people's efforts to understand the nature of human existence. But many other fields of study also help human beings learn about themselves.

For example, anthropology is the study of human cultures and of human physical and cultural development. Linguistics is the scientific study of language. Specialists in psychology study human and animal behavior and mental processes. Sociology deals with the groups and institutions that make up human societies, and history is the study of past human events.

Prehistoric people are human beings who lived before writing was invented about 5,500 years ago.

Writing enabled people to record information they wished to save, including descriptions of events in their lives. In this way, the invention of writing marked the beginning of history. The period before human beings learned to write is called prehistory, and people who lived during this period are known

as prehistoric people.

Most scientists believe the first human beings lived about 2 million years ago. But early people probably arose from prehuman ancestors who first lived more than 4 million years ago. These ancestors were small, humanlike creatures who walked erect. This article will discuss both prehistoric people and their near ancestors. Scientists first discovered evidence of prehistoric people during the mid-1800's. Most of this evidence consisted of ancient, sharp-edged tools that prehistoric people had made of stone. The first fossilized bones of prehistoric people were also found during this time.

As scientists collected more fossils of prehistoric people, they began to form a clearer picture of what these early people looked like. For example, scientists learned from fossil evidence that early human beings had smaller brains than most modern people have. This evidence indicated to many scientists that humans had evolved--that is, modified their physical structure over time. Scientists developed a set of ideas about human origins called the theory of human evolution. This theory states that as the environment of the prehistoric world changed, the prehuman ancestors of prehistoric people went through a series of changes that resulted in the first human beings. They, in turn, evolved into modern human beings.

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INSECT

Insect is a small, six-legged animal. Bees, ants, wasps, butterflies, cockroaches, ladybugs, fireflies, termites, and moths are insects. So are houseflies, dragonflies, mosquitoes, silverfish, grasshoppers, lice, crickets, walkingsticks, and fleas. The list could go on and on. If the scientific names of all the kinds of insects were printed in The World Book Encyclopedia it would take more than 6,000 pages to list them.

Scientists have described and named more than 11/2 million species of animals. Of these, about 1 million are insects. Scientists discover from 7,000 to 10,000 new species of insects every year. They believe there may be from 1 million to 10 million species still undiscovered.

Insects live almost everywhere on earth--from steamy tropical jungles to cold polar regions. They live high on snow-capped mountains, and in deserts below sea level. They can be found in caves deep in the earth, or flying high in the sky. Only in the oceans are few insects found.

We are constantly at war with some insects. They annoy us, bite us, and infect us with deadly diseases. They attack our crops, our pets, and our domestic animals. They invade our homes, eat our food, and damage our property. But insects also have great value to us. They pollinate many of our crops, provide us with honey and other products, and serve as food for fish, birds, and many other animals. In fact, life as we know it could not exist if all the insects were to disappear.

Insects are among the most fascinating animals on earth. They smell chiefly with their antennae, and some taste with their feet. Many insects hear by means of hairs on their bodies. Others have "ears" on their legs or on the sides of their bodies. Insects have no voices, but some make noises that can be heard 1 mile (1.6 kilometers) away. Insects have no lungs, but breathe through holes in their sides. Some insects have no eyes, and others have five eyes or more. Many insects have enormous strength. An ant can lift a weight 50 times as heavy as its body. If a 175-pound (79-kilogram) man could do as well, he could lift more than 4 short tons (3.6 metric tons)--with his teeth. A flea can broad-jump about 13 inches (33 centimeters). If a human being could do as well, he or she could jump 700 feet (210 meters).

Many insects do the same things we do. They build bridges and apartment houses. Some raise crops, and others keep "cattle" that they "milk." There are also insect carpenters, papermakers, guards, soldiers, nurses, slaves, hunters, trappers, thieves, and undertakers. Some insects even go to war against one another. Many people think that such animals as spiders, centipedes, mites, and ticks are insects. But these animals differ from insects. For example, spiders have eight legs, and insects have six. A spider's body is divided into two main parts, but an insect's body has three. Most insects have wings and antennae, but spiders do not.

INSECT/The world of insects

The story of insects is a tremendous success story. Insects first appeared on earth at least 400 million years ago. Down through the ages, they have struggled endlessly to survive. During this struggle, insects have gradually developed an incredible variety of body forms and ways of life. They have adapted themselves to almost all types of living conditions. Insects have been so successful in their fight for life that they are often said to be the only rivals of humans for control of the earth. Today, there are at least four times as many kinds of insects as all other kinds of animals combined. The total number of individual insects is astonishing. Scientists estimate that the average number of

insects for each 1 square mile (2.6 square kilometers) of land equals the total number of people on the earth.

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PEACE

Peace is the state of being calm, quiet, and free of disturbance. From a military and political point of view, peace means freedom from such violent disturbances as wars and riots. It does not mean total harmony among people. Even in peacetime, people take part in such forms of conflict as debates, lawsuits, sports contests, and election campaigns.

Throughout history, most people have wanted lasting peace. Religions and philosophers have called for the peaceful settlement of disagreements. The Bible declares, "Thou shalt not kill" and "Blessed are the peacemakers." Philosophers in ancient Greece and Rome taught brotherhood and nonviolence.

Yet since earliest times, the world has seldom had a long period of unbroken peace. Through the centuries, people have probably spent at least as much time at war as at peace. This article discusses past and present attempts to achieve lasting freedom from war.

Peacemaking efforts through the years

Ancient Greece and Rome. Ancient Greece consisted of many independent regions called city-states. The city-states frequently waged war on one another. As a result, several of them banded together and formed an organization that made one of the first attempts to limit warfare. This organization, called the Amphictyonic League, prohibited any member from destroying another or cutting off another's water supply. Once every four years, the Olympic Games united the city-states. A truce created temporary peace throughout Greece so the games could take place. For a month, no one could bear arms or make war.

The Roman Empire maintained peace throughout a large part of the world during a period known as the Pax Romana (Roman peace). This peace lasted more than 200 years, from 27 B.C. to A.D. 180. During the Pax Romana, the Roman Empire extended over much of Europe, the Middle East, and northern Africa. At that time, no other nation was powerful enough to attack the Romans.

The Middle Ages. After the Roman Empire weakened during the A.D. 400's, small wars raged throughout Europe. The Christian church became the greatest force for peace. A church custom called the Truce of God limited fighting in private disputes to certain days of the week. A ruling called the Peace of God forbade fighting in such holy places as churches and shrines. But the church permitted "just" wars, such as those in defense of Christianity or a people's homeland.

From the 1400's to the 1700's, many people proposed various plans to achieve lasting peace. In the early 1600's, for example, the French statesman Maximilien de Bethune, Duke of Sully, developed a "Grand Design" for peace in Europe. Sully's plan called for the formation of a council of representatives of all European countries. The council would settle disagreements between nations. In 1625, the Dutch statesman Hugo Grotius proposed international rules of conduct in a book called *On the Law of War and Peace*. For example, nations should guarantee certain rights to neutral nations, which took no part in a war. Grotius' ideas formed the basis of international law. The Thirty Years' War ended in 1648 with the Peace of Westphalia. This treaty tried to ensure peace by establishing a balance of power. Such a plan maintains an even distribution of military and economic power among nations. As a result, no nation or group of nations is strong enough to conquer any other nation or group of nations.

About 1647, the English religious leader George Fox founded the Society of Friends, most commonly known today as the Quakers. This group believed that the teachings of Jesus Christ prohibited war. Throughout their history, the Quakers have opposed war and supported peace movements. The Quaker leader William Penn, who founded the colony of Pennsylvania, proposed a peace plan similar to Sully's "Grand Design." Penn wrote a book called *An Essay Towards the Present and Future Peace of Europe* (1693). In it, he called for an international council to settle disputes between nations.

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WAR

War is any struggle in which two large groups try to destroy or conquer each other. Since the dawn of history, there have been many kinds of wars. Families have fought against families, tribes against tribes, followers of one religion against followers of another. In modern times, wars have been fought between nations or groups of nations. Armies and navies once were almost the only factors in deciding the outcome of wars. Today, civilians must join in the war effort if it is to succeed.

Wars have always caused great suffering and hardship. Most people hate war, yet for hundreds of

years war has been going on somewhere in the world nearly all the time. Earthquakes and floods happen to people, but people make war themselves. To understand why wars continue to go on when nearly everyone wants to have peace, we must look into the nature of war.

Causes of war. In modern times, no nation or group chooses war if it can get what it wants peacefully. The fighting starts when a nation wants something so badly that it is willing to go to war to get it. Sometimes war results from a disagreement between two nations, and sometimes from a desire for conquest. Some of the basic causes of war may be a desire for more land, more wealth, more power, or security.

War for land to live on. In ancient times, people often fought so that they could get enough to eat. When the pasturelands in Central Asia dried up, hungry tribes would make war on their neighbors in order to get new lands. The neighbors fought back or tried to seize the lands of a still weaker tribe. Much of the fighting that went on between early American pioneers and American Indians from the early 1600's through the 1800's was this kind of war. The Indians wanted to roam freely over the land, hunting, trapping, or fishing. The pioneers wanted to clear the land and plant it in crops. Indian fighting was dangerous, and no one who already had a good farm was likely to go out and fight the Indians for another. But landless people from abroad preferred the dangers of war to the horrors of poverty.

This type of war has not entirely disappeared, but it is no longer common or important. The early war for land to live on usually had these two important characteristics: those who did the fighting made the decision to fight, and the fighters wanted something for themselves.

War for wealth. The peoples of ancient empires fought many wars for wealth. The decision to fight was made by the ruler of the empire and his or her advisers. The fighting was often done by hired armies. A ruler who sought to conquer new lands did not intend to drive the people out of the lands. Generally, he or she just wanted to collect taxes from them.

When Alexander the Great led his armies against the Persian Empire in 334 B.C., the common people of the invaded lands paid little attention, except to hope their own property would not be destroyed. It usually made little difference to them which ruler collected taxes. Wars were fought solely by rulers and their armies. From the A.D. 400's to the 1500's, people fought numerous wars for wealth. Frequently, one nobleman would try to seize the property of another. He would use his own soldiers and perhaps hire other leaders and their soldiers to help him. Sometimes the conqueror of a city would take a large money payment in return for leaving the city in peace.

War for power. The great European nations fought wars throughout the world to gain or increase their power. These wars united the people and strengthened the governments. Wars of conquest based on the ideas of a super-race or of a superior economic system are often wars to extend the power of a government.

War for security. Most countries fear the possibility of attack, and maintain armed forces to defend themselves. Sometimes this fear may be directed toward a particular country. In that case a nation may decide to choose its own time and strike the first blow. Or it may decide to conquer some weaker neighbor, and thus increase its own resources as a defense against attack.

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MURDER

When one person intentionally kills another without legal justification or excuse, the crime is called murder. The clearest example of this is a case where one person deliberately kills another because of hatred, envy, or greed. But there are also situations where a killing is considered murder even when no specific intent to kill exists. For example, a person who accidentally kills someone while committing a robbery is guilty of murder. The fact that the person is committing a serious crime indicates that he or she has a reckless disregard for human life and safety. This takes the place of intent to kill. The penalty for murder is a long prison sentence or death. But many national, state, and provincial governments have done away with the death penalty.

A killing that has legal justification is called justifiable homicide. For example, a killing in self-defense would be a justifiable homicide. The law regards a purely accidental killing as an excusable homicide. For example, if a pedestrian steps in front of a carefully driven automobile and is killed, the accident would be considered an excusable homicide. When a person in a fit of anger intentionally kills another person after the victim has provoked the attack, the killing is called voluntary manslaughter. When a person's death results from reckless driving or other extreme negligence on the part of the killer, the offense is called involuntary manslaughter. The penalties in most cases of manslaughter are less severe than those for murder.

CHAPLIN, CHARLIE

Chaplin, Charlie (1889-1977), became one of the most famous stars in motion-picture history. During the era of silent comedies, he was often called "the funniest man in the world." Chaplin also gained complete control over production of his films. He wrote and directed nearly all his films, and he composed the music scores for all his sound pictures.

Chaplin's stardom began in 1914, when he first appeared as "the Tramp" or "the Little Fellow." Looking undersized and undernourished, Chaplin wore a battered derby hat, a coat too small for him, and pants much too large. He walked in a shuffling manner that suggested he had never worn a pair of shoes his own size. But this figure of poverty also wore gloves and carried a bamboo cane that seemed to reflect a spirit that bounces back from the most crushing defeats. The last shot in many of Chaplin's early silent films shows him walking down a road into the distance. The Tramp was homeless and penniless once more, but with hat tilted and cane flourishing, he again was ready for whatever adventure lay around the corner.

In 1919, Chaplin formed the United Artists film corporation with actor Douglas Fairbanks, Sr., actress Mary Pickford, and director D. W. Griffith. He made fewer pictures, and those he made were longer and more serious. He continued to create laughter, but he also seemed to be commenting on why the world of respectability and authority offered so little to the human soul. His films during this time included *The Kid* (1920) and *The Gold Rush* (1925). Chaplin played the Tramp in these films and in his first two sound films, *City Lights* (1931) and *Modern Times* (1936). In *The Great Dictator* (1940), he played two roles, a humble Jewish barber and a tyrant based on the German dictator Adolf Hitler. Chaplin played a murderer in *Monsieur Verdoux* (1947) and an elderly music hall comedian in *Limelight* (1952).

Charles Spencer Chaplin was born into a poor London family. He became a variety and music hall performer and began touring the United States in 1910. He lived in the United States for more than 40 years but never became a citizen.

In 1943, Chaplin married Oona O'Neill, the daughter of American playwright Eugene O'Neill. It was Chaplin's fourth marriage.

In the 1940's and early 1950's, Chaplin was a center of controversy. Some people criticized Chaplin's personal life as immoral and accused him of supporting Communism. In 1952, Chaplin traveled to Europe. The U.S. government announced that Chaplin could not reenter the United States unless hearings were held on his personal life and political views. Chaplin decided not to return, and he and his family settled in Switzerland.

In 1972, Chaplin took part in ceremonies in his honor in New York City and Los Angeles. Chaplin received an honorary Oscar at the annual Academy Award ceremonies in April. The award praised Chaplin "for the incalculable effect he has had in making motion pictures the art form of this century."

In 1975, Chaplin was knighted by Queen Elizabeth II.

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GLUE

Glue is an adhesive made from the skins, connective tissues, or bones of animals. Many people use the term glue for all types of adhesives, including those made from plants or plastics. This article deals only with glues made from animal tissues.

Glue is an impure form of gelatin, a protein substance obtained by boiling bones or other animal parts. Glue makes objects stick together by penetrating pores in their surfaces and then drying to form a hard bond. People have made glue for many centuries, and it is one of the most widely used adhesives today.

Types of glue. There are three types of glue: (1) hide glue, (2) bone glue, and (3) fish glue. Most hide and bone glues are sold in the form of powder or small grains and must be dissolved in hot water before they can be used. These glues can be stored for any length of time if they are kept dry. Fish glue is a concentrated liquid that contains about 45 per cent solids. If unused, fish glue begins to lose its strength as an adhesive about two years after it is made.

How glue is made. Manufacturers obtain glue from animal parts by cooking them in water. Cooking breaks down the protein in the animal tissue and dissolves it. The resulting solution may be filtered and concentrated before being sold as glue. The preparations for cooking and the final manufacturing steps vary with the type of glue.

Manufacturers of hide or bone glue obtain their raw materials from meat packing houses or tanning factories. Hide glue is made by first washing the hides in water. The skins are then soaked in water

containing lime to remove nonglue proteins. Next, they are treated with a mild acid and rinsed with water. The rinsed hides are cooked in water in large kettles or tubs. The resulting glue is drained off, filtered, and evaporated. The glue then cools and, in most cases, turns solid. Machines grind the solid glue into grains or powder and then package it for shipping. If the glue is to be sold as a liquid, substances called antigelling agents are added while it is still hot. The antigelling agents keep the glue from solidifying as it cools.

Bone glue is made by first washing the bones in water or dilute acids and crushing them. Next, the bones are cooked in water. The rest of the process resembles that used for hide glues.

Most fish glue is made from washed fish skins. The skins are cooked to form a concentrated broth, which is then cooled and packaged.

Uses of glue. Industries consume most glue. Many manufacturers of wood products use glue to hold together such items as furniture, toys, and musical instruments. Other manufacturers coat paper, cloth, or plastic with glue to make adhesive tape. Makers of sandpaper use glue to hold the scratchy particles to the paper backing. In the textile and paper industries, glue serves as sizing, a preparation used to stiffen cloth and glaze paper. Many book manufacturers hold pages to bindings with glue.

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JOYCE, JAMES

Joyce, James (1882-1941), an Irish novelist, revolutionized the treatment of plot and characterization in fiction. Many critics consider William Shakespeare his only rival as a master of the English language.

Joyce was born in Dublin and wrote all his works about that city, though he lived outside Ireland from 1904 on. He lived and wrote in Paris; Rome and Trieste, Italy; and Zurich, Switzerland. He returned to Ireland only twice, briefly in 1909 and 1912. Joyce suffered a painful eye disease for most of his adult life and became almost blind despite many operations.

Joyce's first major work was *Dubliners* (1914), a collection of stories that reflects his concern with life among the Irish lower middle class. *A Portrait of the Artist as a Young Man* (1916) is a largely autobiographical novel. Joyce appears as the character Stephen Dedalus. Like Joyce, Stephen finds himself in conflict with his family, the Roman Catholic Church, and the nationalistic zeal of the Irish people. And like Joyce, Dedalus leaves Ireland and wishes to become a writer. In tracing Stephen's growth to young manhood, Joyce mixed conventional realist prose with passages using techniques known as interior monologue and stream of consciousness. These techniques give the reader the illusion of following the character's thoughts.

Joyce lived in poverty and obscurity until 1922, when the publication of *Ulysses* made him one of the most celebrated novelists of the 1900's. *Ulysses* takes its title from parallels Joyce established between the adventures of his main character, Leopold Bloom, and those of *Ulysses*. *Ulysses* (Odysseus in Greek) was the hero of the *Odyssey*, a Greek epic poem. Bloom suffers ridicule because he is Jewish and has peculiar sexual tastes and because his wife, Molly, is unfaithful. He survives the pain and sorrow of his life by a remarkable capacity to absorb suffering--and even to enjoy it. *Ulysses* has had an enormous impact on modern world literature.

Finnegans Wake (1939) is probably Joyce's greatest work. In this novel, Joyce portrayed one family and at the same time all families, everywhere, at all times in history. The hero's initials, HCE, stand for Humphrey Chimpden Earwicker, a Dublin innkeeper. But they also stand for Here Comes Everybody. In the story, Dublin symbolizes all cities. Joyce crammed the book with topical and historical names, events, myths, songs, jokes, and gossip. His goal was to make all people, places, things, and times repeat and resemble each other.

Joyce's technique can be studied from the first sentence of *Finnegans Wake*: "riverrun, past Eve and Adam's, from swerve of shore to bend of bay, brings us by commodius vicus of recirculation back to Howth Castle and Environs." The book's last sentence breaks off in the middle but is completed by the book's first sentence. The device is a grammatical representation of the cyclic theory of history that Joyce borrowed from the Italian philosopher Giambattista Vico. The theory also provides the structure for *Finnegans Wake*.

The above sentence traces the flow of the River Liffey through Dublin, past the Church of Adam and Eve, out into Dublin Bay and the Irish Sea. From there, by evaporation and recirculation, the water returns to the physical starting point of the book, Howth Castle. The reference to Adam and Eve introduces a major theme of the book, the Fall of Man. In Irish-Gaelic, the river is called Anna Liffey, meaning River of Life. The river becomes interchangeable with Joyce's major female character, Anna

Livia Plurabelle. She symbolizes the mother of humanity.

Joyce's other works include two collections of poems, *Chamber Music* (1907) and *Pomes Penyeach* (1927); and a play, *Exiles* (1918).

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KAFKA, FRANZ

Kafka, Franz, (1883-1924), was a Czech writer who gained worldwide fame only after World War II. Only a few of his short stories were published during his lifetime. Kafka wanted his unpublished manuscripts to be burned after his death, but his friend Max Brod edited and published them anyhow.

Kafka's highly imaginative works have been associated with such intellectual movements as expressionism, surrealism, and existentialism. But he could not identify himself with any particular creed, class, or ethnic group, and his writings do not belong to any particular literary school. Kafka wrote in German.

Kafka's writings uniquely combine a realistic, sometimes grotesquely exact description of details with an overall atmosphere of fantasies, dreams, and nightmares. He portrays objects and events with precision, but they appear to have no purpose or meaning.

Kafka presents a world in which people are deprived of spiritual security, and tortured by anxiety and loneliness. Kafka's characters repeatedly are frustrated in attempts to gain their goals, such as knowledge, social acceptance, or salvation. They represent typical human conditions and attitudes. Their lives are marked by patterns of hope and despair, attempt and failure. They painfully experience their remoteness from a divine authority. This alienation is rooted in personal guilt and at the same time appears as an inescapable destiny.

Kafka wrote three novels and many short stories. In his novel *The Trial* (1925), a man is arrested, convicted, and executed by a mysterious court. His attempts to learn the nature of his guilt and of the secret court fail, and he dies in ignorance. Another novel, *The Castle* (1926), presents the futile struggle of a newcomer to win acceptance in a village and gain entry to a castle, home of an unknown supreme authority. *Amerika* (1927) is a comic novel about the adventures of an adolescent European immigrant in America. Kafka's best-known short stories include "The Judgment," "The Metamorphosis," "In the Penal Colony," and "A Hunger Artist."

Kafka was born in Prague of German-speaking Jewish parents. He spent most of his life as a state insurance lawyer. He died of tuberculosis.

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TCHAIKOVSKY, PETER ILICH

Tchaikovsky, Peter Ilich, (1840-1893), was the first Russian composer whose music became part of the standard concert program in western Europe. Tchaikovsky had a gift for creating memorable lyric melodies and for contrasting instrumental sounds, particularly those of wind instruments, in his orchestrations.

Tchaikovsky combined native Russian materials with western European influences. His scores contain quotations and transformations of Russian folk melodies. Tchaikovsky's music contains varied and contrasting moods. The last movement of *Symphony No. 6* (1893) projects a dark and melancholy atmosphere. This symphony is also known as the *Pathétique* (Pathetic). However, his *Slavonic March* (1876) and the *1812 Overture* (1882) are spirited and colorful examples of nationalism in Russian music. Some of Tchaikovsky's most original orchestral textures and appealing melodies appear in his ballet scores, from which he arranged concert suites.

His life. Tchaikovsky was born in Votkinsk, Russia. He entered a law school in St. Petersburg in 1850. From 1862 through 1865, he studied music at the St. Petersburg Conservatory with Anton Rubinstein, a Russian pianist and composer. At the conservatory Tchaikovsky became the first Russian composer to receive systematic Western-style academic training in the fundamentals of music.

In 1866, Tchaikovsky began teaching at the Moscow Conservatory of Music. During the next several years, his early emotional sensitivity developed into long periods of depression. But he wrote some of his most optimistic music during this time. Tchaikovsky was married briefly in 1877. However, he and his wife separated after a few weeks, and he left Russia to travel in Switzerland and Italy.

In 1876, Tchaikovsky began his correspondence with Nadezhda von Meck, a wealthy widow who admired his music. She offered financial support so he could devote himself to composition. She insisted that they never meet, but for years they exchanged letters. Assured of a steady income, Tchaikovsky left the Moscow Conservatory in 1877 to concentrate on composition. He also began to

travel widely and in 1891 conducted some of his works in concerts in Baltimore, Philadelphia, and New York City.

His music. Tchaikovsky's six numbered symphonies and his Manfred Symphony (1886) are landmarks in his artistic development. His first three symphonies (written 1866, revised 1874; written 1872, revised 1880; and 1875) are performed less often than the last three. His Symphony No. 4 (1878) is his first success in the symphonic form, and Symphony No. 5 (1888) is excellent from the standpoint of formal construction. Symphony No. 6 departed from tradition through its tragic final movement. Other important orchestral works include Italian Capriccio (1880), the fantasy-overture Romeo and Juliet (3rd version, 1886), the symphony fantasy Francesca da Rimini (1877), and four orchestral suites (1879, 1884, 1885, and 1887).

Tchaikovsky is remembered today outside Russia primarily for his orchestra works. However, he devoted equal attention throughout his career to opera. Of his nine completed operas, only Eugene Onegin (1879) and The Queen of Spades (1890) have gained popularity in the West. Both are based on works by Alexander Pushkin, a Russian writer who died in 1837. Tchaikovsky's other music for the stage includes three ballets: Swan Lake (1877), The Sleeping Beauty (1890), and The Nutcracker (1892).

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EMBROIDERY

Embroidery is the art of stitching decorations on a fabric or similar material with a needle and thread. Stitches can be combined to make an unlimited variety of designs, including flowers, animals, people, and abstract patterns. The design is drawn on the fabric and then embroidered, or it is created during the embroidering process.

Since prehistoric times, most cultures have developed their own embroidery styles. People embroider clothing and use embroidered furnishings to decorate their homes and public buildings. Embroidered clothing ranges from simple undergarments to royal robes decorated with gold and silver threads. Embroidered furnishings include bed linens, chair covers, tablecloths, and wallhangings. Thousands of hours may be needed to richly embroider a garment or furnishing with millions of tiny stitches. Traditionally, craftworkers and hobbyists embroider by hand. Today, however, machines do most embroidering of factory products. Home sewing machines can be equipped with special attachments for embroidery.

Materials. Fabric used for embroidery is called backing fabric. It can be any fabric through which the embroiderer can pull embroidery thread without damaging the fabric or thread. Common backing fabrics include cotton, linen, silk, and wool. Some people use cardboard, leather, and other materials. Embroidery threads range from thin strands to thick yarns. The most widely used threads include embroidery floss, linen, pearl cotton, and yarn. Various sizes of sewing needles are used for embroidery. The size chosen depends on the kind of backing fabric and thread being used.

Embroiderers select materials that are best suited for the finished product. For example, embroidered chair covers that get heavy use are made from durable fabrics and sturdy threads. Wallhangings are exposed to less wear than chair covers and can be made from any materials. Some people attach buttons, shells, or other objects to their embroidery. Embroiderers often stretch their backing fabric tightly across a stretcher frame or hoop before starting to stitch. This method is especially helpful for embroidering fine, detailed work. When working with large stitches on heavy fabrics, the embroiderer can spread the fabric loosely.

Embroidery stitches. There are only a few basic embroidery stitches, but hundreds of variations of them have been developed. Most stitches belong to one of four groups: (1) flat, (2) knotted, (3) chained, and (4) looped. Flat stitches lie straight and flat against the fabric. They can be made in any length and direction to fill in an area. Knotted stitches form knots of thread on the fabric surface and give textural effects to the embroidery. Chained stitches form loops that link together. Looped stitches are curved. Chained and looped stitches are used to outline and fill in designs.

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GOGOL, NIKOLAI

Gogol, Nikolai, (1809-1852), was a major Russian playwright, novelist, and short story writer. In the West, his writing is admired for its ornamental use of language, its romantic treatment of theme, and its use of the fantastic, the grotesque, and caricature. In Russia, he is best loved as a humorist.

Nikolai Vasilievich Gogol was born in Ukraine. In 1828, Gogol went to St. Petersburg to become an actor but decided on a literary career. In 1832, he won attention for Evenings on a Farm near Dikanka, a collection of Ukrainian tales.

Gogol's most important contribution to Russian drama was *The Inspector General* (1836), a satire on corruption among provincial government officials. The play was so harshly criticized that Gogol decided to live abroad. He spent most of the years from 1836 to 1844 in Rome, and returned to Russia in 1848. In 1842, he published the first part of *Dead Souls*, a novel about a swindler who creates a scheme to cheat the government by using the names of dead serfs. That year, he also published his most famous short story, "The Overcoat," a tale about a pathetic clerk.

As years passed, Gogol worried increasingly about the moral influence of his works on the Russians. He felt he had failed to express the positive essence of the Russian soul in his characters. As he worked on the second part of *Dead Souls*, he grew melancholy. While living in Rome, he fell under the influence of a fanatic priest. The priest convinced him that his second novel was evil and demanded that he destroy it. Gogol burned the novel on Feb. 24, 1852, and died several days later.

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MATERIALISM

Materialism is a philosophical position that states that everything is material, or a state of matter.

The word comes from the Latin *materia*, meaning matter. Materialists particularly deny that the human self is a spiritual--or in any way nonmaterial--entity. They interpret beliefs, thoughts, desires, sensations, and other mental states as properties of material systems. Materialism is often considered a "scientific" philosophy because it is closely associated with the view that everything that occurs can be explained by scientific laws--perhaps even by the laws of physics alone.

The Greek philosophers Leucippus and Democritus developed an early form of materialism called atomism in the 400's B.C. They believed that invisible, indivisible material particles, called atoms, of various sizes and shapes make up everything that exists. According to atomism, the mind itself is made up of small, round, material atoms. Later atomists included the Greek philosopher Epicurus and the Roman poet Lucretius.

The growth of Christianity, with its emphasis on spiritual concerns, led to a decline in materialism for many centuries. Materialism reemerged as a significant intellectual force during the rise of modern science in the 1600's. In France, Pierre Gassendi, a philosopher and scientist, revived some of the doctrines of ancient atomism. The English philosopher Thomas Hobbes developed an uncompromisingly materialist philosophy. The French philosophers Denis Diderot and Julien de la Mettrie also were among the best-known materialists of the 1700's.

A version of materialism known as dialectical materialism emerged in the late 1800's with the works of the German philosopher Karl Marx and the German social scientist Friedrich Engels. The German philosopher G. W. F. Hegel had used the term dialectic to indicate a necessary transition from one phase of the world or society or thought to another phase. This transition occurs as a result of inadequacies or "contradictions" in the earlier phase. Hegel identified dialectical processes with the development of reason or spirit, but Marx and Engels combined the notion of dialectic with the view that the forces underlying historical development are always material. Marx and Engels particularly believed that economic factors determine social structure and change. Dialectical materialism provides the philosophical basis for Communism, a political and economic movement.

Since the 1950's, many scientifically oriented philosophers have defended materialist positions in metaphysics, a branch of philosophy that is concerned with the basic nature of reality. These philosophers uphold materialist positions independent of any political ideology or theory of social development.

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DOUGLAS, MICHAEL

Douglas, Michael (1944-...), is a popular American motion-picture actor and producer. He became known for playing strong, morally flawed characters, many of whom are threatened by equally strong women. Douglas was the co-producer of *One Flew over the Cuckoo's Nest*, which won the 1975 Academy Award for best picture. He also won the 1987 Academy Award as best actor for his performance as a greedy stock trader in *Wall Street*.

Douglas was born in New Brunswick, New Jersey. He is the son of actor Kirk Douglas. Michael graduated from the University of California at Santa Barbara in 1968. He began his career as an assistant director in the mid-1960's and turned to acting on the stage, television, and movies a few years later. He made his film acting debut in *Hail, Hero!* (1969). From 1972 to 1975, Douglas starred in the television police drama "The Streets of San Francisco." He increased his reputation as an actor and producer in *The China Syndrome* (1979), a movie about a nuclear power plant disaster. Douglas became a major star with his performances as the arrogant adventurer Jack Colton in

Romancing the Stone (1984) and its sequel, The Jewel of the Nile (1985). Douglas also produced both movies.

Other films in which Douglas starred include Fatal Attraction (1987), The War of the Roses (1989), Basic Instinct (1992), Disclosure (1994), The American President (1995), A Perfect Murder (1998), and Wonder Boys (2000). He also produced several films, including Face/Off (1997) and The Rainmaker (1997).

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INDUCTIVE METHOD

Inductive method is the reasoning process by which a person starts from particular experiences and proceeds to generalizations. A person may start with experiences of eating apples that all tasted sweet. From these experiences, the person may conclude that all apples are sweet. But the next apple may not be sweet. Inductive method leads to probabilities, not certainties. It is the basis of the common sense upon which people act.

Inductive method is also used together with deduction to make scientific discoveries. In deduction, people draw particular conclusions by reasoning from general premises. To make discoveries, scientists first obtain general theories by using induction. From these general theories, they then deduce new, particular predictions. These predictions are tested by observation and experiment. The test results may be used in a new inductive step to obtain a better general theory. Using only deduction, people could not arrive at new theories. Using only induction, people could not correct and improve theories. By combining these methods, science is able to progress.

DEDUCTIVE METHOD

Deductive method is the process of reasoning by which we draw conclusions by logical inference from given premises. If we begin by accepting the propositions that "All Greeks have beards" and that "Zeno is a Greek," we may validly conclude that "Zeno has a beard." We refer to the conclusions of deductive reasoning as valid, rather than true, because we must distinguish clearly between that which follows logically from other statements and that which is the case.

Starting premises may be articles of faith, assumptions, or conclusions based on earlier reasoning. To draw valid conclusions, the deductive method uses a special set of rules. These rules are based on the structures of premises and conclusions. Mathematics and logic make extensive use of the deductive method. The scientific method requires a combination of induction and deduction.

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HOMER

Homer is traditionally considered the ancient Greek poet who composed the great epics the Iliad and the Odyssey. Scholars know almost nothing about Homer. Some believe that he may have lived in a Greek-speaking city on the eastern shore of the Aegean Sea or on the island of Khios. Other scholars deny that he ever existed. According to tradition, Homer was blind.

Homer's poems. The events in the Iliad and the Odyssey occur during and after the Trojan War.

The legend of the war may be based on an actual war fought between Greece and the city of Troy in the mid-1200's B.C. Many scholars believe the poems were composed between 800 and 700 B.C. because the poems refer to social conditions at that time.

Archaeologists have discovered evidence in the ruins of Troy and ancient Greece that confirms the historical basis for some things described in the poems. But the poems' characters and events--even if partly based on real people and historical incidents--were altered over the centuries in the retelling of folk tales and in the poems of singing poets called bards. The bards created a series of poems that told the entire story of the Trojan War. The Iliad and the Odyssey are the only ones that survive, probably because of their long and sophisticated form.

ILIAD

Iliad is one of the oldest surviving Greek poems. According to tradition, it was composed by the ancient Greek poet Homer, probably in the 700's B.C. The Iliad describes certain events in the final year of the Trojan War, which was fought between Greece and the city of Troy. According to legend, the Trojan War lasted 10 years, until Greece defeated Troy. Many scholars believe the legend is based on a real war of the mid-1200's B.C. For information on the historical background and authorship of the Iliad.

According to the Iliad, the Trojan War was fought over Helen, the beautiful wife of King Menelaus of Sparta. Helen had been taken from Sparta to the city of Troy by Paris, a son of the Trojan king, Priam. Menelaus's brother, Agamemnon, led an army of Greek heroes to bring Helen back to Sparta.

The Iliad is divided into 24 books (sections). The story covers 54 days. Most of the action takes place in the Greek camp, inside the walls of Troy, and in nearby areas. A quarrel develops between Agamemnon and Achilles, the greatest of the young Greek heroes. Achilles feels he is not being adequately rewarded for his services to the Greeks. Agamemnon, in turn, feels that Achilles does not have enough respect for his position as commander of the army. Achilles withdraws into his tent and refuses to fight. Without Achilles, the Greeks are driven back to their ships by Trojan forces led by Hector, another of Priam's sons. Achilles's closest friend, Patroclus, goes to fight in Achilles's armor to help the Greeks. Hector kills Patroclus, which arouses Achilles to seek revenge. Achilles then kills Hector outside Troy. He keeps Hector's body, until Priam comes to plead with him. Achilles takes pity on Priam and gives him the body for proper burial. The story ends with Hector's funeral. For nearly 3,000 years, readers have found the Iliad a moving expression of the heroism, idealism, and tragedy of war. In addition to the battle scenes, the Iliad tells about life within Troy. It describes the emotional farewell between Hector and his wife, Andromache, who foresees his death. Hector is a great soldier. But he basically represents the family man who is called on to defend his country and, in so doing, loses his life. The poem also deals with issues of honor and social obligation.

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SYNAGOGUE

Synagogue is the Jewish house of worship and the center of Jewish education and social life. The word synagogue usually refers to the place where worship and other activities take place. The synagogue has become one of the most important centers for the transmission and preservation of Judaism.

A synagogue has many functions. People gather there for worship services every morning and evening, as well as on the Sabbath and on holy days. Synagogues have schools where children and adults study the scriptures, the Hebrew language, and Jewish history. Such important events as a wedding or a bar mitzvah are celebrated in the synagogue. In the United States, many synagogues also serve as meeting places for Jewish organizations in the community.

Jews began to gather for formal prayer in Biblical times at the Temple in Jerusalem when it was the center of Jewish life. The Temple was destroyed in 587 or 586 B.C. Later, buildings called synagogues were built. They served as places of prayer and study, and as centers of Jewish life worldwide.

BAR MITZVAH

Bar mitzvah is the entry of a Jewish boy into the adult Jewish community. The boy who has attained religious adulthood is called a bar mitzvah. The term means son of the commandments. The celebration of the occasion is also called a bar mitzvah.

When a Jewish boy reaches physical maturity, assumed to be the age of 13, he is responsible for all the observances, obligations, and prohibitions of a Jewish adult. No formal religious ceremony is needed for this to happen. Traditionally, however, a boy demonstrates his new status by participating in or, preferably, leading public worship. He may conduct a public service, read from the Torah (Law) in Hebrew, or chant a portion from the Biblical prophets. After the service, it is customary for the bar mitzvah's parents to host a party. Friends, relatives, and members of the Jewish community are invited to share in the festivities.

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BLAKE, WILLIAM

Blake, William (1757-1827), was a brilliant and unconventional English poet, engraver, and painter. His symbolic pictures and visionary poems are not always easy to understand because Blake developed an elaborate personal mythology that underlies virtually all the symbolism and ideas in his works. Blake's writings and pictures reveal how a powerful artistic imagination can mold the world in its own image.

Blake thought that we have war, injustice, and unhappiness because our way of life is founded on mistaken beliefs. We cannot truly know reality through our five senses, yet we concern ourselves almost entirely with scientific truth and materialistic values gained through those very senses. We cannot understand the vast reality beyond the material and achieve full control of ourselves until we learn to trust our instincts, energies, and imaginations. For Blake, this belief was the basis for all personal, social, and religious truth.

Blake was born in London and lived most of his life there. He was a book illustrator and engraver by profession. He claimed to have seen visions, beginning in his childhood, and he called many of his

poems either visions or prophecies.

Blake has received much praise for such pictures as his illustrations for the Book of Job, but he was most interested in his "illuminated printing." This was a process of engraving poems and related pictures on metal plates and then hand-coloring the prints made from them. Except for Poetical Sketches (1783), most of Blake's published poetry appeared in this unique form.

Blake is best known for Songs of Innocence (1789) and Songs of Experience (1794). In these works, he shows, in such contrasting poems as "The Lamb" and "The Tiger," symbols of what he calls "the two contrary states of the human soul." His other works include The Marriage of Heaven and Hell (about 1793), America (1793), and Jerusalem (about 1820).

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SHAW, GEORGE BERNARD

Shaw, George Bernard (1856-1950), a British playwright, critic, and essayist, became one of the most famous writers of the 1900's. Shaw was awarded the Nobel Prize for literature in 1925. He wrote over 50 plays in a remarkable career that spanned 70 years. His plays are performed more than those of any English playwright except William Shakespeare.

Shaw's dramas are filled with wit, challenging ideas, forceful characters, and vigorous, eloquent dialogue. While the plays often treat serious matters and promote Shaw's views, their points are frequently twisted, compromised, or emphasized through comedy. Shaw thought that a sense of humor can give balance and depth to seriousness.

Shaw also gained fame as a witty and wise "character." The press eagerly sought him out. Shaw was a political, social, and religious thinker. He was a critic of art, music, and theater, as well as a socialist, vegetarian, and feminist. Shaw had so many stimulating opinions and presented them so sharply that his views are often quoted. He defended his ideas in a series of essays, many published as prefaces to his plays. Like the plays, the essays are stimulating for their brilliance and wit, even when the causes they argue no longer seem daring or unconventional.

Early life. Shaw was born in Dublin. In 1876, he settled in London. He wrote five novels, but none were successful. In 1884, Shaw joined the Fabian Society, an organization of socialists who believed that political and economic change could be gained through reform. Soon he represented the society in essays and lectures, and became known as one of England's finest public speakers (see FABIAN SOCIETY). Shaw wrote music reviews from 1888 to 1894 and theater criticism from 1895 to 1898. He proved himself the keenest critic in London and among the best of any time.

Shaw promoted the realistic social dramas of Norwegian playwright Henrik Ibsen in a long essay, The Quintessence of Ibsenism (1891). The radical subject matter of two early plays showed Ibsen's influence. Widowers' Houses (1892) attacks slum landlords. Mrs. Warren's Profession, written in 1893, highlights the social causes of prostitution. It was immediately censored and not produced until 1902. Because of the unpopularity of these plays, Shaw then combined his unconventional views with more pleasant, often comic ingredients in Arms and the Man (1894), Candida (1897), The Devil's Disciple (1897), and Caesar and Cleopatra (1901).

Mature period. Shaw's plays were little known in England until many were performed at the Royal Court Theatre from 1904 to 1907. Man and Superman (1905) presents Shaw's theory of God as a "life force" evolving through humanity. In Major Barbara (1905), the ideals of the Salvation Army are challenged by the social philosophy of an armaments tycoon.

Shaw's popular Pygmalion (1913) was adapted into the musical My Fair Lady in 1956. In this ironic Cinderella story, a professor of phonetics (speech sounds) demonstrates the absurdity of class distinctions by teaching an ignorant Cockney girl how to speak and act like a duchess (see PYGMALION). Heartbreak House (1920) depicts the negligent society that allowed World War I (1914-1918) to occur. Saint Joan (1923) is a humanistic portrayal of the sainthood of Joan of Arc. Shaw's later plays became increasingly political and fanciful. He also wrote an important book on socialism, The Intelligent Woman's Guide to Socialism and Capitalism (1928) and a religious parable called The Adventures of the Black Girl in Her Search for God (1933).

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SEVEN WONDERS OF THE ANCIENT WORLD

Seven Wonders of the Ancient World is a listing of notable objects built between about 3000 B.C. and A.D. 476. The practice of listing the seven wonders probably began in ancient Greece. The ancient Romans also listed memorable things that travelers should see. Many such lists were made, and they included many different objects. But all the lists of ancient wonders included only objects made by human beings and considered notable because of their great size or some other unusual quality. This

article discusses the seven most commonly listed wonders of the ancient world.

The pyramids of Egypt at Giza, built as tombs for Egyptian kings, are the oldest and best preserved of all the ancient wonders. Three famous pyramids there were built about 2600 to 2500 B.C. The largest pyramid, called the Great Pyramid, stands about 450 feet (137 meters) high. Its base occupies about 13 acres (5 hectares). The Greeks and Romans marveled at the size of the pyramids. They were unaware of the religious importance of the pyramids as tombs, and considered the pyramids to be foolish extravagances of the Egyptian kings.

The Hanging Gardens of Babylon were probably built by King Nebuchadnezzar II for one of his wives.

Nebuchadnezzar ruled Babylon from 605 to 562 B.C.

Babylon was located near modern Baghdad in Iraq.

Scientists have been unable to identify positively the remains of the gardens. Our information about the gardens comes from an account by Berossus, a Babylonian priest of the 200's B.C. Berossus described gardens that were laid out on a brick terrace about 400 feet (120 meters) square and 75 feet (23 meters) above the ground. In order to irrigate the flowers and trees in the gardens, slaves worked in shifts turning screws to lift water from the Euphrates River.

The Temple of Artemis at Ephesus, built about 550 B.C., was one of the largest and most complicated temples built in ancient times. It stood in the Greek city of Ephesus, on the west coast of what is now Turkey. The temple was entirely marble, except for its tile-covered wooden roof. It was dedicated to the Greek goddess Artemis and was designed by the architect Chersiphron and his son, Metagenes. Its foundation measured 377 by 180 feet (115 by 55 meters). It had 106 columns, about 40 feet (12 meters) high, in a double row around the cella (inner space). Wealthy King Croesus of Lydia donated some of the columns. The temple burned down in 356 B.C., and another one like it was built on the same foundation. Goths burned down the second temple in A.D. 262. Only the foundation and parts of the second temple remain. The British Museum in London contains sculptures from the second temple.

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The statue of Zeus at Olympia, Greece, was perhaps the most famous statue in the ancient world. The Greek sculptor Phidias made it about 435 B.C., and dedicated it to Zeus, the king of the gods. The statue, 40 feet (12 meters) high, showed Zeus on his throne. Phidias made Zeus's robe and ornaments out of gold, and he made the god's flesh of ivory. In the statue, Zeus had a wreath around his head and held a figure of Nike, his messenger, in his right hand. He held a scepter (king's rod) with an eagle in his left hand. The statue no longer exists.

The Mausoleum at Halicarnassus, in what is now southwestern Turkey, was a huge, white marble tomb. It was built about 353 B.C. to hold the remains of Mausolus, a provincial ruler in the Persian Empire. Its size and decorations made it so famous that all large tombs are now

called mausoleums. The tomb was about 135 feet (41 meters) high. It had a rectangular basement beneath a colonnade formed by 36 columns. A stepped pyramid rested on the colonnade, and a statue of Mausolus in a chariot probably stood on top of the pyramid. The Greek architects Satyros and Pythios designed the tomb. Four famous Greek sculptors--Bryaxis, Leochares, Scopas, and Timotheus--carved the frieze (decorated band) on the building. The top part of the mausoleum was destroyed by an earthquake, and only pieces of the building and its decorations remain. The British Museum in London contains some sculptures from the mausoleum.

The Colossus of Rhodes was a huge bronze statue that stood near the harbor of Rhodes, an island in the Aegean Sea. The statue honored the sun god Helios. It stood about 120 feet (37 meters) tall--about as high as the Statue of Liberty. The Greek sculptor Chares worked 12 years on it in the early 200's B.C. He used stone blocks and about 71/2 short tons (6.8 metric tons) of iron bars to support the hollow statue. In 224 B.C., the Colossus was destroyed by an earthquake. The metal supports were sold for scrap in A.D. 653.

The Lighthouse of Alexandria, over 400 feet (122 meters) high, stood on the island of Pharos in the harbor of Alexandria, Egypt. It became so famous that the word pharos came to mean lighthouse. The lighthouse is also called the Pharos of Alexandria. The structure, completed during the reign of Ptolemy II (283-246 B.C.) from a design by the Greek architect Sostratos, rose from a stone platform in three sections. The bottom section of the lighthouse was square, the middle eight-sided, and the top circular. A fire burning at the top of the lighthouse provided light. The Lighthouse of Alexandria stood for about 1,500 years before it was finally toppled by an earthquake.

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GOD

God is a religious term for the "supreme reality." In many religions, God is the creator of the universe and the ultimate source of knowledge, power, and love.

God is sometimes portrayed as a humanlike male with supernatural powers. However, most religions teach that God has many different forms. Christians believe that God appears in three ways: as Father and Creator, as His Son Jesus Christ, and as the Holy Spirit. Hindus refer to the ultimate reality as Brahman, but they think that God is also revealed in more than 1,000 other gods and goddesses. Although Buddhists do not accept the idea of God as Creator, the role Buddha plays in their religion is similar to that of God in other religions. In the Hebrew Bible, or Old Testament, God is called by a variety of names, such as Yahweh (Jehovah), Elohim, and Adonai. Muslims call God Allah, as well as 99 other names that describe perfect qualities.

Cosmic Gods. Some early religions came to associate a sky god with the entire expanse of the universe. The Greeks' Zeus and the Romans' Jupiter, for example, emerged as supergods. In other religions, such as Judaism and Islam, the cosmic God has been thought to be the sole creator and sustainer of life.

Personal Gods. In many religions, people believe that a supreme God has been revealed as a friendly human being. For example, most Christians believe that God is seen through the person of Jesus Christ. In Hindu tradition, the god Krishna is portrayed as a lovable and intimate human being, especially in stories about his childhood. In some traditions, intermediary spirits, such as the Buddhists' Bodhisattva, bridge the gap between humanity and a remote and distant God. In other traditions, even the distant, cosmic God is sometimes believed to interact in a personal and loving way with His followers. For example, in the Hebrew Bible, God forms a covenant with the Jewish

people and promises to bless them if they stay faithful to the divine laws. Muslim mystics, known as sufis, also claim to have a special and intimate relationship with God.

Gods of nature. In the Shinto religion of Japan, gods are thought to reside in particular trees, rocks, and streams. In other societies where natural forces are an important part of life, gods have also been identified with nature. For example, a major god in the Yoruba religion of Africa is the god of iron. In the religion of the Hopi Indian tribe, divine spirits are identified with eagles, foxes, and buffaloes. In ancient Mesopotamia, there were gods of the sky, water, and wind, and in ancient Egypt the central god was Re, god of the sun.

Ideas about God. There are many ways of thinking about God. Agnostics question the existence of God. Atheists deny the existence of God. Theists believe that a Supreme Being exists. Theology is the study of ideas about God. Experts in this study are called theologians.

Many theologians have used rational arguments to defend the existence of God. Some have developed cosmological arguments, which state that a first cause must have begun the process of creation, a cause that must be God. Others have set forth teleological arguments based on belief in a grand design or purpose for the world that only a supreme God could have created.

Some Christian theologians in the 1960's suggested that "God is dead." They argued that the traditional image of God as a father figure with supernatural powers does not reflect the modern world's scientific view of reality. Other theologians have kept the idea of God but used names that are not personalized or limited, such as "the unconditioned ultimate" and "the wholly other."

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RELIGION

No simple definition can describe the numerous religions in the world. For many people, religion is an organized system of beliefs, ceremonies, practices, and worship that center on one supreme God, or the Deity. For many others, religion involves a number of gods, or deities. Some people have a religion in which no specific God or gods are worshiped. There are also people who practice their own religious beliefs in their own personal way, largely independent of organized religion. But almost all people who follow some form of religion believe that a divine power created the world and influences their lives.

People practice religion for several reasons. Many people throughout the world follow a religion simply because it is part of the heritage of their culture, tribe, or family. Religion gives many people a feeling of security because they believe that a divine power watches over them. These people often ask the power for help or protection. Numerous people follow a religion because it promises them salvation and either happiness or the chance to improve themselves in a life after death. For many people, religion brings a sense of individual fulfillment and gives meaning to life. In addition, religion provides answers to such questions as What is the purpose of life? What is the final destiny of a person? What is the difference between right and wrong? and What are one's obligations to other people? Finally, many people follow a religion to enjoy a sense of kinship with their fellow believers.

There are thousands of religions in the world. The eight major ones are Buddhism, Christianity, Confucianism, Hinduism, Islam, Judaism, Shinto, and Taoism. Of these eight religions, Hinduism, Shinto, and Taoism developed over many centuries. Each of the other religions traditionally bases its faith on the life or teachings of specific individuals. They are Prince Siddhartha Gautama, who became known as Gautama Buddha, for Buddhism; Jesus Christ for Christianity; Confucius for Confucianism; Muhammad for Islam; and Abraham and Moses for Judaism.

The religions that trace their history to individuals follow a general pattern of development. During the individual's lifetime or soon after his death, a distinctive system of worship ceremonies grew up around his life and teachings. This system, called a cult, became the basis of the religion. The heart of the cult is the individual's teachings. In addition to inspiring worship, the individual represents an ideal way of life that followers try to imitate.

The teachings of religions have shaped the lives of people since prehistoric times. Judaism, Islam, and especially Christianity have been major influences in the formation of Western culture. These three faiths, particularly Islam, have also played a crucial role in the development of Middle Eastern culture. The cultures of Asia have been shaped by Buddhism, Confucianism, Hinduism, Shinto, and Taoism.

Religion has been a supreme source of inspiration in the arts. Some of the most beautiful buildings in the world are houses of worship. Much of the world's greatest music is religious. Religious stories have provided countless subjects for paintings, sculptures, literature, dances, and motion pictures.

The earliest recorded evidence of religious activity dates from only about 60,000 B.C. However, anthropologists and historians of religion believe that some form of religion has been practiced since people first appeared on the earth about 2 million years ago. Experts think prehistoric religions arose out of fear and wonder about natural events, such as the occurrence of storms and earthquakes and the birth of babies and animals. To explain why someone died, people credited supernatural powers greater than themselves or greater than the world around them.

Prehistoric people centered their religious activities on the most important elements of their existence, such as the prosperity of their tribe and getting enough food to survive. They often placed food, ornaments, and tools in graves. They believed that these items would be useful to or desired by dead people. Prehistoric people drew pictures and performed dances that were intended to promote the fertility of women and animals and to ensure good hunting. They also made sacrifices for the same reasons.

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TROJAN WAR

Trojan War was a conflict in which ancient Greece defeated the city of Troy. The legend of the war inspired many leading works of classical literature. Some of the events that occurred during and after the Trojan War became the subject of three great epic poems--the *Iliad* and the *Odyssey*, attributed to the Greek poet Homer, and the *Aeneid* by the Roman poet Virgil. The heroes and victims of the war were portrayed in such Greek tragedies as *Agamemnon* by Aeschylus, *Ajax* by Sophocles, and *The Trojan Women* by Euripides.

Scholars do not agree about the truth behind the legend of the Trojan War. Some of them believe it distorts and exaggerates small conflicts involving the Greeks from about 1500 to 1200 B.C. Others think the legend is based on one great war, which most say probably took place during the mid-1200's B.C. The Homeric epics combine historical material of different times with fictional material. As a result, the works are not reliable historical documents. But archaeologists have found historical evidence in the ruins of Troy and other places that confirms certain events described in the epics.

The beginning of the war. According to ancient Greek myths, the Trojan War resulted from an incident at the wedding feast of Peleus, the king of Phthia, and Thetis, a sea goddess. All the gods and goddesses had been invited except Eris, the goddess of discord. Eris was offended and tried to stir up trouble. She sent a golden apple inscribed "For the most beautiful." Three goddesses--Hera, Athena, and Aphrodite--each claimed the apple, and a quarrel began. Paris, the son of King Priam of Troy, judged the dispute. He awarded the apple to Aphrodite because she promised him Helen, the most beautiful woman in the world.

Helen was already married to King Menelaus of Sparta. But when Paris visited her, she fled with him to Troy. Menelaus and his brother, Agamemnon, organized a large Greek expedition against Troy to win Helen back. The Greek army included such heroes as Achilles, Ajax the Greater, Nestor, and Odysseus (Ulysses in Latin).

The siege of Troy. The Greek army laid siege to Troy for 10 years but could not conquer the city. The *Iliad* describes some of the events that occurred during the last year of the struggle. The war began to go badly for the Greeks after Achilles, their bravest warrior, left the battlefield. Achilles refused to fight because Agamemnon, the Greek commander, had insulted him. The Trojans, led by Hector, drove the Greeks back to their ships. Achilles finally returned to combat after his best friend, Patroclus, had been slain by Hector. Achilles killed Hector to avenge Patroclus' death.

The *Iliad* ends with Hector's funeral, and Greek legends relate events that followed. The Trojans received help from their allies, the Ethiopians and an army of women warriors called Amazons. But Achilles enabled the Greeks to defeat their enemies by killing Penthesilea, the queen of the Amazons, and Memnon, the king of the Ethiopians. Paris, aided by the god Apollo, later shot Achilles in the heel with an arrow and killed him.

The fall of Troy is described in the *Aeneid*. The Greeks built a huge wooden horse, which has become known as the Trojan horse, and placed it outside the walls of Troy. Odysseus and other warriors hid inside the horse while the rest of the Greek army sailed away.

The prophetess Cassandra and the priest Laocoon warned the Trojans against taking the horse into their city. But Sinon, a Greek prisoner, persuaded them that the horse was sacred and would bring the protection of the gods. The Trojans then pulled the horse into Troy. That night they fell asleep after celebrating their apparent victory. Odysseus and his companions then crept out of the horse and opened the city gates for the rest of their warriors, who had returned from a nearby island. The Greeks took back Helen, killed almost all the Trojans, and burned Troy. According to the *Aeneid*,

the few Trojan survivors included the warrior Aeneas, whose descendants founded Rome.

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HUNTING

Hunting is the attempt to capture or kill wild animals. At one time, people had to hunt for their food. Today, most people hunt because they enjoy it as a sport. Hunting enthusiasts see it as a contest between the hunter and the hunted. Hunters have weapons, but animals move faster, know the outdoors better, and can smell and hear better.

Kinds of hunting depend on the game being hunted, the location, and the methods used to catch the animal. Upland hunters shoot pheasants, quail, grouse, and other game birds found in farm country. Waterfowl hunters shoot ducks and geese from boats or from blinds, hiding places made from such materials as tall grass or twigs. These hunters also use decoys (artificial ducks) and calls to deceive ducks and lure them closer. Other hunters use calls that imitate injured prey to attract carnivorous (meat-eating) animals, such as bears and mountain lions.

Most hunters use a rifle or shotgun to kill game. In North America, high-velocity (high-speed) rifles are used to hunt such big game as white-tailed deer, black bear, mule deer, elk, and pronghorns. People use small-caliber rifles to shoot smaller game, including cottontail rabbits, foxes, and squirrels. Shotgun shells filled with small pellets called bird shot are used to shoot ducks, upland game, and migratory game birds. Deer hunters sometimes use larger shot called buckshot. Many people also hunt with bows and arrows, pistols, muzzleloading rifles, and crossbows.

Some types of dogs are bred especially for hunting. A bird dog is trained to locate birds or to bring back birds shot by the hunter. Hounds are trained to follow the scent of game animals, including cottontail rabbits and raccoons. Pointing dogs, such as pointers and Brittanys, find game by scent and then point (alert the hunter to the game by standing in a rigid position). Retrievers swim to get waterfowl shot by the hunter.

Opposition to hunting. Some people say hunting unnecessarily kills animals and endangers species. They argue that hunters could enjoy nature and test their skills by tracking and photographing animals instead of killing them. However, hunters say the sport helps keep deer and other animals from multiplying so rapidly that they exceed the food supply or even damage their environment. State and federal laws prohibit the hunting of endangered or threatened species.

Game laws. All states in the United States and Mexico and all provinces in Canada have laws that regulate hunting. These game laws control the kind and number of animals that can be killed, the hunting methods to be used, and when and where game can be hunted. In the United States, the state agencies that enforce these laws are funded mostly by license fees, and partly by federal taxes on hunting equipment. About 16 million people buy hunting licenses each year in the United States. States and the federal government have also set up refuges, areas where strict hunting rules apply or hunting is prohibited.

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RECREATION

Recreation is an activity that people voluntarily pursue for personal enjoyment or satisfaction, usually during their free time. Recreation takes a wide variety of forms and occurs in many different places, depending on the choice of the individual. Some recreation is passive, such as watching television. Many people enjoy extremely active forms of recreation, such as jogging or participating in sports. Since the 1940's, recreation has become an important element in modern life. Higher incomes and improvements in working conditions and transportation have given many people more money, time, and mobility for recreation. Today, recreation is a major industry. By the early 1980's, Americans were spending more than \$200 billion annually on recreation. Many companies provide facilities and equipment for commercial recreational use. Popular facilities include motion-picture theaters, bowling lanes, campgrounds, resorts, golf courses, tennis centers, and theme parks. A number of companies manufacture merchandise for recreation, such as sports equipment and camping supplies. Recreation provides pleasure for millions of people, but it may also make an important contribution to an individual's mental and physical health. For example, hospitals often organize recreational activities under trained supervisors as therapy for patients.

Kinds of recreation. The most popular kind of recreation is watching television. On the average, a TV set in an American home is in use about seven hours a day.

Hobbies are an important form of recreation for millions of people. Many families engage in gardening. Stamp collecting is a very popular hobby. Games such as bridge and chess are a common type of recreation.

Many people concentrate on outdoor forms of recreation. The 10 most popular types of recreation in the United States are (1) visiting zoos, aquariums, fairs, and carnivals; (2) picnicking; (3) automobile driving for pleasure; (4) walking or jogging; (5) swimming; (6) travel; (7) watching sports events; (8) participating in sports and games; (9) fishing; and (10) taking nature walks.

For many people, attending cultural events is a favorite form of recreation. Such people may attend museum exhibits, theater performances, or concerts.

Opportunities for recreation. Private businesses, service organizations, and government agencies all provide opportunities for recreational activities. Many companies offer organized recreation for their employees, such as softball leagues and bowling tournaments. Community recreation services are provided by boys clubs, scouting organizations, and religious groups.

Local, state or provincial, and national government agencies provide many recreational services.

Most local governments have a recreation and parks department responsible for maintaining facilities and offering programs. These services are financed by taxes and fees.

At the state or provincial and national levels, opportunities for recreation are primarily provided through parks.

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OXFORD UNIVERSITY

Oxford University is the oldest university in Britain and one of the world's most famous institutions of higher learning. Oxford University started to develop during the 1100's. It is in Oxford, England, about 50 miles (80 kilometers) northwest of London.

The university has over 13,000 students. It consists of 35 colleges, plus 5 private halls established by various religious groups. Three of the 5 private halls are for men only. Of the colleges, St. Hilda's and Somerville are for women, and the rest are for men and women. The coeducational colleges include All Souls, Christ Church, Jesus, Lady Margaret Hall, Magdalen, Nuffield, St. John's, and Trinity. At Oxford, each college is a corporate body distinct from the university and is governed by its own head and fellows. Most fellows are college instructors called tutors, and the rest are university professors, readers, and lecturers. Each college manages its own buildings and property, elects its own fellows, and selects and admits its own undergraduate students. The university provides some libraries, laboratories, and other facilities, but the colleges take primary responsibility for the teaching and well-being of their students.

Educational program. Each student at Oxford is assigned to a tutor, who supervises the student's course of study, primarily through tutorials. Tutorials are weekly meetings of one or two students with their tutor. Students may see other tutors for specialized instruction. They may also attend lectures given by university teachers. Students choose which lectures to attend on the basis of their own special interests and on the advice of their tutor.

The university, not the individual colleges, grants degrees. The first degree in the arts or sciences is the Bachelor of Arts with honors. Oxford also grants higher degrees, diplomas, and certificates in a wide variety of subjects.

The Rhodes scholarship program enables students from the United States, Canada, and many other nations to study at Oxford for a minimum of two years. The British government grants Marshall scholarships to citizens of the United States for study at Oxford and other universities that are located in Britain.

History. During the 1100's, a university gradually developed from a number of schools in the city of Oxford. Its development was aided by a break in relations between England and France in 1167. Hostility between the two nations prevented English students from attending the University of Paris, and many of them went to Oxford instead. The university received its first official recognition in 1214.

The three oldest Oxford colleges--University, Balliol, and Merton--date from the 1200's. Twelve more colleges were founded between 1300 and 1555. The first colleges for women were established during the late 1800's. The university did not grant degrees to women until 1920.

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EFFICIENT LEARNING

Readiness to learn. Learning occurs more efficiently if a person is ready to learn. This readiness results from a combination of growth and experience. Children cannot learn to read until their eyes and nervous systems are mature enough. They also must have a sufficient background of spoken words and prereading experience with letters and pictures.

Motivation. Psychologists and educators also recognize that learning is best when the learner is

motivated to learn. External rewards are often used to increase motivation to learn. Motivation aroused by external rewards is called extrinsic motivation. In other cases, people are motivated simply by the satisfaction of learning. Motivation that results from such satisfaction is called intrinsic motivation. This type of motivation can be even more powerful than extrinsic motivation. Punishment, particularly the threat of punishment, is also used to control learning. Experiments have shown that intrinsic and extrinsic rewards serve as more effective aids to learning than punishment does. This is due largely to two factors: (1) learners can recognize the direct effects of reward more easily than they can the effects of punishment; and (2) the by-products of reward are more favorable. For example, reward leads to liking the rewarded task, but punishment leads to dislike of the punished deed.

Psychologists also look at the motivation of learning from the point of view of the learner. They tend to talk about success and failure, rather than reward and punishment. Success consists of reaching a goal that learners set for themselves. Failure consists of not reaching the goal. An ideal learning situation is one in which learners set progressively more difficult goals for themselves, and keep at the task until they succeed.

Skill learning and verbal learning. Through research, psychologists have discovered some general rules designed to help a person learn. The following rules apply particularly to learning skills. (1) Within a given amount of practice time, you can usually learn a task more easily if you work in short practice sessions spaced widely apart, instead of longer sessions held closer together. (2) You can learn many tasks best by imitating experts. (3) You should perform a new activity yourself, rather than merely watch or listen to someone. (4) You learn better if you know immediately how good your performance was. (5) You should practice difficult parts of a task separately and then try to incorporate them into the task as a whole.

Two additional rules apply mainly to verbal learning. (1) The more meaningful the task, the more easily it is learned. You will find a task easier to learn if you can relate it to other things you have learned. (2) A part of a task is learned faster when it is distinctive. When studying a book, for example, underlining a difficult passage in red makes the passage distinctive and easier to learn.

Transfer of training. Psychologists and educators recognize that new learning can profit from old learning because learning one thing helps in learning something else. This process is called transfer of training. Transfer of training can be either positive or negative. Suppose a person learns two tasks. After learning Task 1, the person might find Task 2 easier or harder. If Task 2 is easier, then the old learning has been a help and positive transfer of training has occurred. If Task 2 is harder, the old learning is a hindrance and negative transfer has occurred.

Whether transfer is positive or negative depends on the relationship between the two tasks. Positive transfer occurs when the two tasks have similar stimuli and both stimuli elicit the same response. For example, if we know the German word *gross*, it is easier to learn the French word *gros* because both words mean large. In this case, similar stimuli (*gross* and *gros*) elicit the same response (large).

Negative transfer occurs when the two tasks have similar stimuli, which elicit different responses. After you learn the German word *Gras* (grass), it is harder to learn the French word *gras* (fat). The words are similar, but they have different meanings. In this case, similar stimuli (*Gras* and *gras*) elicit different responses. Psychologists believe new learning can profit from old learning because of three factors: (1) positive transfer of training, (2) general principles that we learn in one task and apply to another task, and (3) good study habits that we learn in one task which help us learn another task.

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MEMORY

Memory experts believe that people can, with practice, increase their ability to remember. One of the most important means of improving memory is the use of mental aids called mnemonic devices. Other techniques can also be used to help people improve their memory.

Mnemonic devices include rhymes, clues, mental pictures, and other methods. One of the simplest ways is to put the information into a rhyme. Many people remember the number of days in each month by using a verse that begins, "Thirty days hath September. . . ."

Another method provides clues by means of an acronym, a word formed from the first letters or syllables of other words. For example, the acronym *homes* could help a person remember the names of the Great Lakes--Huron, Ontario, Michigan, Erie, Superior. A mental picture can be provided by the key-word method, which is particularly useful in learning foreign words. Suppose you want to remember that the German word *Gabel* (pronounced GAH behl) means fork. First, you think of a key word in English that sounds like the foreign word--for example, *gobble*. Next, you connect the two

words through a mental image, such as that of a person gobbling food with a fork. From then on, to recall the meaning of Gabel, you would remember gobble and the stored image linking it to fork. Mental pictures can also be used to remember names. When you meet a person for the first time, pick out a physical feature of the individual and relate it to his or her name. For example, if you meet a very tall man named Mr. Shackley, imagine his bumping his head on the roof of a shack. In the future, this image will help you remember his name when you see or think of him.

Mnemonic techniques work best for remembering lists of specific items, such as words or objects. They do not work well for learning complex materials, such as stories and poems. For this reason, many psychologists favor more general strategies for improving memory.

Other ways to improve memory. A good way to help remember a piece of information is to rehearse (repeat) it a number of times. You can rehearse aloud or quietly to yourself. The more you rehearse, the more lasting the memory will be. In addition to repeating the information over and over, rehearsal also can involve elaborating upon the information. For example, suppose you want to remember the year that the telephone was invented--1876. You might elaborate upon this information by reminding yourself that the Declaration of Independence was signed 100 years earlier. Another memory aid involves making the surroundings in which you remember material similar to those in which you learned the material. For this reason, football coaches often require players to practice under conditions similar to those of an actual game.

Exceptionally good memory. You sometimes hear of someone who has a "photographic memory," which supposedly works like a camera taking a picture. A person with such a memory would be able to take a quick mental picture of a textbook page or a scene. Later, the person could describe the page or scene perfectly by causing the image to reappear in his or her mind.

No one actually has a photographic memory. However, some people have a similar ability called eidetic imagery. An eidetic image is a picture that remains in a person's mind for a few seconds after a scene has disappeared. People who have eidetic imagery can look at a scene briefly and then give a thorough description of the scene based on a mental image. But the image fades quickly and may be inaccurate. Eidetic imagery is rare. Only 5 to 10 percent of all children have this ability, and most of them lose it as they grow up. Certain people possess an exceptionally good memory. They may be able to memorize the names of all the state capitals or hundreds of names and numbers from a telephone book. When such exceptional memory occurs in people with mental handicaps, psychologists refer to this condition as savant syndrome.

Deja vu is the feeling of having already experienced a situation that is actually happening for the first time. For example, a person who goes to a restaurant in a foreign city for the first time may have the overwhelming sensation of having been there before. Episodes of deja vu occur most often in people who have epilepsy. Deja vu is a French term meaning already seen.

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THE ROLE OF ARMIES

In war, a nation uses its army to conquer enemy territory and to defend itself from attack. In peacetime, an army can help prevent war. It also aids civilians in certain emergencies.

Attack. A nation may seek to take over territory held by an enemy by conducting offensive operations. The attacker's tanks and other armored vehicles invade the enemy's territory, with planes and artillery supporting the advance. Other planes drop airborne troops behind enemy lines, and helicopters carry in specially trained soldiers, sometimes called special forces or commandos, to seize certain key positions. Later, mechanized infantry sweeps in and occupies the conquered territory.

Defense. An army is trained for both offensive and defensive combat operations. But some units may be assigned to fight only in case of an enemy attack. In the past, fortifications along borders formed the main line of defense for many countries. But modern armies do not rely nearly as much on fortifications, which can often be bypassed with airborne assaults or by the combined action of land, sea, and air forces.

Prevention of war. A powerful nation may sometimes station troops in politically troubled regions or in areas threatened by attack. Such a show of military strength may help prevent war. In 1991, for example, French and Belgian troops went to Zaire--now Congo (Kinshasa)--to restore order after Zairian soldiers rioted.

The development of tactical nuclear weapons in the 1950's gave armies an important defensive strategy. These weapons are designed to be used in areas where a conventional war is being fought. An army that massed its men and equipment was vulnerable to a nuclear attack. The fear of such an

attack could prevent a nation from invading an enemy. This idea, known as deterrence, was used by the Soviet Union and Western nations from the end of World War II in 1945 to the late 1980's, a period of hostility known as the Cold War.

Internal security and civilian aid. Armies may be used by a nation for roles other than combat. In some countries, armies serve as an internal police force. In others, regular or reserve forces may serve in a multitude of roles that include disaster relief, humanitarian aid to foreign nations, and peacekeeping functions. They may respond to major disasters, such as forest fires or hurricanes, in order to provide emergency medical aid and food and water distribution, or to prevent looting.

THE WORLD'S MAJOR ARMIES

An army's ranking among the armies of the world is based on its overall fighting strength. In general, fighting strength depends on the number of troops on active duty. However, an army's size does not necessarily reflect its actual strength. Well-trained soldiers and modern weapons are also important. A small army with tactical nuclear weapons may have greater striking power than a large army with outdated weapons.

The world's major armies include those of China, India, North Korea, Russia, the United States, France, and the United Kingdom. All of these armies except India's and North Korea's have tactical nuclear weapons. However, both India and North Korea have the capability to produce such weapons.

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COMPUTER

Computer is a device that processes information with astonishing speed and accuracy. Computers process information by helping to create it and by displaying it, storing it, reorganizing it, calculating with it, and communicating it to other computers. Computers can process numbers, words, still pictures, moving pictures, and sounds. The most powerful computers can perform tens of billions of calculations per second.

The computer has changed the way we work, learn, communicate, and play. Virtually every kind of organization throughout the world conducts business with computers. Students, teachers, and research scientists use the computer as a learning tool. Millions of individuals and organizations communicate with one another over a network of computers called the Internet. Computer games entertain people of all ages.

Almost all computers are electronic digital computers. They are electronic in their use of electric current (a flow of electric charge) to carry information. They are digital in that they process information as units of electric charge representing numbers. The word digital means having to do with numbers.

To enable a computer to process information that is not numerical--such as words, pictures, or sounds--the computer or some other device must first digitize that information. A device digitizes information by translating it into charges that represent numbers. After the computer processes the digitized information by working with the charges, the computer or a device connected to the computer translates its results back into their original form.

Thus, an artist might use a machine called a scanner to digitize a photograph. The artist would next process the resulting electric charges in a computer to change the photograph--perhaps to add a border. The artist would then use a printer connected to the computer to produce a copy of the altered photo.

Digital computers are one of two general kinds of computers. The other kind are calculating devices called analog computers. An analog computer represents amounts with physical quantities, such as distances along a scale, rather than with numbers. The remainder of this article deals with digital computers. For more information on analog computers.

The technology of computer hardware (the physical parts of computer systems) has advanced tremendously since 1946, when the first electronic digital computer was built. That machine filled a huge room. Today, a single microprocessor, a device the size of a fingernail, can do the same work as that pioneering machine.

The technology of software (programs, or sets of computer instructions and information) is also advancing rapidly. Early users of computers wrote their own software. Today, most users buy programs created by companies that specialize in writing software. Hundreds of thousands of different programs are available for businesses and individuals.

Because of advances in hardware and software, the price of computing has dropped sharply. As a result, the number of computers in operation has risen rapidly ever since the first commercial digital

computers were manufactured in the 1950's. More than 10,000 computers were in operation worldwide by 1961. Ten years later, the number exceeded 100,000. By 1990, about 100 million computers were running. By the mid-1990's, the number had reached about 200 million.

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INTERNET

Internet is a vast network of computers that connects many of the world's businesses, institutions, and individuals. The Internet, which means interconnected network of networks, links tens of thousands of smaller computer networks. It enables computer users throughout the world to send and receive messages, share information in a variety of forms, and even play computer games with people thousands of miles away. Computers linked to the Internet range from simple and inexpensive personal computers, often called PC's, to huge mainframe computers used by government institutions, educational institutions, and businesses.

Computers require special hardware and software to connect to the Internet. Necessary hardware includes a modem, a device that translates a computer's digital information into signals that can be transmitted over telephone lines (MODEM). Required software includes a communications program that allows the transmission and receipt of messages.

The Internet, often called simply the Net, began as a collection of text-based information. But the development and rapid growth of a part of the Internet called the World Wide Web (also known as WWW or the Web), transformed the presentation of information on the Net. In addition to text, the Web allows the use of photographs, moving pictures, and sound to create presentations approaching the visual quality of television and the audio quality of recorded music.

USES OF THE INTERNET

The major uses of the Internet include communication, research, publishing, and sales.

Communication. Probably the most popular use of the Internet and the Web is e-mail, also called electronic mail. Virtually every Internet user is assigned an electronic address from which e-mail messages are sent and at which they are received. The Internet carries hundreds of millions of email messages each day.

Research. The Internet is like a vast library, containing as much knowledge on every subject as might be held in millions of books. Information is available in many forms, from files consisting only of text to multimedia files that combine text, photos, animation or video, software programs, and sound. Internet resources grow larger every day.

Because of the ease with which information is stored on computers, and the speed with which it can be accessed, the Internet is a popular first stop for many people performing research. A businessperson might search Internet resources for help in developing sales or product information. Students can access databases to find material related to homework assignments or courses of study. Physicians use the Net to compare medical treatments and to review advances in medical science. Scientists share research data on the Internet.

Publishing. Publishers are increasingly using the Internet as a medium for presenting newspapers, magazines, and books. Because information on the Net is electronic, the publisher is freed from the costs of paper, printing, and distribution. More importantly, the publisher can update information instantly, making it possible to distribute far more current news than could be provided on paper.

Sales. Many businesses use the Internet to carry on commerce. Retail establishments sell nearly every type of product over the Internet. Software publishers view the Net as a convenient and inexpensive way to distribute products. Over the Internet, users can buy new programs, sample programs before purchasing them, or receive upgrades to programs they already own. Users generally make Internet purchases with credit cards.

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MARIJUANA

Marijuana, also spelled marihuana, is a drug made from the dried leaves and flowering tops of the hemp plant. Marijuana has many psychological and physical effects. People usually smoke marijuana in cigarettes or pipes, but it also can be mixed with food and beverages. Almost all nations, including the United States and Canada, have laws that prohibit the cultivation, distribution, possession, and use of marijuana.

Marijuana has many nicknames, including grass, pot, and weed. It is also called cannabis, a word that comes from *Cannabis sativa*, the scientific name for hemp.

Effects. Marijuana contains more than 400 chemicals. When smoked, it produces over 2,000 chemicals that enter the body through the lungs. These chemicals have a variety of immediate,

short-term effects. In addition, the repeated use of marijuana has been linked to a number of longterm effects.

Short-term effects of marijuana include both psychological and physical reactions. These reactions usually last for three to five hours after a person has smoked marijuana. The psychological reaction, known as a high, consists of changes in the user's feelings and thoughts. Such changes are caused mainly by THC, a chemical in marijuana that impairs brain function.

The effects of a marijuana high vary from person to person and from one time to another in the same individual. In most cases, the high consists of a dreamy, relaxed state in which users seem more aware of their senses and feel that time is moving slowly. Sometimes, however, marijuana produces a feeling of panic and dread. The different reactions result partly from the concentration of THC in the marijuana. Other factors, such as the setting in which marijuana is used and the user's expectations, personality, and mood, also affect a person's reaction to the drug.

The short-term physical effects of marijuana include redness in the eyes and a rapid heartbeat. The drug also interferes with a person's judgment and coordination. Therefore, driving a motor vehicle while under the influence of marijuana is particularly dangerous.

Long-term effects of marijuana are not completely known. But studies have shown that some people who have used marijuana regularly for several months or longer develop serious problems. Use of marijuana harms memory and motivation. Some chronic users suffer bronchitis, coughing, and chest pains. Marijuana smoke also contains cancer-causing substances. Among males, marijuana use can reduce the production of sperm and of the male sex hormone testosterone. Among females, it can cause menstrual irregularity and reduced fertility. Extended use of marijuana also has a psychological effect on many people. These individuals lose interest in school, their job, and social activities.

Why people use marijuana. Most people who use marijuana begin to do so between the ages of 12 and 18. They try the drug because of curiosity. Some people believe marijuana improves their talents and capabilities. But scientists have found that marijuana impairs all abilities. A marijuana high gives some people a false sense of having important new ideas and achieving new understanding about life.

Many people who try marijuana use it only a few times or infrequently. However, others become regular users. Some regular users become dependent on the drug and have great difficulty in stopping its use.

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MOON

Moon is the earth's nearest neighbor in space. In 1969, this huge natural satellite of the earth became the first object in space to be visited by human beings.

The moon is the brightest object in the night sky, but it gives off no light of its own. When the moon "shines," it is reflecting (casting back) light from the sun. On some nights, the moon looks like a gleaming silver globe. On others, it appears as a thin slice of light. But the moon does not change its size or shape. Its appearance seems to change as different parts of it are lighted by the sun.

The moon travels around the earth once about every 27 $\frac{1}{3}$ days. The average distance between the centers of the earth and the moon is 238,857 miles (384,403 kilometers). A rocket journey from the earth to the moon and back takes about six days.

Because the moon is relatively close to the earth, it seems much larger than the stars and about the same size as the sun. The moon measures about 2,160 miles (3,476 kilometers) across. This distance is about a fourth the diameter of the earth and 400 times smaller than that of the sun. If the moon were seen next to the earth, it would look like a tennis ball next to a basketball.

The earth is not the only planet with a moon. For example, Jupiter has 16 known satellites. The earth's moon is the sixth largest of the more than 40 natural satellites of the planets. For more information on natural satellites, see the separate planet articles.

The moon has no life of any kind. Compared with the earth, it has changed little over billions of years. The moon has no air, wind, or water. On the moon, the sky is black--even during the day--and the stars are always visible. At night, the rocky surface becomes colder than any place on the earth. In the day, the temperature of the rocks is slightly higher than that of boiling water.

Through the centuries, people have gazed at the moon, worshiped it, and studied it. The long-time dream of traveling to the moon became history on July 20, 1969, when astronaut Neil A. Armstrong of the United States set foot on it.

Space flights and moon landings have provided many facts about the moon. Moon exploration has

also helped solve many mysteries about the earth, the sun, and the planets.

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ZEUS

Zeus was the ruler of the gods in Greek mythology. Zeus was a sky and weather god, especially associated with rain, thunder, and lightning. The Greeks believed he was all-knowing and all-seeing. The Greeks considered Zeus a father figure and a protector, especially of guests and strangers. The Roman god Jupiter was equivalent to Zeus.

Zeus was the son of Cronus and Rhea, members of an earlier race of ruling gods called the Titans. Zeus and the other children of Cronus defeated the Titans. Zeus then took Cronus' place and ruled from his home on Mount Olympus. He headed a family of 12 major gods and goddesses called the Olympians. Some lesser gods also lived on Olympus. Zeus's brothers were the gods Hades and Poseidon. Hades ruled the underworld, and Poseidon ruled the seas. The goddesses Demeter, Hera, and Hestia were Zeus's sisters.

At the time Zeus was introduced in Greece, the religion of that area was based on fertility. Each community had a major fertility goddess and a male god associated with her. Zeus eventually took the place of many of these male gods, and became the husband or lover of the goddesses. Later, Hera became Zeus's wife, and other goddesses took a lesser status.

Zeus had many love affairs with goddesses and mortal women and fathered many children. His children included the goddess Aphrodite; the gods Apollo, Dionysus, and Hermes; and the mortal heroes Perseus and Heracles (Hercules in Latin). Zeus alone gave birth to the goddess Athena. In art, Zeus is depicted as bearded and majestic, often holding a thunderbolt. The eagle and the oak tree were symbols associated with Zeus.

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PHOBIA

Phobia is a persistent, strong fear of a certain object or situation. Common phobias include fear of crowds, darkness, heights, and such animals as cats, snakes, or spiders. Phobic individuals may spend much time worrying about their fears and may be too frightened to carry out normal activities. Psychologists and psychiatrists classify phobias as an anxiety disorder, a mild psychological problem. Many phobias have special names. The fear of heights is acrophobia. Agoraphobia is the dread of open spaces, and claustrophobia is the fear of small places or of being closed in. Ailurophobia is the fear of cats, ophidiophobia the fear of snakes, and arachnophobia the fear of spiders. Other phobias include hydrophobia (fear of water), mysophobia (fear of dirt or germs), and xenophobia (fear of foreigners or strangers).

Therapists use numerous approaches to treat phobias. Two popular treatments are psychoanalysis and behavioral therapy, which are based on different ideas about the causes of psychological problems.

Sigmund Freud, an Austrian physician and the founder of psychoanalysis, believed that phobias and other psychological disorders are caused by unconscious desires. According to Freud, individuals repress (force into the unconscious mind) desires that they have been taught are bad. Freudians believe that a phobia is a symbolic expression of these repressed feelings, such as aggressive impulses or sexual drives, and of the punishment linked with the feelings in the unconscious. In psychoanalytic treatment of phobias, the therapist and patient try to uncover such repressed feelings. Psychoanalysts believe that when a patient fully understands the repressed feelings, the fear will disappear or become manageable.

Behavioral therapy holds that a phobia is a learned response and can be unlearned. Therapists using behavioral treatments often employ techniques that involve gradually exposing the phobic individual to whatever is feared. The exposure may take place in real life or in the person's imagination. For example, claustrophobic patients may imagine themselves in smaller and smaller rooms until they can visualize a tiny space without anxiety. The gradualness of the exposure is considered important in making the treatment effective and relatively painless. A popular technique called systematic desensitization combines gradual exposure with relaxation or other experiences to reduce anxiety. Many therapists who treat phobias conduct group therapy in addition to individual treatment. Group therapy enables phobic patients to talk with others who have the same fears and learn from one another. Some therapists also use hypnosis to help phobic patients face their fears.

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DEATH

Death is the end of life. Every living thing eventually dies, but human beings are probably the only creatures that can imagine their own deaths. Most people fear death and try to avoid thinking about it. But the awareness of death has been one of the chief forces in the development of civilization.

Throughout history, people have continually sought new medical knowledge with which to delay death. Philosophers and religious leaders have tried to understand the meaning of death. Some scholars believe that much human progress results from people's efforts to overcome death and gain immortality through lasting achievements.

Medical aspects of death. Scientists recognize three types of death that occur during the life of all organisms except those consisting of only one cell. These types are necrobiosis, necrosis, and somatic death.

Necrobiosis is the continual death and replacement of individual cells through life. Except for nerve cells, all the cells of an organism are constantly being replaced. For example, new skin cells form under the surface as the old ones die and flake off.

Necrosis is the death of tissues or even entire organs. During a heart attack, for example, a blood clot cuts off the circulation of the blood to part of the heart. The affected part dies, but the organism continues to live unless the damage has been severe.

Somatic death is the end of all life processes in an organism. A person whose heart and lungs stop working may be considered clinically dead, but somatic death may not yet have occurred. The individual cells of the body continue to live for several minutes. The person may be revived if the heart and lungs start working again and give the cells the oxygen they need. After about three minutes, the brain cells--which are most sensitive to a lack of oxygen--begin to die. The person is soon dead beyond any possibility of revival. Gradually, other cells of the body also die. The last ones to perish are the bone, hair, and skin cells, which may continue to grow for several hours.

Many changes take place after death. The temperature of the body slowly drops to that of its surroundings. The muscles develop a stiffening called rigor mortis. The blood, which no longer circulates, settles and produces reddish-purple discolorations in the lowest areas of the body.

Eventually, bacteria and other tiny organisms grow on the corpse and cause it to decay.

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MUMMY

Mummy is an embalmed body that has been preserved for thousands of years. The ancient Egyptians believed that the dead lived on in the next world, and that their bodies had to be preserved forever as they were in life. They believed that the body would serve a person in the next world and therefore spent much effort in developing methods of embalming. Thousands of years later, archaeologists found the preserved bodies in tombs. Many museums have one or more Egyptian mummies. The most famous are probably those of Ramses II and Tutankhamen, who were pharaohs (rulers) of Egypt.

Scientists now know what materials and processes the Egyptians used to mummify bodies. The process was simple when mummifying began, and gradually became more elaborate. Wealthy persons could afford a more expensive treatment than the poor. Ancient texts state that a complete treatment required 70 days. Embalmers removed the brain through a nostril by using a hook. They removed the internal organs, except the heart and kidneys, through an incision such as a surgeon makes. They usually filled the empty abdomen with linen pads, and sometimes with sawdust. Then they placed the body in natron (sodium carbonate) until the tissues were dried out. Finally, they wrapped the body carefully in many layers of linen bandages and placed it in a coffin. Sometimes there were two or more coffins, one inside the other. The coffins were made of wood or stone, and were either rectangular or shaped like the wrapped mummy. The mummy in its coffin was then placed in a tomb, along with many objects of daily use. The ancient Egyptians believed that the dead would need this equipment in the next world.

The dry climate in some parts of the world, such as Peru, Mexico, and Egypt, preserves dead bodies almost as well as Egyptian embalming methods did. Such naturally preserved bodies are sometimes called mummies also. The word mummy comes from mumiya, an Arabic word for embalmed body.

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PYRAMIDS

Pyramids are large structures with square bases and four smooth, triangular-shaped sides that come to a point at the top. Several ancient peoples used pyramids as tombs or temples. The most famous pyramids are those built about 4,500 years ago as tombs for Egyptian kings. These Egyptian pyramids are among the Seven Wonders of the Ancient World.

EGYPTIAN PYRAMIDS

The ruins of 35 major pyramids still stand near the Nile River in Egypt. Each was built to protect the body of an Egyptian king. The Egyptians thought that a person's body had to be preserved and protected so the soul could live forever. The Egyptians mummified (embalmed and dried) their dead and hid the mummies in large tombs. From about 2700 to 1700 B.C., the bodies of Egyptian kings were buried inside or beneath a pyramid in a secret chamber that was filled with treasures of gold and precious objects.

Many scholars believe that the pyramid shape has a religious meaning to the Egyptians. The sloping sides may have reminded the Egyptians of the slanting rays of the sun, by which the soul of the king could climb to the sky and join the gods.

Funeral ceremonies were performed in temples that were attached to the pyramids. Most pyramids had two temples that were connected by a long stone passageway. Sometimes a smaller pyramid for the body of the queen stood next to the king's pyramid. Egypt has at least 40 smaller pyramids that were used for queens or as memorial monuments for kings. The king's relatives and officials were buried in smaller rectangular tombs called mastabas. These buildings had sloping sides and flat roofs. A study of the Great Pyramid shows how these gigantic structures were built. The ancient Egyptians had no machinery or iron tools. They cut big limestone blocks with copper chisels and saws. Most of the stones came from quarries nearby. But some came from across the Nile River, and others came by boat from distant quarries. Gangs of men dragged the blocks to the pyramid site and pushed the first layer of stones into place. Then they built long ramps of earth and brick, and dragged the stones up the ramps to form the next layer. As they finished each layer, they raised and lengthened the ramps. Finally, they covered the pyramid with an outer coating of white casing stones. They laid these outer stones so exactly that from a distance the pyramid appeared to have been cut out of a single white stone. Most of the casing stones are gone now, but a few are still in place at the bottom of the Great Pyramid.

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BOXING

The beginning of modern boxing. Boxing almost disappeared as a sport until the late 1600's, when it reappeared in England. However, it remained a cruel sport, and many fighters were crippled, blinded, or even killed while fighting.

In the early 1700's, James Figg, one of England's most famous athletes, introduced modern boxing. In Figg's day, boxing involved much wrestling. Figg became successful by punching instead of wrestling. In 1719, he opened a boxing school in London and began to teach his style of bareknuckle (gloveless) fighting.

Figg's boxing rules were still brutal, however. For example, one rule required that boxers continue to fight without rest periods until one man could not go on. In 1743, Jack Broughton, a well-known British boxer, introduced new rules. Under Broughton's rules, a fight ended when one man was knocked down and could not get up within 30 seconds. However, bouts were still continuous. Broughton's rules, with some additions, became standard for all bouts. They were known as the London Prize Ring Rules, and they helped make boxing less savage.

From bare knuckles to gloves. In the mid-1860's, the Marquess of Queensberry, a British sportsman, sponsored a new boxing code of 12 rules. In 1872, the Queensberry Rules were first used in a professional tournament in London. They have been used throughout the world ever since with only slight changes. The rules require boxers to wear gloves. They also call for three-minute rounds with a one-minute rest period between rounds. The rules further state that a man down on one knee may not be struck and that a fallen man must be given 10 seconds to get back on his feet.

During the 1850's and 1860's, British boxers visited the United States, where they tried to create greater interest in boxing. But many Americans opposed the sport. It was also illegal in many areas. The matches themselves drew only small crowds that watched boxers battle with bare knuckles. In 1882, John L. Sullivan, an American, claimed the world bare-knuckle championship. But he realized that there was no future in bare-knuckle fighting and that the police allowed matches held under the Queensberry Rules. Sullivan therefore joined a traveling theatrical group and staged gloved boxing matches throughout the country. Huge crowds turned out to watch these exhibitions.

During the 1880's, Sullivan occasionally took time off from theatrical appearances to defend his bareknuckle

championship. He defended the title the last time in 1889, when he defeated Jake Kilrain in

the 75th round. The fight was the last world heavyweight bare-knuckle championship ever fought. In 1892, Sullivan fought James J. Corbett to decide the heavyweight championship under the Queensberry Rules. Corbett knocked out Sullivan in the 21st round.

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HOW PREGNANCY AFFECTS WOMEN

During pregnancy, a woman's body undergoes enormous changes. Many changes result from increased levels of the hormones estrogen and progesterone in the woman's blood. During pregnancy, these hormones are secreted into the bloodstream primarily by the placenta. The placenta also produces certain other hormones that trigger changes in a woman's body. To help describe when changes occur in the woman and her developing baby, pregnancy is often divided into three three-month periods called trimesters.

Weight gain. Women normally gain between 25 and 35 pounds (11 and 16 kilograms) during pregnancy. Several factors affect the amount gained, including a woman's weight at the start of pregnancy and the number of babies she is carrying. At birth, the baby accounts for about 6 1/2 to 8 pounds (3 to 3.5 kilograms) of the weight gained and the placenta about 1 to 1 1/2 pounds (0.5 to 0.7 kilogram). The rest of the weight is mainly fat, blood and other fluids, and extra tissue in the breasts and uterus.

Changes in breasts. A woman's breasts change in certain ways throughout pregnancy so that they can produce milk to feed the baby after birth. For example, the glands in the breasts that make the milk and the ducts (tubes) that carry the milk to the nipples both enlarge. The breasts themselves become larger and more tender. The lactation (milk-making) process begins soon after the baby is born.

Changes in the uterus prepare a woman's body for the birth process, also called labor. During labor, contractions of the uterus and abdomen push the baby out of the woman's body through the vagina. The uterus expands to about 24 times its normal size during pregnancy, mostly because the muscle cells in the wall of the organ increase in size. Around the sixth month of pregnancy, the uterus begins to have irregular contractions that may be mild or intense.

Other common symptoms of pregnancy. During the first trimester, hormonal changes cause many women to experience morning sickness (nausea and vomiting). By about the fourth month, however, morning sickness usually lessens or disappears.

Many pregnant women experience increased fatigue and the need to urinate frequently. Hormonal changes, weight gain, and other changes in the woman's body contribute to fatigue. Frequent urination results mainly from the expanding uterus pressing on the bladder.

Other symptoms caused or made worse by the uterus pressing on organs include back pain, shortness of breath, discomfort in the pelvic region, heartburn, and constipation. In addition, varicose veins (enlarged veins in the legs) and hemorrhoids (enlarged veins around the anus) may occur.

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BIRTH CONTROL

Most birth control methods are designed to prevent conception and are called contraceptives. The most effective contraceptive method is surgical sterilization. The operation can be performed on both men and women. It makes conception impossible by blocking the sperm ducts in men or the fallopian tubes in women. Such an operation is called a vasectomy on a male. On a female, it is called a laparoscopic sterilization, a tubal ligation, or a tubectomy, depending on the procedure used. These operations can seldom be reversed if a couple later desires to have children.

Other highly effective contraceptive methods involve the use of hormone drugs in order to prevent pregnancy. Oral birth control pills contain the sex hormones estrogen and progesterone. These drugs, also called oral contraceptives, hinder both the normal release of an egg once a month and the attachment of an egg to the uterus. Birth control pills are relatively expensive, require regular use to prevent pregnancy, and may produce harmful side effects in some women. In many developing nations, hormone drugs may be injected into the body. The injections must be given every 90 days and are as effective as birth control pills. In addition, contraceptive implants that contain hormone drugs are available in some countries, including the United States and Canada. The implants consist of tiny capsules that are surgically placed under the skin. The capsules slowly release hormone drugs into the body. The implants must be replaced periodically by a doctor and may be removed if pregnancy is desired.

Intrauterine devices, also called IUD's, are another highly effective method of contraception. An IUD

is a tiny device made of plastic and metal. It is inserted into the uterus. Doctors are not yet sure how IUD's prevent pregnancy. When a woman wishes to become pregnant, she has the device removed. IUD's are relatively inexpensive and they require little attention for most women. But some users experience undesirable side effects. Such effects cease when the IUD is removed. There are also several other methods of contraception. The condom is a thin sheath worn over the penis during sexual intercourse. Sperm are trapped inside the condom. The diaphragm and the cervical cap are devices that are inserted into the vagina so that they cover the opening of the uterus. A spermicide--a drug that kills sperm--must be applied to the diaphragm or cervical cap. These devices then hold the spermicide near the opening of the uterus. A spermicide-treated device called the vaginal sponge works on similar principles as the diaphragm and the cervical cap. Vaginal spermicides, in the form of creams, gels, and suppositories, can be used by themselves, but they are less effective in preventing conception. An even less effective method is withdrawal, in which the male attempts to withdraw the penis from the vagina before the sperm are released.

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CATS

Cat is a favorite pet of people around the world. Cats are intelligent and have an independent nature. These small animals can also be playful and entertaining. Many cats make affectionate, loyal pets, providing companionship for people of all ages. About 55 million cats are kept as pets in the United States. About 4 million pet cats live in Canada.

The word cat also refers to a family of meat-eating animals that includes tigers, lions, leopards, and panthers. This family also includes domestic cats--that is, those that people keep as pets. Domestic cats and their wild relatives share many characteristics. All these animals have long, powerful bodies and somewhat rounded heads. They have short, strong jaws and 30 sharp teeth. Cats are also skillful hunters. They are able to catch other animals by approaching them swiftly and quietly on padded feet. Or they may wait motionless until an animal comes close and then spring upon it suddenly.

This article deals with domestic cats. These animals have many special physical abilities. They see better in dim light than people do. They can climb trees, run at a high speed, and leap long distances. Cats also have a keen sense of balance and can easily walk along the tops of narrow fences or along narrow ledges. When cats fall, they almost always land on their feet.

Cats vary in personality and in certain physical features, such as the length and color of their coats. There are many breeds of cats. Special characteristics set each breed apart from all others. Among the favorite breeds are the Siamese and the Persian.

No one knows exactly when the first cats were tamed. But some authorities believe cats were tamed about 5,000 years ago. Throughout history, people have valued cats for their skill at hunting and killing mice, rats, and snakes. Cats help keep farms, homes, and businesses free of these pests. The ancient Egyptians considered cats sacred. Today, people in many societies believe cats bring good fortune. But some people associate cats with bad luck and so fear them. Many people find cats mysterious because they move swiftly and silently and because their eyes seem to glow in the dark. The grace and beauty of cats have made them favorite subjects of artists throughout history. Cats have also been featured in almost every type of literature. They appear in the mythology of ancient Greece and Rome. Hundreds of years ago, Oriental writers praised cats in their stories and poems. Cats are also commonly mentioned in the fairy tales, folklore, and legends of many countries. In modern times, books, comic strips, motion pictures, and television programs have featured cats.

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DEMOCRACY

Democracy is a form of government, a way of life, a goal or ideal, and a political philosophy. The term also refers to a country that has a democratic form of government. The word democracy means rule by the people. United States President Abraham Lincoln described such self-government as "government of the people, by the people, for the people."

The citizens of a democracy take part in government either directly or indirectly. In a direct democracy, also called a pure democracy, the people meet in one place to make the laws for their community.

The characteristics of democracy vary from one country to another. But certain basic features are more or less the same in all democratic nations.

Free elections give the people a chance to choose their leaders and express their opinions on issues. Elections are held periodically to ensure that elected officials truly represent the people. The

possibility of being voted out of office helps assure that these officials pay attention to public opinion. In most democracies, the only legal requirements for voting or for holding public office have to do with age, residence, and citizenship. The democratic process permits citizens to vote by secret ballot, free from force or bribes. It also requires that election results be protected against dishonesty.

Majority rule and minority rights. In a democracy, a decision often must be approved by a majority of voters before it may take effect. This principle, which is called majority rule, may be used to elect officials or decide a policy. Democracies sometimes decide votes by plurality. Most democracies go beyond a simple majority to make fundamental or constitutional changes. In the United States, constitutional amendments must be ratified by the legislatures of three-fourths of the states or by special conventions called in three-fourths of the states.

Majority rule is based on the idea that if all citizens are equal, the judgment of the many will be better than the judgment of the few. Democracy values freely given consent as the basis of legitimate and effective political power. But democracies are also concerned with protecting individual liberty and preventing government from infringing on the freedoms of individuals.

Democratic countries guarantee that certain rights can never be taken from the people, even by extremely large majorities. These rights include the basic freedoms of speech, press, assembly, and religious worship. The majority also must recognize the right of the minority to try to become the majority by legal means.

Political parties are a necessary part of democratic government. Rival parties make elections meaningful by giving voters a choice among candidates who represent different interests and points of view.

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ELECTIONS

Election is the process by which people vote for the candidate or proposal of their choice. The basis of democratic government is that citizens have the right to choose the officials who will govern them. Elections thus rank as one of the most important political activities. Elections also serve as a means of peacefully transferring power from one person or group to another.

Most countries hold elections to select governmental officials. But in countries without democratic government, the people have little real choice. The only candidates allowed on the ballot are those approved by the leaders or by a single political party. In such countries, elections are held for propaganda reasons and to demonstrate popular support for the government.

In addition to public elections, nongovernmental elections are also held to select the officials of many organizations. Labor unions, social clubs, and the student bodies of schools hold elections to select their officers.

ELECTIONS IN A DEMOCRACY

Election procedures differ from country to country. However, certain principles characterize elections in democratic nations. In the United States, Canada, and other democratic countries, nearly all adults can vote. Those not permitted to vote include certain criminals and people with severe mental illness or mental retardation. Citizens vote by secret ballot so that they can vote without fear of how others will react. The mass media--which include radio, television, magazines, and newspapers--freely discuss the candidates and issues.

In most democratic countries, political parties select candidates for public office and propose public policies. However, in some countries and in parts of the United States, local elections are nonpartisan--that is, candidates appear on the ballot without being identified by political party.

Voters elect officials by either direct or indirect elections. In direct elections, the people themselves vote for public officials. In the United States, for example, citizens vote for members of Congress and for state and local officials in this way. In indirect elections, people elect representatives called electors to choose public officials. The U.S. President and Vice President are chosen in an indirect election. The voters of each state select electors, who make up the Electoral College. The electors in turn choose the President and Vice President based on the popular vote in the states they represent.

Under a parliamentary system of government, also called a cabinet system, citizens elect members of the legislature. The head of state--the king or queen of a monarchy or the president of a republic--then selects a prime minister from the members of the legislature. Australia, Canada, and certain other Commonwealth nations regard the British ruler as head of state. In such nations, the governor general makes the appointment, acting as the representative of the monarch. In most countries, the head of state can appoint only the leader of the majority party in the legislature or the head of a coalition of parties.

VIVALDI

Vivaldi Antonio (1678-1741), was an Italian composer. He was one of the most productive composers in the baroque style, which was marked by regular rhythm and elaborate melody. Vivaldi helped develop the baroque concerto, which influenced the German composer Johann Sebastian Bach and the early symphony composers. Bach admired Vivaldi's concertos and arranged 10 of these works for the harpsichord and the organ.

Vivaldi was an accomplished violinist and composed his most important works for the violin. Four violin concertos known as The Four Seasons (1725) are his best-known compositions. They are an important example of program music--that is, music that tells a story or depicts a landscape. Vivaldi also composed operas, cantatas, oratorios, and solo and trio sonatas. His best-known sacred choral work is the Gloria in D Major (1708).

Vivaldi was born in Venice. He was ordained a priest in 1703 but devoted his life to music. In 1703, he became a violin teacher at the Venetian Ospedale della Pieta, a girls' orphanage with an excellent chorus and orchestra. He composed many of his works for the orphanage musicians, writing concertos for almost every instrument known in Europe at the time.

HITLER, ADOLF

Hitler, Adolf (1889-1945), ruled Germany as dictator from 1933 to 1945. He turned Germany into a powerful war machine and provoked World War II in 1939. Hitler's forces conquered most of Europe before they were defeated in 1945.

Hitler spread death as no person has done in modern history. "Have no pity! Act brutally!" he told his soldiers. He ordered tens of thousands of those who opposed him to be executed, and hundreds of thousands to be thrown into prison.

Hitler particularly persecuted Jews. He ordered them removed and killed in countries he controlled. Hitler set up concentration camps where about 4 million Jews were murdered. Altogether, Hitler's forces killed about 6 million European Jews as well as about 5 million other people that Hitler regarded as racially inferior or politically dangerous.

Adolf Hitler began his rise to political power in 1919, the year after World War I had ended. The German Empire had been defeated, and the nation's economy lay in ruins. Hitler joined a small group of men who became known as Nazis. He soon became their leader. Hitler and his followers believed he could win back Germany's past glory. He promised to rebuild Germany into a mighty empire that would last a thousand years.

Many people did not take Hitler seriously. But his fiery words and brilliant blue eyes seemed to hypnotize those who listened to him. Many Germans believed he was their protector and friend. His emotional speeches made crowds cheer "Heil, Hitler!" ("Hail, Hitler!").

Hitler became dictator of Germany in 1933 and quickly succeeded in regaining some territories taken from Germany as a result of World War I. He threatened war against Czechoslovakia in 1938 but was stopped by a combination of counterthreats and concessions. His forces invaded Poland in 1939. Then Britain, France, Australia, New Zealand, South Africa, and Canada declared war on Germany, and World War II began.

Hitler had a clear vision of what he wanted, and he had the daring to pursue it. But his aims had no limits, and he overestimated the resources and abilities of Germany. Hitler had little regard for experts in any field. He regularly ignored the advice of his generals and followed his own judgment, even while Germany was being defeated in the last years of the war. Finally, as United States, British, and Soviet troops closed in on the heart of Germany, Hitler killed himself.

Death. By April 1945, Hitler had become a broken man. His head, hands, and feet trembled, and he was tortured by stomach cramps. Eva Braun, Hitler's mistress since the 1930's, joined him at his headquarters in a bomb shelter under the Reich Chancellery in Berlin. She and Hitler were married there on April 29. The next day, they killed themselves. Aides burned their bodies. Seven days later, Germany surrendered.

JAZZ

Jazz is a kind of music that has often been called the only art form to originate in the United States. The history of jazz began in the late 1800's. The music grew from a combination of influences, including black American music, African rhythms, American band traditions and instruments, and

European harmonies and forms. Much of the best jazz is still written and performed in the United States. But musicians from many other countries are making major contributions to jazz. Jazz was actually widely appreciated as an important art form in Europe before it gained such recognition in the United States.

One of the key elements of jazz is improvisation--the ability to create new music spontaneously. This skill is the distinguishing characteristic of the genuine jazz musician. Improvisation raises the role of the soloist from just a performer and reproducer of others' ideas to a composer as well. And it gives jazz a fresh excitement at each performance.

Another important element of jazz is syncopation. To syncopate their music, jazz musicians take patterns that are even and regular and break them up, make them uneven, and put accents in unexpected places.

The earliest jazz was performed by black Americans who had little or no training in Western music. These musicians drew on a strong musical culture from black life. As jazz grew in popularity, its sound was influenced by musicians with formal training and classical backgrounds. During its history, jazz has absorbed influences from the folk and classical music of Africa, Asia, and other parts of the world. The development of instruments with new and different characteristics has also influenced the sound of jazz.

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VOLCANO

Powerful forces within the earth cause volcanoes. Scientists do not fully understand these forces. But they have developed theories on how the forces create volcanoes. This section describes how most scientists explain the beginning and eruption of a volcano.

The beginning of a volcano. A volcano begins as magma, melted rock inside the earth. Magma results from the extreme heat of the earth's interior. At certain depths, the heat is so great it partly melts the rock inside the earth. When the rock melts, it produces much gas, which becomes mixed with the magma. Most magma forms 50 to 100 miles (80 to 160 kilometers) beneath the surface. Some develops at depths of 15 to 30 miles (24 to 48 kilometers).

The gas-filled magma gradually rises toward the earth's surface because it is lighter than the solid rock around it. As the magma rises, it melts gaps in the surrounding rock and forms a large chamber as close as 2 miles (3 kilometers) to the surface. This magma chamber is the reservoir from which volcanic materials erupt.

The eruption of a volcano. The gas-filled magma in the reservoir is under great pressure from the weight of the solid rock around it. This pressure causes the magma to blast or melt a conduit (channel) in a fractured or weakened part of the rock. The magma moves up through the conduit to the surface. When the magma nears the surface, the gas in the magma is released. The gas and magma blast out an opening called the central vent. Most magma and other volcanic materials then erupt through this vent. The materials gradually pile up around the vent, forming a volcanic mountain, or volcano. After the eruption stops, a bowl-like crater generally forms at the top of the volcano. The vent lies at the bottom of the crater.

Once a volcano has formed, not all the magma from later eruptions reaches the surface through the central vent. As the magma rises, some of it may break through the conduit wall and branch out into smaller channels. The magma in these channels may escape through a vent formed in the side of the volcano. Or it may remain below the surface.

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DENTISTRY

Dentistry is the art and science of diagnosing, treating, and preventing diseases of the teeth, jaws, and surrounding soft tissues of the mouth. Dentists care for their patients in many ways, but mainly through their skill at recognizing, correcting, and preventing problems of the teeth and the tissues that support them.

Dental treatment includes a wide range of dental services. Some of these services focus on correcting problems of the teeth caused chiefly by dental decay. Such treatment, called restoration, often involves the use of some kind of dental filling. Other dental services deal with the prevention and treatment of diseases of the teeth and their supporting tissues and nerves. Still others concentrate on the position of the teeth in relation to each other and to the jawbones. Sometimes teeth require removal. This process, usually performed using an anesthetic (painkilling drug), is called extraction. Dentists may also treat injuries, infections, tumors, and various other conditions of the teeth, jawbones, and related tissues.

Dentistry is practiced in dental offices where one or a number of dentists treat patients. Dentistry is also practiced in large clinics, in hospitals, and in dental schools. Dental schools, in addition to training future dentists, also conduct research. This research provides improvements in the diagnosis and the treatment of dental disorders.

Early dentistry. Human beings have always experienced dental problems. The ancient Greeks, Romans, and Egyptians used various remedies for toothaches, including tooth extraction. People in early civilizations even developed gold dental bridges. In the Middle Ages, dentistry was practiced by such craftworkers as jewelers and barbers.

In 1728, Pierre Fauchard, a French dental scientist, published *The Surgeon Dentist*. This book detailed complex dental devices, instruments, and methods and is considered a landmark in the history of dentistry. Dentistry emerged as a profession in the mid-1800's. In 1840, the world's first dental school, the Baltimore College of Dental Surgery, was founded in Baltimore by the American dentists Horace Hayden and Chapin Harris.

The teeth of the American colonists of the 1600's and 1700's were considered the worst in the world. Poor diet and inadequate dental cleaning and maintenance caused many colonists to lose at least half of their teeth before the age of 20. The founding of the first dental schools in the United States marked the beginning of the solution of this problem for Americans. The United States then became the world's leading center for dental learning and practice.

Modern dentistry began during the mid-1800's with the introduction of general anesthetics to relieve discomfort during dental procedures. General anesthetics make patients unconscious and unable to feel pain throughout the body.

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PETROLEUM

Petroleum is one of the most valuable natural resources in the world. Some people call petroleum black gold, but it may be better described as the lifeblood of industrialized countries. Fuels made from petroleum provide power for automobiles, airplanes, factories, farm equipment, trucks, trains, and ships. Petroleum fuels also generate heat and electricity for many houses and business places. Altogether, petroleum provides nearly half the energy used in the world.

In addition to fuels, thousands of other products are made from petroleum. These products range from paving materials to drip-dry fabrics and from engine grease to cosmetics. Petroleum is used to make such items in the home as aspirins, carpets, curtains, detergents, phonograph records, plastic toys, and toothpaste.

Although we use a huge variety of products made from petroleum, few people ever see the substance itself. Most of it comes from deep within the earth as a liquid called crude oil. Different types of crude oil vary in thickness and color, ranging from a thin, clear oil to a thick, tarlike substance. Petroleum is also found in solid form in certain rocks and sands.

The word petroleum comes from two Latin words meaning rock and oil. People gave it this name because they first found it seeping up from the earth through cracks in surface rocks. Today, petroleum is often referred to simply as oil, and most of it is found in rocks beneath the earth's surface.

People have used petroleum for thousands of years. But few people recognized its full value until the 1800's, when the kerosene lamp and the automobile were invented. These inventions created an enormous demand for two petroleum fuels, kerosene and gasoline. Since about 1900, scientists have steadily increased the variety and improved the quality of petroleum products.

Petroleum, like other minerals, cannot be replaced after it has been used. People are using more and more petroleum each year, and the world's supply is rapidly running out. If present rates of consumption continue, petroleum may become scarce sometime in the mid-2000's.

Most industrialized nations depend heavily on imported petroleum to meet their energy needs. As a result of this dependence, oil-exporting countries have been able to use petroleum as a political and economic weapon by restricting exports to some of these nations. Oil exporters have also strained the economies of a large number of countries, particularly the poorer ones, by drastically increasing the price of petroleum.

To prevent a full-scale energy shortage, scientists are experimenting with artificial forms of oil and with other sources of fuel. But even if new energy sources appear quickly, people will have to rely on petroleum for many years. Conservation of oil has thus become urgent for every country. People now need to be just as inventive in finding ways to conserve petroleum as they have been in finding ways to use it.

WORLD WAR II

World War II (1939-1945) killed more people, destroyed more property, disrupted more lives, and probably had more far-reaching consequences than any other war in history. It brought about the downfall of Western Europe as the center of world power and led to the rise of the Soviet Union. The development of the atomic bomb during the war opened the nuclear age.

The exact number of people killed because of World War II will never be known. Military deaths probably totaled about 17 million. Civilian deaths were even greater as a result of starvation, bombing raids, massacres, epidemics, and other war-related causes. The battlegrounds spread to nearly every part of the world. Troops fought in the steaming jungles of Southeast Asia, in the deserts of northern Africa, and on islands in the Pacific Ocean. Battles were waged on frozen fields in the Soviet Union, below the surface of the Atlantic Ocean, and in the streets of many European cities. World War II began on Sept. 1, 1939, when Germany invaded Poland. Germany's dictator, Adolf Hitler, had built Germany into a powerful war machine. That machine rapidly crushed Poland, Denmark, Luxembourg, the Netherlands, Belgium, Norway, and France. By June 1940, the United Kingdom stood alone against Hitler. That same month, Italy joined the war on Germany's side. The fighting soon spread to Greece and northern Africa. In June 1941, Germany invaded the Soviet Union. Japan attacked United States military bases at Pearl Harbor in Hawaii on Dec. 7, 1941, bringing the United States into the war. By mid-1942, Japanese forces had conquered much of Southeast Asia and had swept across many islands in the Pacific.

CAUSES OF THE WAR

Many historians trace the causes of World War II to problems left unsolved by World War I (1914-1918). World War I and the treaties that ended it also created new political and economic problems. Forceful leaders in several countries took advantage of those problems to seize power. The desire of dictators in Germany, Italy, and Japan to conquer additional territory brought them into conflict with democratic nations.

DISABLED

Disabled is a term used to describe people who have a physical or mental impairment that interferes with their ability to lead a happy, productive life. Physical impairments include blindness, deafness, deformity, muscular and nervous disorders, paralysis, and loss of limbs. There are two general kinds of mental impairments, mental illness and mental retardation.

An impairment may or may not be a disability. It becomes so if it interferes with a person's expectations, job performance, or relationships with his or her family, friends, and society in general. Individuals with similar impairments may not be equally disabled. For example, a history professor may not be greatly disabled by the loss of a finger. However, the same impairment would be a terrible disability to a concert pianist. People who have disabilities are sometimes referred to as handicapped.

There are about 35 million disabled people in the United States. Many common disabilities result from diseases. Heart disease may permanently decrease the victim's strength and endurance. Strokes may produce paralysis and loss of speech. Arthritis and many bone diseases can lead to deformity. Certain nerve diseases may result in blindness, deafness, and lack of coordination. Cerebral palsy is a disorder that damages the brain before, during, or after birth. Depending on what part of the brain is damaged, cerebral palsy can cause speech problems, mental retardation, muscular weakness, or involuntary movements of the arms and legs. Accidents cause a wide range of disabilities, including spinal damage and loss of limbs.

With proper motivation and special training, people with severe disabilities can lead productive, fulfilling lives. Many famous people have overcome physical impairments to make major contributions to humanity. The English poet John Milton was blind when he wrote his epic masterpiece, *Paradise Lost*. The great German composer Ludwig van Beethoven wrote much of his finest music after he became deaf. The American inventor Thomas Edison, perhaps the greatest inventor in history, was deaf much of his life. Franklin D. Roosevelt, paralyzed in both legs by polio at the age of 39, became President of the United States. Helen Keller became blind, deaf, and mute before she was 2 years old, but she learned to read, write, and speak. She devoted her life to helping the deaf and the blind.

PEACE

Peace is the state of being calm, quiet, and free of disturbance. From a military and political point of view, peace means freedom from such violent disturbances as wars and riots. It does not mean total harmony among people. Even in peacetime, people take part in such forms of conflict as debates, lawsuits, sports contests, and election campaigns.

Throughout history, most people have wanted lasting peace. Religions and philosophers have called for the peaceful settlement of disagreements. The Bible declares, "Thou shalt not kill" and "Blessed are the peacemakers." Philosophers in ancient Greece and Rome taught brotherhood and nonviolence.

Yet since earliest times, the world has seldom had a long period of unbroken peace. Through the centuries, people have probably spent at least as much time at war as at peace. This article discusses past and present attempts to achieve lasting freedom from war.

CURRENT EFFORTS TO ENSURE PEACE

Since the end of World War II in 1945, many attempts have been made to assure lasting peace among all nations. The major forms of these efforts have included (1) diplomacy, (2) international organizations, (3) arms control, (4) collective security, and (5) improvement of international communication and trade.

Diplomacy involves negotiations (discussions) between two or more nations. Most governments have diplomats who serve as their representatives in other countries to promote international cooperation and harmony. Other peace efforts depend largely on successful diplomacy. Many political experts rate diplomacy as the most important factor in peacekeeping.

International organizations work for the peaceful settlement of disagreements between nations. In 1945, 50 countries created the United Nations (UN), the major international organization dedicated to world peace. The League of Nations was dissolved in 1946.

The UN Security Council investigates quarrels between nations and suggests ways of settling them. If any nation endangers the peace, the council may use economic sanctions (penalties) against it. For example, member nations might stop trading with the offender. If such measures fail, the council may ask UN members to furnish troops to enforce its decision. The UN has achieved some success in keeping the peace. But it has failed to prevent local wars in several regions, including Africa, Southeast Asia, and the Middle East.

Arms control involves the control, reduction, or elimination of certain armed forces or weapons. In 1968, the UN approved a nonproliferation treaty to stop the spread of nuclear weapons. This treaty, which took effect in 1970, bars the nuclear powers from giving nuclear weapons or knowledge to other nations. The UN also won approval of arms-control treaties during the 1970's. One treaty banned the production and stockpiling of biological weapons. The United States, Russia, and other nations have agreed to observe limits on the production and possession of nuclear weapons. In 1993, 125 countries signed a UN-sponsored treaty banning the manufacture, use, transfer, and stockpiling of chemical weapons. The treaty took effect in 1997.

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AIDS

AIDS is the final, life-threatening stage of infection with human immunodeficiency virus (HIV). AIDS stands for acquired immunodeficiency syndrome. The name refers to the fact that HIV severely damages the immune system, the body's most important defense against disease. Cases of AIDS were first identified in 1981 in the United States, but researchers have detected HIV in a specimen collected in 1959 in central Africa. Millions of AIDS cases have been diagnosed worldwide.

HOW AIDS AFFECTS THE BODY

Cause. AIDS is caused by two viruses that belong to a group called retroviruses. The first AIDS virus was isolated by researchers in France in 1983 and researchers in the United States in 1984. This virus became known as HIV-1. In 1985, scientists in France identified another closely related virus that also produces AIDS. This virus, named HIV-2, occurs mainly in west Africa. HIV-1 occurs throughout the world.

Symptoms. People infected with HIV eventually develop symptoms that also may be caused by other, less serious conditions. With HIV infection, however, these symptoms are prolonged and often more severe. They include enlarged lymph glands, tiredness, fever, loss of appetite and weight, diarrhea, yeast infections of the mouth and vagina, and night sweats.

HIV commonly causes a severe "wasting syndrome," resulting in substantial weight loss, a general decline in health, and, in some cases, death. The virus often infects the brain and nervous system.

There HIV may cause dementia, a condition characterized by sensory, thinking, or memory disorders. HIV infection of the brain also may cause movement or coordination problems.

HOW HIV IS TRANSMITTED

Researchers have identified three ways in which HIV is transmitted: (1) sexual intercourse, (2) direct contact with infected blood, and (3) transmission from an infected woman to her fetus or baby. The most common way of becoming infected is through sexual intercourse with an HIV-infected person. In the United States, sexual transmission of HIV has occurred mainly among homosexual and bisexual men, but it is becoming more frequent among heterosexual men and women. HIV is transmitted through all forms of sexual intercourse, including genital, anal, and oral sex. People who inject drugs into their bodies can be exposed to infected blood by sharing needles, syringes, or equipment used to prepare drugs for injection. In the past, transfusion and transplant recipients and people with hemophilia contracted the virus from the blood, blood components, tissues, or organs of infected donors. But screening and testing of donated blood and of potential organ donors have virtually eliminated this hazard. Health-care workers can become infected with HIV by coming into direct contact with infected blood. This infection may occur through injury with a needle or other sharp instrument used in treating an HIV-infected patient. A few patients became infected while receiving treatment from an HIV-infected American dentist and from a French surgeon. An infected pregnant woman can transmit the AIDS virus to her fetus even if she has no symptoms. Transmission may also occur from an HIV-infected mother to her baby through breast-feeding. Studies indicate that HIV is not transmitted through air, food, or water, or by insects. No known cases of AIDS have resulted from sharing eating utensils, bathrooms, locker rooms, living space, or classrooms.

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GAMBLING

Gambling is betting on the outcome of a game, event, or chance happening. Gamblers or players usually bet money on the outcome they predict. People bet on such games of chance as lotteries, card games, and dice, or on horse racing, boxing, and other sports events.

The popularity of gambling. Gambling is popular throughout the world. Many people gamble because of the excitement and tensions of uncertainty. Others enjoy taking risks and the challenge of testing their skill or luck. Some people gamble because they enjoy competing with others. Many people believe gambling is a quick way to make money. In most cases, however, winning is determined by chance. But people can increase their chances of winning by understanding the rules of a game thoroughly and learning which bets offer better chances to win.

In Europe, the Far East, and other parts of the world, gambling usually operates under close government supervision. In the United States, legal and illegal gambling make up a multibillion-dollar industry. Nevada is the only state that permits most forms of gambling, including betting on sports events. Race track betting and lotteries are legal in about three-fourths of the states. Several states allow casino gambling on Indian reservations, on riverboats or cruise ships, or to raise funds for charities or nonprofit organizations. When legal facilities are not available, people often gamble illegally by placing bets with bookmakers, also called bookies.

Some people oppose gambling because excessive gambling may bring financial ruin to gamblers and their families. Others claim that the gambling industry is influenced by organized crime and that gambling contributes to higher crime rates.

People in favor of legalized gambling claim it encourages economic development through tourism and that tax revenues from gambling benefit the public. They argue that people will always gamble because gambling laws are not fully enforced and probably cannot be. They also claim legalization would end organized crime's influence on gambling.

Casino gambling features four table games: craps, roulette, and the card games baccarat and blackjack. People also play the wheel of fortune game and slot machines. Slot machines, including video poker games, attract more players than any other game and take in about half of all money players bet at casinos. Casinos are found in Australia, Europe, the Far East, and the United States and on several Caribbean islands.

Sports betting involves wagering on such organized sports events as football, baseball, and basketball or on informal games with friends, such as softball or golf. Many people bet on such events through sports pools, private wagers, or bookies.

In the United States, horse racing attracts millions of racing fans in over 100 race tracks throughout the country. All tracks operate under the pari-mutuel wagering system. In this system, the race

track, the state, and the owner of the winning horse get a part of each bet. But most of the money is divided among the people who bet on the winning horse.

The payoff on a winning bet is determined by the odds on the horse. If the odds are 5 to 1, people get \$6 for every \$1 they bet. Harness racing and greyhound racing also operate on the pari-mutuel betting system and produce millions of dollars in gambling revenue.

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SMOKING

Smoking is drawing tobacco smoke from a cigarette, cigar, or pipe into the mouth--and often into the lungs--and puffing it out. The term usually refers to cigarette smoking, the most common form of smoking.

People have smoked tobacco for thousands of years. American Indians smoked tobacco in pipes during religious ceremonies long before white people came to the New World. In the 1500's, many Europeans began smoking because they believed tobacco had medicinal benefits. Today, people smoke chiefly for relaxation and pleasure, and to satisfy a craving for nicotine, a chemical substance in cigarette smoke. However, since 1950, scientists have accumulated increasing evidence that smoking can be hazardous to a person's health.

In the mid-1990's, about 28 percent of the men and 23 percent of the women in the United States 18 years old or older smoked cigarettes. Cigarette smoking had been increasing rapidly in the United States until 1964, when 53 percent of the men and 32 percent of the women 21 years old and older smoked. That year, the U.S. surgeon general first officially warned of the health hazards of smoking. Since then, the surgeon general has issued several reports linking cigarette smoking to heart disease; lung disease; cancers of the lung, mouth, and other tissues; and other ailments. Cigar and pipe smoking have been linked to cancers of the mouth.

In spite of the dangers, many people become smokers. Many young people begin smoking as an act of rebellion or independence. Most adults smoke to reduce their craving for nicotine. The effects of nicotine help make smoking pleasurable. Nicotine stimulates the nervous system and the heart and other organs. However, its effect on the nervous system also causes many people to become addicted to it. Such an addiction makes it hard for people to quit smoking. In 1988, the surgeon general warned that the nicotine in tobacco products was as addictive as the drugs heroin and cocaine.

Smoking and disease. Cigarette smoking is a leading cause of many life-threatening diseases. Smoking substantially increases a person's risk of developing heart disease and lung cancer. Smoking is the leading cause of chronic lung diseases, such as bronchitis. In addition, the efficiency of the lungs decreases with age much faster in smokers compared to nonsmokers. Smoke from other people's cigarettes--called second-hand smoke--is also harmful. Inhaling such smoke is called passive smoking. In 1993, the U.S. Environmental Protection Agency (EPA) designated passive smoking as a known cause of cancer in humans. Pregnant smokers increase their risk of having a miscarriage or of having a baby that weighs too little at birth. Infants under 1 year of age whose mothers smoke have twice as many lung infections as do infants of nonsmoking mothers.

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PIRATES

Pirate is a person who attacks and robs ships. Such robbers have also been called buccaneers, filibusters, freebooters, ladrones, pickaroons, and sea rovers. Pirates differ from sea raiders known as privateers. Pirates were not licensed by any nation, but privateers were licensed by a particular nation during wartime to attack enemy ships. Therefore, privateers were generally not considered pirates.

Pirates have robbed ships and raided coastal towns since ancient times. The greatest period of pirate attacks, or piracy, occurred from the 1500's through the 1700's on the Mediterranean and Caribbean seas. The most famous pirates of this age included Henry Morgan, Blackbeard, and William Kidd. Most pirates were men, but a few women became pirates.

Widespread piracy no longer exists. But attacks have occurred in some areas. In the 1980's, for example, pirates carried out numerous attacks against Cambodian and Vietnamese refugees in the Gulf of Thailand.

How pirates lived. People became pirates for various reasons. Sometimes, the harsh conditions of life at sea led honest seamen to desert or mutiny their ships. These men often turned to piracy to survive. Others sought riches or adventure. Many privateers drifted into piracy when wars between

nations ended.

Legend, fiction, and motion pictures have helped create an exciting, romantic image of pirates. A typical pirate is portrayed as a fierce-looking man with a beard. He is sometimes handsomely dressed.

In real life, however, most pirates probably led miserable lives. They were often drunk and quarrelsome. Many pirates died of wounds or disease. Some were shot or marooned by their own crews or captured and sentenced to death by authorities.

In spite of their unlawful way of life, most pirate crews developed rules and regulations to govern their ships. Crew members elected a captain and other officers and had a code of punishment for breaking agreements. They also developed pay scales to determine each person's share of the booty (stolen goods).

Until about 1700, pirate ships flew a red banner called the Bloody Flag. They then began using flags that pictured such objects as skeletons, flaming swords, and hourglasses. The most popular of the new pirate flags showed a white skull and crossbones on a black background. This symbol became known as the Jolly Roger.

Ships involved in trade carried weapons in case of attack. But a pirate crew usually outnumbered the other crew and could defeat it in hand-to-hand combat after coming aboard. Pirates seized trading ships by first maneuvering their vessel next to the ship. They boarded by using hooks and ropes to keep the ships together.

Besides robbing ships, pirates also attacked towns. In the towns, they murdered innocent people and took prisoners. The pirates held some captives for ransom and enslaved others. They sometimes tortured prisoners to get information about treasure. There is little evidence that they made their victims "walk the plank."

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MANDELA

Mandela Nelson (1918-...), was president of South Africa from 1994 to 1999. He was the country's first black president. Mandela was elected by the country's National Assembly. The Assembly had been chosen in South Africa's first elections in which the country's blacks were allowed to vote. Blacks won a majority of the Assembly seats, and the Assembly selected Mandela as president. These developments marked the beginning of a new era in South Africa. They resulted in blacks gaining control of the government after a long period of domination by the white minority. Since 1991, Mandela had served as president of the African National Congress (ANC), a largely black group that opposed the South African government's policy of rigid racial segregation called apartheid. He had long been a leader of protests against apartheid and was imprisoned in 1962 on charges of conspiring to overthrow the white-minority government. While in prison, he became a symbol of the struggle for racial justice. After being freed in 1990, he led negotiations with white leaders that eventually brought an end to apartheid and established a nonracial system of government. Mandela and then-President F. W. de Klerk of South Africa won the 1993 Nobel Peace Prize. They were honored for their work to end apartheid and to enable the country's nonwhites to fully participate in the South African government.

Early life. Nelson Rolihlahla Mandela was born in Umtata, in the Transkei territory of South Africa. His father was a chief of the Xhosa-speaking Tembu tribe. Mandela gave up his right to succeed his father and instead prepared for a legal career. He attended the University College of Fort Hare, studied law by correspondence at Witwatersrand University, and received a law degree from the University of South Africa in 1942. That year, in Soweto, he and a friend opened the first black law partnership in South Africa.

Imprisonment. Mandela joined the ANC in 1944 and helped form the organization's Youth League. In 1948, the South African government established its policy of apartheid. The ANC called for equality for all races and began leading open resistance to the government. In 1956, the government charged Mandela with treason and other serious crimes, but he was found not guilty in 1961. The government had outlawed the ANC in 1960, but Mandela renewed the protests and went into hiding. He was arrested in 1962, convicted of sabotage and conspiracy, and sentenced to life in prison.

While Mandela was in prison, growing antiapartheid forces in South Africa argued that he should be freed. His wife at that time, Winnie Mandela, became a leading spokesperson for his cause. Shortly before Mandela's release in 1990, the government recognized the ANC as a legal political organization.

End of white rule. After leaving prison, Mandela agreed to suspend an armed struggle the ANC had been waging against the South African government. Over the objections of more radical ANC members, he urged conciliation with South African President de Klerk and other government leaders. He sought to obtain political power for the country's blacks in a peaceful way.

In 1990 and 1991, the government repealed the laws that formed the legal basis of apartheid. But Mandela also negotiated an end to other forms of racial injustice, including laws that denied blacks the right to vote in national and provincial elections. The first truly open national elections in which all races could vote were held in April 1994. The ANC won a majority of the seats in the country's National Assembly, and Mandela became president. Mandela stepped down as head of the ANC in 1997. In 1999, he retired as president of South Africa.

In 1992, Mandela announced that he and his wife, Winnie, had agreed to separate. The couple was divorced in 1996. In 1998, Mandela and Graca Machel, the widow of President Samora Machel of Mozambique, were married.

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OLIVE

Olive is the fruit of a tree that grows in subtropical regions. Olives are cultivated chiefly for their oil, which is used in cooking. The fruit is also eaten whole after processing. People have grown olives since prehistoric times. It is thought that the fruit first grew in the eastern Mediterranean basin. Centuries ago, it began to grow wild around the Mediterranean Sea. The Spaniards brought olives to South America, and they were introduced into California in 1769.

Appearance of the fruit and tree. The fruit may be oval or oblong. As it matures, it turns from green to yellow to red to purple-black. It has a smooth skin, and its flesh surrounds a hard pit. Both the flesh and the seed in the pit contain oil, which makes up 10 to 40 percent of the mature fresh fruit's weight. Fresh olives contain oleuropein, a bitter substance that makes them unpleasant to eat before processing. During processing, this substance is largely or entirely removed.

The olive tree's bark and leaves are a soft gray-green, and its trunk becomes gnarled as it ages.

Olive trees live longer than most other fruit trees. There are olive trees in Palestine that may be more than 2,000 years old.

A mature olive tree may have as many as 500,000 small flowers. Most of the flowers are imperfect, and fruit cannot grow from them. They give off pollen, which is usually carried from flower to flower by the wind. Most varieties of olive trees bear a large crop one season and a small crop the next.

Cultivation. Parts cut off from an olive tree may take root and grow into new trees. The trees will grow in many types of soil but need good drainage. To produce large fruit, the grower must irrigate and prune the trees, and thin the fruit. Fertilizers that add nitrogen to the soil can increase yields.

The olive tree will grow where the climate is hot and dry. But for bearing good fruit, the tree needs a moderate supply of water. The fruit matures from October to January and is injured if the temperature falls below 26 °F (-3 °C). The tree itself is not seriously injured until the temperature falls to 16 °F (-9 °C). The fruit needs much heat to have a good quality when mature. The air must be dry when the flowers blossom, and also when the fruit begins to grow.

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BEHAVIOR

Behavior is the way human beings and other organisms act. Many people use the word behavior to mean conduct--that is, how a person's actions fit society's idea of right and wrong. But in psychology and other behavioral sciences, behavior is regarded as any activity of a person or other living thing. This article reflects the more general usage and focuses on human behavior.

THE STUDY OF BEHAVIOR

Most human behavior results from a combination of many factors. For example, a person might shout at someone who has insulted him or her. This response probably results from more than just the insult. It may be caused partly by being tired or hungry or by having been hurt by someone similar to the person now doing the insulting.

Although behavior has many causes, most scientists seek to isolate single causes. This makes the scientific study of behavior hard. Many researchers in psychology use controlled experiments in which they can examine the effect of one factor at a time on a particular kind of behavior. Some investigators design experiments to test the behavioral effects of several factors in various combinations. Still other researchers study behavior in the "real" world by observing people in their daily activities. Observing behavior outside controlled experiments cannot prove that one thing causes another. But studying people in the real world often helps scientists see the ways in which

causes identified in experiments actually operate in people's daily lives.

Specialists in many fields study behavior. Psychologists and some biologists study animal behavior in controlled experiments. Other psychologists study individuals or small groups of people in controlled games or tasks to understand many aspects of behavior, including the reasons for people's feelings, thoughts, and motives. These studies help establish principles that can be used to explain, predict, and modify behavior. Educational researchers study how people behave in the classroom. In sociology, behavioral research focuses mainly on the behavior of people in large groups and social institutions, such as businesses, churches, governments, and hospitals. An anthropologist may live in an isolated community to study behavior patterns of a whole group.

Scientists from different fields carry out joint studies of specific problems of behavior. Many psychologists, educational researchers, sociologists, and anthropologists are concerned with the ways in which behavior is connected to physical illness. These scientists work together to learn why people adopt such harmful behavior patterns as smoking and overeating. The scientists also study how to encourage more healthy behavior.

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FREUD

Freud Sigmund (1856-1939), was an Austrian physician who revolutionized ideas on how the human mind works. Freud established the theory that unconscious motives control much behavior. He thus greatly advanced the fields of psychiatry and psychology. His work has helped millions of mentally ill patients. Freud's theories have brought new approaches in child rearing, education, and sociology and have provided new themes for many authors and artists. Most people in Western society view human behavior at least partially in Freudian terms.

HIS LIFE

Freud was born on May 6, 1856, in Freiberg, Moravia, a region now in the Czech Republic. He was the oldest of eight children, and his father was a wool merchant. When Freud was 4 years old, his family moved to Vienna, the capital of Austria. He graduated from the medical school of the University of Vienna in 1881. Freud later decided to specialize in neurology, the study and treatment of disorders of the nervous system.

In 1885, Freud went to Paris to study under Jean Martin Charcot, a famous neurologist. Charcot was working with patients who suffered from a mental illness called hysteria. Some of these people appeared to be blind or paralyzed, but they actually had no physical defects. Charcot found that their physical symptoms could be relieved through hypnosis.

Freud returned to Vienna in 1886 and began to work extensively with hysterical patients. He gradually formed ideas about the origin and treatment of mental illness. Freud used the term psychoanalysis for both his theories and his method of treatment. When he first presented his ideas in the 1890's, other physicians reacted with hostility. But Freud eventually attracted followers, and by 1910, he had gained international recognition.

During the following decade, Freud's reputation continued to grow. But two of his early followers, Alfred Adler and Carl Gustav Jung, split with Freud and developed their own theories of psychology. Freud was constantly modifying his own ideas, and in 1923, he published a revised version of many of his earlier theories. That same year, he learned he had cancer of the mouth. He continued his work, though the cancer made working increasingly difficult. In 1938, the Nazis gained control of Austria. Under their rule, Jews were persecuted. Freud, who was Jewish, went to England with his wife and children to escape persecution. He died there of cancer in 1939.

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BUTTERFLY

Butterfly is one of the most beautiful of all insects. People have always been charmed by the delicate, gorgeously colored wings of butterflies. The beauty and grace of these insects have inspired artists and poets. Butterflies have also played a part in religious beliefs. The ancient Greeks believed that the soul left the body after death in the form of a butterfly. Their symbol for the soul was a butterfly-winged girl named Psyche.

Butterflies live almost everywhere in the world. Tropical rain forests have the most kinds of butterflies. Other kinds of butterflies live in woodlands, fields, and prairies. Some butterflies live on cold mountaintops, and others live in hot deserts. Many butterflies travel great distances to spend the winter in a warm climate.

There are about 15,000 to 20,000 species (kinds) of butterflies. The largest butterfly, Queen Alexandra's birdwing of Papua New Guinea, has a wingspread of about 11 inches (28 centimeters).

One of the smallest butterflies is the western pygmy blue of North America. It has a wingspread of about 3/8 inch (1 centimeter). Butterflies are every color imaginable. The colors may be bright, pale, or shimmering and arranged in fantastic patterns. The word butterfly comes from the Old English word *butterfleoge*, meaning butter and flying creature. Butter probably referred to the butteryellow color of some European butterflies.

Butterflies and moths together make up an insect group called Lepidoptera. The name comes from two

Greek words: *lepis*, which means scale; and *pteron*, which means wing. The name refers to the powdery scales that cover the two pairs of wings of both butterflies and moths. However, butterflies differ from moths in a number of important ways, including the following four. (1) Most butterflies fly during the day. The majority of moths, on the other hand, fly at dusk or at night. (2) Most butterflies have knobs at the ends of their antennae. The antennae of most moths are not knobbed. (3) Most butterflies have slender, hairless bodies. The majority of moths have plump, furry bodies. (4) Most butterflies rest with their wings held upright over their bodies. Most moths rest with their wings spread out flat.

A butterfly begins its life as a tiny egg, which hatches into a caterpillar. The caterpillar spends most of its time eating and growing. But its skin does not grow, and so the caterpillar sheds it and grows a larger one. It repeats this process several times. After the caterpillar reaches its full size, it forms a protective shell. Inside the shell, an amazing change occurs--the wormlike caterpillar becomes a beautiful butterfly. The shell then breaks open, and the adult butterfly comes out. The insect expands its wings and soon flies off to find a mate and produce another generation of butterflies. Butterfly caterpillars have chewing mouthparts, which they use to eat leaves and other plant parts. Some kinds of caterpillars are pests because they damage crops. One of the worst pests is the caterpillar of the cabbage butterfly. It feeds on cabbage, cauliflower, and related plants.

Adult butterflies may have sucking mouthparts. The adults feed mainly on nectar and do no harm. In fact, they help pollinate flowers. Many flowers must have pollen from other blossoms of the same kind of flower to produce fruit and seeds. When a butterfly stops at a flower to drink nectar, grains of pollen cling to its body. Some of the pollen grains rub off on the next blossom the butterfly visits.

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STONE AGE

Stone Age is a term used to designate the period in all human cultures when people used stone, rather than metal, tools. The Stone Age began about 2 1/2 million years ago, when small stones were first made into crude chopping tools. It ended in the Near East about 3000 B.C., when bronze replaced stone as the chief material from which tools were made.

Scientists have divided the Stone Age on the basis of toolmaking techniques into Paleolithic, Mesolithic, and Neolithic phases. But only the term paleolithic (Old Stone Age) is still commonly used. This phase includes the prehistory of all human beings until about 8000 B.C. Paleolithic people were hunters and gatherers. After 8000 B.C., hunting and gathering became more specialized. Some people mainly gathered wild vegetables, while others fished or hunted large game. Many early farmers in the Near East, Asia, and the Americas had no metals and lived in the Stone Age. They used polished stone axes and flint sickles to harvest crops.

Many peoples were still using Stone Age technology when Europeans began their voyages of exploration and discovery in the A.D. 1400's. The Aborigines of Tasmania and Australia were making Stone Age tools when white explorers discovered them in the 1700's. Europeans found groups in southern Africa living like their Stone Age ancestors. Islanders of the South Pacific Ocean and most American Indians lacked metal farming tools when they first met Europeans. A few groups in New Guinea and Australia are still in the Stone Age.

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SHARK

Shark is a meat-eating fish and one of the most feared sea animals. Scientists classify about 360 species of fish as sharks. These fish live in oceans throughout the world but are most common in warm seas.

Sharks vary greatly in size and habits. Whale sharks, the largest kind of shark--and the largest of all fish--may grow up to 40 feet (12 meters) long. They may weigh over 15 short tons (14 metric tons), more than twice as much as an average African elephant. The smallest sharks may measure about 6 inches (16 centimeters) long and weigh about 1 ounce (28 grams).

Some kinds of sharks live in the depths of the ocean. Others are found near the surface. Some species of sharks live in coastal waters, but others dwell far out at sea. A few species enter rivers

and lakes that have outlets to the sea. Scientists believe that one species, the Ganges River shark of India and Pakistan, lives only in rivers.

All sharks are carnivores (meat-eaters). Most of them eat live fish, including other sharks. In fact, a shark's most common natural enemy is a larger shark. Most sharks eat their prey whole, or they tear off large chunks of flesh. Some sharks crush their prey. Others scoop out small pieces of flesh from large fish. Sharks also feed on dead or dying animals. Sharks have the reputation of attacking human beings. But fewer than 100 shark attacks a year are reported throughout the world.

Shark attacks. About a seventh of the approximately 360 species of sharks are considered potentially dangerous to human beings. Most shark attacks do not result in death or serious injury. However, swimmers should take special care in areas known to have sharks.

People once thought that sharks ate constantly and would attack any human being immediately. But scientists have learned that some species of sharks can go for days or weeks without feeding. During this time, the oil stored in their liver probably nourishes them.

Scientists do not know why sharks sometimes attack people and at other times leave them alone.

The American Elasmobranch Society studies shark attacks throughout the world. The society supports safety rules for people who swim in water where sharks may be nearby. These rules include the following:

(1) Never swim or dive alone.

(2) Never swim or dive with an open wound. Blood attracts sharks.

(3) Never swim or dive at night or in dirty water, where there is less chance of spotting a shark.

(4) Leave the water immediately if a shark is sighted. Swim as smoothly as possible because thrashing movements might attract the shark.

(1) Never grab or injure any shark, even a small and apparently harmless one.

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TIBET

Tibet is a land in south-central Asia. It is often called the Roof of the World. Its snow-covered mountains and a windswept plateau are the highest in the world. The world's highest mountain, Mount Everest, rises in southern Tibet. Ka-erh, in western Tibet, is believed to be the highest town in the world. It is more than 15,000 feet (4,570 meters) above sea level. Valley bottoms in Tibet are higher than the mountains of most countries. Lhasa is Tibet's capital.

Tibet has been a part of China since the 1950's. However, for many years Tibet was an independent or semi-independent state. Although Tibet carried on some trade with other lands, its mountain ranges generally isolated the country from outside peoples. The Tibetans are sometimes called the hermit people. Tibet was traditionally a theocracy (religious kingdom). Buddhist monks had a strong voice in the rule of Tibet before China took control.

Large parts of Tibet are wastelands of gravel, rock, and sand. Most of the land cannot be farmed because of poor soil and cold climate. But there are some fertile valleys and other areas suitable for farming. Tibet also has areas of grasslands and forests. More than 5,000 different kinds of plants grow in Tibet. Tibet's wild animals include deer, gazelles, tigers, bears, monkeys, pandas, and wild horses. Tibet has hundreds of lakes and streams, but many of them have barren shores and a high salt content. Some of the great rivers of Asia begin in the mountains of Tibet. These include the Brahmaputra, Indus, Mekong, Salween, and Yangtze rivers.

The people and their work. Tibet has a population of about 2 million. About 96 per cent of the people are Tibetans. Most of the rest are Chinese. Most of the people live in southern Tibet, where there is land that is fertile enough for farming and raising livestock. Nomads who raise sheep and yaks

live in the northern grasslands. About 106,000 people live in Lhasa, Tibet's largest city. Many of these people are employed in jobs in government, light industry, or tourism.

Tibet's main traditional language is Tibetan. All Tibetans speak Tibetan at home. But Mandarin Chinese is the official language of Tibet. Both Tibetan and Mandarin Chinese are taught in the schools. All government documents are written in both languages.

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BALLET

Ballet is a form of theatrical dance that uses formal, set movements and poses characterized by elegance and grace. Ballet dancers usually hold their bodies straight and lifted up. Ballet technique is based on positions in which the dancer's legs rotate outward from the hip joint and the feet turn outward. This rotation is called turnout.

An individual work or performance is called a ballet if it features ballet dancing. A ballet may tell a

story, express a mood, illustrate the music that accompanies it, or simply portray movement. A ballet may consist of a full-length story, or it can be made up of short works, often in different styles. Ballets are sometimes included in other theatrical works, such as musical comedies and operas. Choreographers (creators of dances) arrange the steps and movements that form the complete work. Ballet is a living art that can vary from performance to performance. Different dancers bring different qualities to their roles. The production will be affected by the harmony among performers, especially between the principal male dancer and the ballerina (leading female dancer). Throughout ballet history, some remarkable partnerships have developed, such as the one that began in the 1960's between Russian-born dancer Rudolf Nureyev and English ballerina Dame Margot Fonteyn. These pairings emerge when the partners show a particular understanding of each other, look good together physically, and perform in a complementary way.

Although dancing is the most important feature of a ballet, the presentation usually includes music, scenery, and costumes. Many ballets are collaborations among choreographers, set and costume designers, and composers. Ballets are performed by groups called companies or troupes. The artistic director of the company selects the repertory (ballets to be performed). The artistic director may also be the troupe's choreographer.

Ballet dancers perform many movements that are difficult for the body. However, when these movements are well executed, they look easy. Ballet dancers have always been known for their ability to control their bodies. Skilled dancers can perform complex turns, make magnificent leaps, and maintain control whether moving slowly or with great speed. Some dancers are also known for their dramatic and expressive skills or for their sensitivity to the phrasing of the music.

Ballet has become increasingly athletic over time, requiring greater flexibility and strength. Male dancers were once known primarily for their leaps, turns, and skills at partnering ballerinas. Now men have gained recognition for flexibility, high leg kicks, and other feats rarely attempted by earlier dancers. Female dancers were once known largely for dancing on point (on their toes) with the support of special shoes. Now female dancers also perform strong, complex leaps.

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PROFIT

Profit is the amount of money a company has left over from the sale of its products after it has paid for all the expenses of production. These expenses include costs of such things as raw materials, workers' salaries, and machinery. They also include a reasonable return on the owner's investment, a salary for the labor the owner supplies to the firm, and other costs that are hard to calculate. A main task of accounting is to define and measure profits accurately.

Profits are vital to the economic system of the United States, Canada, and other countries where private enterprise is encouraged. In such countries, profits belong to the owners of companies or the stockholders of corporations. One of the chief reasons for operating a business is to make a profit. The desire for profits motivates companies to produce their goods efficiently. This is because the lower a company's costs are, the greater its profits can be.

A business can earn a profit only by producing goods and services whose selling price is greater than the cost of producing them. Therefore, business executives seek to use labor and raw materials to produce and sell things for which customers will pay a price that is greater than the cost of production. Thus, the search for profits is also the search for the uses of a country's labor and raw materials that will satisfy consumers most completely.

Some business executives constantly lower prices to capture sales and profits from their competitors. However, there are several reasons why competition does not eliminate profits. For one thing, at any one time, there will be many firms that have discovered profitable opportunities their competitors cannot yet match. Sometimes, new firms cannot duplicate a profitable product because of patents or trademarks, or for other reasons. Sometimes, new firms cannot produce goods as cheaply as established ones. The bother and risk of entering an unfamiliar industry also keeps some new firms from competing with a product that is not especially profitable. The established firms can then enjoy reasonable profits without fear of new competition.

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TRAFFIC

Traffic is the movement of people and goods from one place to another. This article deals with traffic on streets and highways. For a discussion of other kinds of traffic with its list of Related articles.

Traffic problems

The millions of automobiles in the United States cause many traffic problems. In the morning and

evening rush hours, city streets are often jammed with automobiles. On holidays and weekends, many highways are too full for comfort or safety. Freeways and expressways have been built to replace the horse-and-buggy-day streets, roads, and highways. They are constantly being maintained and improved to relieve crowded conditions. The main streets of many small towns are overburdened with through traffic, making it difficult for local people to get to the stores. Bypasses around these towns ease the pressure and help local business. It is hard to find a parking place in the business sections of cities and towns. Parking at the curb is being prohibited in more and more places in order to make additional street space available for traffic. Off-street parking areas are being provided in large numbers.

Improved mass transit systems help relieve congestion when the service is convenient, comfortable, and inexpensive. Better provision for truck loading and unloading at stores, office buildings, and factories eases the problem of truck interference on streets. It also reduces cost of delivery and distribution of goods. More efficient use of existing streets is obtained in several ways. These include: (1) creating one-way streets; (2) changing traffic lanes to one-way operation during hours of heavy traffic; (3) prohibiting curb parking; (4) installing modern coordinated traffic-signal systems, turn controls, and pedestrian controls; and (5) developing through-street systems to move traffic faster.

Traffic control

Every year in the United States, more than 40,000 people are killed and several million are injured in traffic accidents. Drivers and pedestrians can reduce the number of traffic accidents, injuries, and deaths by watching and obeying traffic control signs, signals, and pavement markings. Special control devices, such as electric signs that tell when to cross streets and highways, are often used to aid pedestrians. These signs operate with vehicle traffic signals.

Signals, signs, and markings. There is no clear record of who invented or first used traffic control devices. The first electric signals on record were installed in Cleveland, Ohio, in 1914. It is generally agreed that 3-color, 4-way traffic lights first appeared in Detroit in the early 1920's. The Wayne County (Michigan) Road Commission developed the use of a white center line for separating driving lanes on highways. Traffic signs date back to the early Roman roads.

Traffic controls are increasingly necessary for regulating, warning, and guiding motor vehicle and pedestrian traffic. The law requires signs to indicate how certain traffic regulations apply. Adequate use of warning signs, and well-designed and well-located route markings have great value, too, in helping the flow of traffic. Pavement and curb markings and traffic islands, when properly designed and located, also help guide traffic.

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MOUSE

Mouse is a small animal with soft fur, a pointed snout, round black eyes, rounded ears, and a thin tail. The word mouse is not the name of any one kind of animal or family of animals. Many kinds of rodents (gnawing animals) are called mice. They include small rats, hamsters, gerbils, jerboas, lemmings, voles, harvest mice, deer mice, and grasshopper mice. All these animals have chisel-like front teeth that are useful for gnawing. A rodent's front teeth grow throughout the animal's life. There are hundreds of kinds of mice, and they live in most parts of the world. They can be found in the mountains, in fields and woodlands, in swamps, near streams, and in deserts. Probably the best known kind of mouse is the house mouse. It lives wherever people live, and often builds its nest in homes, garages, or barns. Some kinds of white house mice are raised as pets. Other kinds are used by scientists to learn about sickness, to test new drugs, and to study behavior.

House mice probably could be found in the homes of people who lived during ancient times. Those mice probably stole the people's food, just as mice do today. The word mouse comes from an old

Sanskrit word meaning thief. Sanskrit is an ancient language of Asia, where scientists believe house mice originated. House mice spread from Asia throughout Europe. The ancestors of the house mice that now live in North and South America were brought there by English, French, and Spanish ships during the 1500's.

House mice always seem to be busy. Those that live in buildings may scamper about day or night. House mice that live in fields and forests usually come out only at night. All house mice climb well and can often be heard running between the walls of houses.

A house mouse has a small head and a long, narrow snout. Several long, thin whiskers grow from the sides of the snout. These whiskers, like those of a cat, help the mouse feel its way in the dark. The animal has rounded ears, and its eyes look somewhat like round black beads. A mouse can hear

well, but it has poor sight. Probably because house mice cannot see well, they may enter a lighted room even if people are there.

Like all other rodents, mice have strong, sharp front teeth that grow throughout the animal's life. With these chisel-like teeth, mice can gnaw holes in wood, tear apart packages to get at food inside, and damage books, clothing, and furniture.

Food. A house mouse eats almost anything that human beings eat. It feeds on any meat or plant materials that it can find. Mice also eat such household items as glue, leather, paste, and soap. House mice that live out of doors eat insects, and the leaves, roots, seeds, and stems of plants. Mice always seem to be looking for something to eat, but they need little food. They damage much more food than they eat.

Homes. House mice live wherever they can find food and shelter. Any dark place that is warm and quiet makes an excellent home for mice. A mouse may build its nest in a warm corner of a barn, on a beam under the roof of a garage, or in a box stored in an attic or basement. The animal may tear strips of clothing or upholstery to get materials for its nest. It may line the nest with feathers or cotton stolen from pillows. House mice that live in fields or woodlands dig holes in the ground and build nests of grass inside. They may line the nests with feathers or pieces of fur.

Young. A female house mouse may give birth every 20 to 30 days. She carries her young in her body for 18 to 21 days before they are born. She has four to seven young at a time. Newborn mice have pink skin and no fur, and their eyes are closed. They are completely helpless. Soft fur covers their bodies by the time they are 10 days old. When they are 14 days old, their eyes open. Young mice stay near the nest for about three weeks after birth. Then they leave to build their own nests and start raising families. Most female house mice begin to have young when they are about 45 days old.

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CANNIBALS

Cannibal is a person who eats human flesh. Throughout history, many individuals and societies in all parts of the world have committed acts of cannibalism. Archaeologists have found evidence of cannibalism that occurred more than 500,000 years ago. Today, cannibalism no longer exists in the world except perhaps among some societies in isolated areas of Africa, Asia, and the Pacific Islands. Cannibalism may also be practiced today by people who can obtain no food except human flesh. Survivors of a plane crash in the Andes Mountains in 1972 ate their dead companions to survive.

Through the centuries, most cases of cannibalism have been connected with religious or other traditional beliefs. Most cannibals ate only the parts of the body that they considered important. For example, some cannibals believed that the heart contained such qualities as courage and wisdom. They ate the hearts of the dead in order to acquire those qualities themselves. The inhabitants of ancient Gaul (now mainly France) thought that eating parts of another human being cured diseases. Some cannibals showed respect to dead relatives and friends by eating them. The Aborigines of central Australia thought this practice strengthened the ties between the dead members of the family and the living ones. Some mothers ate their dead babies to get back the strength they thought they had given the infants during pregnancy.

Some societies thought that eating the corpses of enemies prevented the souls of the slain foes from seeking revenge. The Maori of New Zealand felt they insulted their enemies by cooking and eating them. Some cultures in southern Africa believed that their members gained such qualities as courage and wisdom by eating the enemies they had killed.

The word cannibal comes from Carib, the name of a warlike society whose members ate human flesh. The Carib, whose name means strong men, lived on islands in the Caribbean Sea when the Italian navigator Christopher Columbus sailed there in the late 1400's. Columbus called them Canibales by mistake. The Spaniards continued to call them Canibales probably because the old Spanish word for dog was can. They thought the practice of cannibalism among the Carib seemed more doglike than human. The term cannibal also refers to any animal that eats others of its own kind.

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VEGETARIANISM

Vegetarianism is the practice of not eating meat. Vegetarians regard the flesh of all animals, including that of fish and poultry, as meat. Most vegetarians avoid eating meat because of moral or religious beliefs. They believe it is wrong to kill animals for food. Many vegetarians also think that eating meat is unhealthy.

Some vegetarians exclude milk and eggs, as well as meat, from their diet because these foods come from animals. Vegetarians are divided into three groups, based on their attitude toward milk and eggs. Lactoovo-vegetarians include milk and eggs, and foods made from milk and eggs, in their diet. Lacto-vegetarians do not eat eggs, but they drink milk and eat such milk products as butter and cheese. Vegans avoid milk and eggs and all foods made from these animal products.

A vegetarian diet must be well planned to replace the protein and other nutrients provided by meat. Most lacto-ovo-vegetarians and lacto-vegetarians can easily plan a healthy diet because milk and eggs are good sources of high-quality protein. Milk also provides large amounts of calcium, which helps strengthen bones. Milk and eggs both contain vitamin B-12, which forms a part of red blood cells and helps the nerves function properly.

Vegans must plan their diet especially well because no single fruit, vegetable, or grain contains the nutritionally complete protein found in meat, milk, and eggs. Beans, nuts, peas, and many other vegetarian foods contain large amounts of protein. However, these foods must be eaten in particular combinations to provide the body with nutritionally complete protein. For example, beans and rice together provide complete protein, but neither food does when eaten alone. To obtain calcium, vegans must eat sesame seeds or certain green leafy vegetables, such as broccoli or spinach. Most vegans take vitamin B-12 tablets to obtain this nutrient.

Most vegetarian diets contain fewer calories than diets that include meat. As a result, vegetarians tend to be thinner than meat-eaters. Most vegetarians also consume less saturated fat and smaller amounts of a fatty substance called cholesterol than most meat-eaters do. Lower dietary levels of saturated fat and cholesterol result in lower levels of cholesterol in the blood. Medical research indicates that a high level of cholesterol in the blood is associated with heart disease. Some studies have shown that vegetarians in the United States are healthier and live longer than other Americans.

Vegetarianism is practiced by some religious groups, including Hindus and Seventh-day Adventists.

Some Americans practice vegetarianism because they believe that consumption of meat, especially beef, reduces the world food supply. They feel that grain used to fatten cattle would nourish more people if the grain were eaten directly by people. Some people also believe the land on which livestock graze should be used to grow grain. But many agricultural experts disagree. They argue that most grazing land is not suitable for farming.

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FAMINE

Famine is a prolonged food shortage that causes widespread hunger and death. Throughout history, famine has struck at least one area of the world every few years. Most of the developing nations of Africa, Asia, and Latin America have barely enough food for their people. Roughly a half billion people on the earth are seriously malnourished, either from having too little food or from eating the wrong food. When food production or imports drop, famine may strike and thousands or millions of people may die.

Many famines have more than one cause. For example, the great Bengal famine of 1943 in eastern India was caused by both historical and natural events. World War II created a general food shortage and led to the cutoff of rice imports from Burma (now Myanmar), which was occupied by the

Japanese. Then a cyclone destroyed much farmland. Famine struck, and more than 11/2 million people died.

Nearly all famines result from crop failures. The chief causes of crop failure include (1) drought (prolonged lack of rain), (2) too much rainfall and flooding, and (3) plant diseases and pests. Many other factors may also help create a famine.

Drought ranks as the chief cause of famine. Certain regions of Africa, China, and India have always been those hardest hit by famine. All have large areas near deserts, where the rainfall is light and variable. In a dry year, crops in those areas fail and famine may strike. In the 1870's, for example, dry weather in the Deccan plateau of southern India caused a famine that took about 5 million lives. During the same period, a famine in China killed more than 9 million people.

In the late 1960's and early 1970's, lack of rain produced widespread famine in a region of Africa called the Sahel. The Sahel lies just south of the Sahara. Famine again struck this part of Africa and parts of eastern and southern Africa during the mid-1980's. The famine was especially devastating in Ethiopia, where a civil war hampered relief efforts. Since the late 1960's, millions of Africans have died of malnutrition or hunger-related causes. But many have been saved by international assistance.

Too much rainfall may also bring famine. Rivers swollen by heavy rains overflow their banks and

destroy farmland. Other crops rot in the field because of the excess water. In the 1300's, several years of heavy rains created widespread famine in western Europe. The Huang He River in northern China is called China's Sorrow because it often floods, ruining crops and bringing famine. In 1929 and 1930, flooding along this river caused a famine that killed about 2 million people. Plant diseases and pests sometimes produce famine. During the 1840's, a plant disease destroyed most of Ireland's potato crop. Between 1841 and 1851, Ireland's population dropped by about 21/2 million through starvation, disease, and emigration. Occasionally, swarms of locusts cause widespread destruction of crops and vegetation in the Sahel and other areas of Africa. Other causes of famine include both natural and human ones. Such natural disasters as cyclones, earthquakes, early frosts, and huge, destructive waves called tsunamis may affect a large area, destroying enough crops to create a famine. War may result in a famine if many farmers leave their fields and join the armed forces. Sometimes, an army deliberately creates a famine to starve an enemy into surrender. The army destroys stored food and growing crops and sets up a blockade to cut off the enemy's food supply. Blockades prevented food shipments from reaching the Biafra region in the Nigerian civil war (1967-1970). A famine resulted, and over a million Biafrans probably starved. Poor transportation may also contribute to a famine because of the difficulty of shipping food where it is most needed. Many famines result largely from primitive transportation. A famine in what is now the state of Uttar Pradesh in northern India killed about 800,000 people in 1837 and 1838. Lack of transportation prevented the shipment of grain from other areas of India.

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PERFUME

Perfume is a substance that gives off a pleasing fragrance. Perfumes are made of natural or synthetic (artificially created) materials, or a combination of both. People who make perfumes are called perfumers.

People use perfumes in many ways to create a pleasant odor. They apply paste and liquid perfumes to their bodies and clothing. They use lipsticks, face and body lotions and powders, and other cosmetics that contain perfume. By far the largest amount of perfume is used in soaps, especially bar soaps. Industrial odorants (low-priced, scented substances) are added to some products to hide unpleasant odors and make the products attractive to buyers. Paper, plastic, and rubber products are often treated with odorants. Since ancient times, plants and plant products with pleasing odors have been burned as incense during religious services.

All liquids used for body scenting, including colognes and toilet waters, are sometimes considered to be perfumes. But true perfumes--called extracts or essences--contain a greater amount of perfume oils and are more expensive than colognes and toilet waters. Most perfumes consist of 10 to 20 per cent perfume oils dissolved in alcohol. Colognes contain 3 to 5 per cent perfume oils dissolved in 80 to 90 per cent alcohol, with water making up the balance. Toilet waters have about 2 per cent of perfume oils in 60 to 80 per cent alcohol, and the balance consists of water.

How perfumes are made

The composition of a perfume depends largely on its intended use. Most expensive body perfumes contain rare flower oils from many parts of the world. Perfumes used in soapmaking come from lowcost materials. Industrial odorants also consist mainly of low-cost fragrances. Many perfumes are blends of flower and plant oils, animal substances, synthetics, alcohol, and water.

Plant substances. Fragrant plants have tiny sacs (baglike parts) that make and store the substances that give them their pleasant odor. These substances are called essential oils. Essential oils taken from flower petals are used in the most delicate and expensive perfumes. Essential oils are also found in other parts of plants. They may come from the bark, buds, leaves, rinds, roots, wood, or from whole plants. Plants whose oils are used extensively in perfumes include the cinnamon, citronella, geranium, jasmine, lavender, patchouli, rose, rosemary, sandalwood, and tuberose. Much essential oil is extracted (obtained) from plants by steam distillation. The first step in this process is to pass steam through the plant material. The essential oil turns to gas, which is then passed through tubing and cooled to make it liquid again. Essential oil is obtained from some flowers by boiling the petals in water, rather than by passing steam through them.

Solvent extraction is an important way of obtaining essential oils from flowers. The petals are dissolved in a solvent (liquid that can dissolve other substances). The solvent is distilled from the solution, leaving a waxy material that contains the oil. This material is placed in ethyl alcohol. The essential oil dissolves in the alcohol and rises with it to the top of the wax. Heat is applied, and the

alcohol evaporates, leaving a highly concentrated form of perfume oil.

Enfleurage is another method of extracting flower oils. Glass plates are covered with fat, and flower petals are spread over the fat. The fat absorbs the oil from the petals, forming a greasy pomade.

The pomade is treated with alcohol to dissolve out the oil.

Animal substances slow the evaporation of perfume oils, and make the fragrances long-lasting. For this reason, they are often called fixatives. Perfume ingredients from animals include castor, from the beaver; civet musk, a fatty substance from the civet; musk, from the male musk deer; and ambergris, a waxy substance from the sperm whale.

Synthetic substances account for the largest amount of materials used in the perfume industry. The raw materials for these substances may be obtained from natural sources, petrochemicals, or coal
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tar. Some synthetic materials have the same chemical makeup as naturally occurring materials.

Others are different from any material found in nature. Many synthetic odors have been developed throughout the world to meet the increasing demand for perfumes and to add to the creative development of the perfume industry.

History

Ancient peoples burned fragrant resins, gums, and woods as incense at their religious ceremonies. The word perfume comes from the Latin words *per*, meaning through, and *fumus*, meaning smoke.

Perfumes have been found in the tombs of Egyptian pharaohs (rulers) who lived more than 3,000 years ago. The Egyptians soaked fragrant woods and resins in water and oil, and then rubbed their bodies with the liquid. They also embalmed (preserved) their dead with these liquids. The ancient Greeks and Romans learned about perfumes from the Egyptians.

For hundreds of years, perfume making was chiefly an Oriental art. In the early 1200's, the crusaders brought perfume from Palestine to England and France. By the 1500's, perfumes had become popular throughout Europe. Synthetic chemicals have been used extensively in perfumes since the late 1800's. Today, the perfume industry is a billion-dollar-a-year business in the United States.

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WRESTLING

Wrestling is a sport in which two opponents try to pin (hold) each other's shoulders to a mat on the floor. Wrestlers use maneuvers called holds to grasp their opponents and control their movements. Successful wrestling demands strength, speed, coordination, balance, physical conditioning, and knowledge of body leverage. A clever wrestler can often defeat a stronger and heavier opponent. There are more than 50 kinds of wrestling. Each has its own rules. Some kinds do not require a pin for victory. In Japanese sumo, for example, a wrestler tries to throw his opponent to the ground or force him outside a 15-foot (4.6-meter) circle.

Amateur wrestling

Amateur wrestling is a popular sport in schools in the United States and Canada. Every year, students in elementary school through college take part in wrestling matches. National and world championship competitions are held annually. Every four years, wrestlers compete in the Summer Olympic Games. Wrestlers from Western Hemisphere nations also meet at four-year intervals in the Pan American Games.

The Federation Internationale de la Lutte Amateur (FILA) governs international amateur wrestling. USA Wrestling governs the sport in the United States. Although amateur wrestling traditionally is a sport for boys and men, FILA established separate competition for women's freestyle wrestling in 1988.

Chief forms of wrestling. The two most popular forms of wrestling in the world are Greco-Roman and freestyle. Freestyle is the older of the two forms and the most popular in North America. It resembles the style practiced by the ancient Greeks. The Greco-Roman style developed after the Romans conquered Greece and modified the Greeks' style. Greco-Roman is the more popular form throughout Europe. International competition, including the Olympics, is held in both freestyle and Greco-Roman.

Most of the rules and procedures in the two styles are the same. The main difference concerns the use of the legs. In freestyle, wrestlers may use the legs to grasp an opponent's arms or legs, or to trip or tackle an opponent's legs. In Greco-Roman, a wrestler cannot attack an opponent's legs or attack with his own legs. The legs may be used only for support, so upper body strength and leverage are the chief factors.

Some international wrestling meets feature competition in a style called sambo, or sombo, which originated in the Soviet Union in the 1930's. Sambo is a blend of several forms of wrestling and the martial arts, especially judo.

High school and intercollegiate wrestling. There are 13 weight classes in high school wrestling in the United States. There are 10 intercollegiate classes. A wrestler may weigh no more than the weight in his class, though he may weigh less. High school weight classes range from 100 pounds to a heavyweight class of no more than 275 pounds. Intercollegiate classes range from 118 pounds to no more than 275 pounds.

High school matches are divided into three periods of two minutes each. Intercollegiate matches begin with a three-minute period. The remaining two periods last two minutes each. Matches take place on a cushioned mat with a wrestling area at least 32 feet (9.75 meters) square or 32 feet in diameter. At least 5 feet (1.5 meters) of mat must surround the wrestling area. The first period begins with the wrestlers standing and facing each other. The second period begins with one wrestler having a choice of top position, bottom position, or neutral position, or the wrestler can defer the choice to the opponent. For a description of these positions, see the illustrations of holds and positions in the Wrestling article in the print version of The World Book Encyclopedia

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Wrestlers receive points for skillfully executing various holds and maneuvers. They may also win points if their opponent commits a technical error, uses an illegal hold, or breaks a rule. The match ends when a wrestler gains a fall by holding his opponent's shoulders to the mat. The opponent's shoulders must be held for two seconds in a high school match and for one second in an intercollegiate match. If no fall occurs, the wrestler with the most points wins by a decision. The referee is sometimes assisted by a second referee.

International competition. There are 10 weight classes in both freestyle and Greco-Roman wrestling in international competition, including the Olympics. They range from 105.5 pounds to a class of no more than 286 pounds. The participants in each weight class are paired using a blind draw within a bracket system. The athletes wrestle for the first six places. The top three receive medals.

Each match consists of one five-minute period, plus a three-minute overtime if neither wrestler has scored at least three points. The wrestlers start the match on their feet, facing each other. Three officials direct each match. At least two of them must agree on a decision.

Professional wrestling

Professional wrestling has become more of an entertainment spectacle than a sport. Showmanship often replaces skill. Most matches take place in a roped and padded ring similar to a boxing ring. Many wrestlers wear fantastic costumes and use unusual names. Many matches pair a "hero" against a "villain," and they often appear to be violently attacking each other.

History

Wrestling dates back to prehistoric times. In French caves, drawings and carvings 15,000 to 20,000 years old show wrestlers in various positions. Wrestling was introduced into the Olympic Games in Greece in 708 B.C. In America, Indians wrestled before Europeans arrived in the New World.

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TEA

Tea is a beverage prepared by pouring boiling water over dry processed tea leaves. It ranks as the most popular refreshing drink in more countries than any other beverage.

The annual worldwide production of dried tea totals about 53/4 billion pounds (2.6 billion kilograms). India has always played a dominant role in world tea production. Today, India produces over 11/2 billion pounds (720 million kilograms) each year. China is the second largest producer with over 11/4 billion pounds (600 million kilograms) annually. Other tea-producing countries include Indonesia, Kenya, and Sri Lanka.

The tea-producing countries themselves consume over one-half of the global tea crop. Britain imports the greatest amount of tea--about 400 million pounds (180 million kilograms) annually. On the average, about 7 pounds (3.2 kilograms) of tea are consumed per person each year in Britain. People in the United States consume about 3/4 pound (0.34 kilogram) of tea per person per year.

From leaf to cup

The tea plant grows in tropical and subtropical climates. The plant, an evergreen, grows quickly at low altitudes where the air is warm. The finest tea comes from elevations of 3,000 to 7,000 feet (900 to 2,100 meters). The plant grows more slowly in cool air, adding to its flavor.

Tea plants have small, white, sweet-smelling flowers. Each flower produces three seeds that look like

hazelnuts. On a tea estate or in a tea garden where tea plants are grown commercially, workers plant the seeds in a nursery bed. Another method of cultivating tea involves planting cuttings of tea plants with desirable qualities, such as high yield or special flavor, in the bed. About a year later, when the plants are about 8 inches (20 centimeters) high, they are transplanted to the field. About 3,000 tea plants grow on 1 acre (0.4 hectare) of land.

Wild tea plants grow as high as 30 feet (9 meters). But a commercial tea plant is pruned to keep it from 3 to 4 feet (91 to 120 centimeters) high. The plant matures in three to five years and produces a flush (growth of new shoots). Each shoot consists of several leaves and a bud. At lower altitudes, tea plants may grow a flush every week. At higher altitudes, a plant needs as long as two weeks to grow a flush. Tea plants produce no flushes in cold weather.

Workers called tea pluckers pick the flushes off the bush by hand. A plucker can harvest about 40 pounds (18 kilograms) of tea leaves a day, enough to make about 10 pounds (4.5 kilograms) of manufactured tea. Mechanical pluckers are common in countries with flat land. These devices are tractorlike machines that can harvest as much tea leaf as up to 100 manual pluckers. However, tea of higher quality is generally produced from leaves that have been hand-plucked.

Processing tea. There are three main kinds of tea: (1) black, (2) green, and (3) oolong. They differ in the method used to process the leaves. The processing takes place in a factory on or near the tea estate. All tea-producing countries manufacture black tea. Most of the green and oolong tea comes from China, Japan, and Taiwan.

Black tea. To make black tea, workers first spread the leaves on shelves called withering racks. Air is blown over the leaves to remove excess moisture, leaving them soft and flexible. Next, the leaves are crushed between the rollers of a machine to release their flavorful juices. Then, in a fermenting room, the tea leaves change chemically under controlled humidity and temperature until they turn coppery in color. Finally, the leaves are dried in ovens and become brownish-black. Green tea is made by steaming the leaves in large vats. The steaming prevents the leaves from changing color.

The leaves are then crushed in a machine and dried in ovens. Oolong tea is made by partially fermenting the leaves. This gives tea leaves a greenish-brown color. Grades of tea vary only according to the size of the leaves. The size of a tea leaf has nothing to do with the quality of the tea.

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To sort the processed tea leaves by grade, they are passed across screens with different size holes. The largest tea leaves, selected for loose tea, are classified--in order of size--as orange pekoe, pekoe, and pekoe souchong. The smaller or broken tea leaves, generally used in tea bags, are classified as broken orange pekoe, broken orange pekoe fannings, and fannings. Instant tea is made by brewing tea on a large scale and then removing the water by a drying process. When the process is completed, only a powder remains. The powdered tea combines easily with moisture, and so it must be packed under controlled humidity and temperature. People make instant tea at home by simply adding water to the powder.

Teas grown in different countries, or even in different parts of the same country, vary in taste, flavor, and quality. To obtain the best teas, each tea company employs tea tasters who select only certain teas for purchase. These teas, after being blended by the company, have a flavor for which the firm is known. The company then sells its blend of tea under its own brand name.

Brewing tea. Tea is brewed by pouring boiling water over one teaspoon of loose tea, or one tea bag, per cup. To obtain the best flavor, the tea should steep (soak) for three to five minutes before being served. People who prefer weak tea can add hot water. Iced tea, the most popular form of the beverage in the United States, is prepared by first brewing a strong hot tea. For each two glasses, three teaspoons of tea or three tea bags should be used. After steeping for five minutes, the tea is cooled at room temperature and served over ice cubes.

History

According to legend, the use of tea was discovered by Emperor Shennong of China about 2737 B.C. The earliest known mention of tea appeared in Chinese literature of about A.D. 350. The custom of tea drinking spread to Japan around A.D. 600. The first shipment of tea to Europe was made in 1610 by Dutch traders who imported it from China and Japan. By 1650, the Dutch were importing tea into the American Colonies. In 1657, the beverage was sold for the first time in coffee houses in England. Tea went on to become the national drink of Britain. In 1767, Britain placed a tax on the tea being used by the American colonists. Colonial resistance to the tax brought about the Boston Tea Party in 1773 and contributed to the American independence movement. The use of iced tea and tea bags

began in the United States. Richard Blechynden, an Englishman trying to increase the use of tea in the United States, first served iced tea at the Louisiana Purchase Exposition (also called the St. Louis World's Fair) in 1904. That same year, Thomas Sullivan, a New York City coffee and tea merchant, sent his customers samples of tea leaves in small silk bags instead of the usual tin containers. The customers began to order tea leaves in bags after finding that tea could be brewed easily with them. Instant tea was developed in the United States and first marketed in 1948.

Scientific classification. The tea plant is a member of the tea family, Theaceae. It is *Camellia sinensis*.

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AESTHETICS

Aesthetics, also spelled esthetics, is the study of theories that apply to the arts in a broad and fundamental way. People think about aesthetics when they ask why some things are beautiful and some are not, or whether there are basic rules for creating or interpreting good paintings, poems, and music.

Aestheticians study the arts in general. They compare arts from different cultures and from different periods of history, in order to organize our knowledge of them systematically. For many years, the study of beauty was regarded as the central problem of aesthetics. Now the subject has broadened to include many other aspects of art. Aestheticians try to understand how art is related to what people feel, to what they learn, and to the cultures in which they live. To gain this understanding, they collect, organize, and interpret information about the arts and aesthetic experience.

Aestheticians try to find whether there are standards of art criticism. This helps people appreciate different kinds of art and judge them intelligently.

In addition to studying theories about works of art, aestheticians want to understand artists and audiences. They can understand art better if they have learned how artists imagine, create, and perform, and what makes artists' activities different from the work of nonartists. They also try to understand what happens to people's feelings when they experience art. Aestheticians study how art affects people's moods, beliefs, and values.

Aesthetics is the youngest branch of philosophy to be given its own name, which was first used in the late 1700's. But philosophers from the ancient Greeks to the present day have discussed the philosophy of art. Almost all of them have talked about whether art is good for people and for society. Some point out that art can have dangers as well as benefits, and a few argue that art and artists are so disruptive that they threaten the social order. But most philosophers believe art is good because it allows us to express our emotions, teaches us about ourselves and the world, or communicates the traditions of different times and cultures.

Aestheticians use art history to understand the art of previous times. They use the psychology of art to learn how our senses interact with our imagination and understanding when we experience art.

Art criticism serves as a guide to enjoy each individual work of art. The social sciences, such as anthropology and sociology, help aestheticians understand how creating and appreciating art relate to other human activities. The social sciences also indicate how art varies in relation to physical, social, and cultural environments.

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BIOLOGY

Biology is the scientific study of living things. There are more than 10 million species of living things on the earth. They range in size from microscopic bacteria to huge blue whales and towering redwood trees. Living things also differ greatly in where and how they live. However, all forms of life share certain characteristics that set them apart from nonliving things. These characteristics include the ability to reproduce, to grow, and to respond to changes in the environment.

Traditionally, biology has been divided into two major fields. Botany deals with plants, and zoology with animals. Botany and zoology are further divided into various branches and specialized areas of study. But most branches of biology--for example, anatomy (the study of the structure of living things) and genetics (the study of heredity)--apply to both plants and animals.

Biology may also be divided into ecology, physiology, and systematics. Ecology deals with the relationships among living things and between organisms and their environment. Physiology concerns life functions, such as digestion and respiration. Systematics, also called taxonomy, is the scientific classification of organisms.

Biologists often make use of the methods and findings of other sciences. For instance, they rely on physics and chemistry to help them understand the processes that occur in living plants and animals.

They use statistics in studying changes in the size of an animal or plant population--that is, the number of organisms of a particular species in an area. Exobiologists work with astronomers in searching for life elsewhere in the universe.

Biological research has greatly affected people's lives. For example, farm production has soared as biologists have helped develop better varieties of plants and new agricultural techniques. Discoveries in biology have enabled physicians to prevent, treat, or cure many diseases. Research on the relationships between living things and their environment has helped in the management of wildlife and other natural resources.

What biologists study

Biology is such a broad subject that most biologists specialize in some area of study. But in whatever area they work, all biologists are interested in both the parts of living things and how the parts work together.

Certain biologists study organisms that live in a specific environment. Marine biologists, for example, investigate life in the ocean. Some biologists concentrate on a particular type of organism.

Ornithologists, for instance, study birds. Many biologists examine the parts of living things.

Cytologists, for example, deal with the structure, composition, and functions of cells. Other biologists analyze life processes. Embryologists, for example, investigate the formation and development of animals and plants before they become independent organisms.

The techniques and tools that biologists use depend on what they are investigating. Many biologists conduct experiments to gain information and to develop and test theories. Their experiments may involve making a change in an organism's way of life or its environment and then observing the effects of that change. For example, a biologist may change the diet of an animal and study how the animal's growth and functioning are thereby affected. The microscope has long been one of the biologist's most useful tools. An entire branch of biology, called microbiology, is devoted to the study of organisms that can be seen only with a microscope. Other techniques and tools used by biologists range from aerial surveys of plant and animal populations to techniques that isolate the molecules of living cells.

History of biology

Beginnings. In prehistoric times, people gradually developed a great deal of practical biological knowledge. They learned to grow many kinds of plants and to tame and raise certain animals. In 125

ancient times, people of China, India, and the Middle East accumulated further knowledge of plants and animals. For instance, they knew how to use numerous plants as medicines or poisons. The Egyptians learned some anatomy and physiology through embalming their dead.

The ancient Greeks made major advances in biology. Unlike most other people of the time, some Greek thinkers did not believe that gods or spirits caused natural events. Instead, they saw nature as operating according to laws that people could discover. About 400 B.C., a Greek physician named Hippocrates taught that diseases have only natural causes. He also emphasized the relationships among the parts of an organism and between an organism and its environment. Hippocrates is often called the father of modern medicine.

During the 300's B.C., the Greek philosopher Aristotle gathered a vast amount of information about plants and animals. He was one of the first thinkers to classify animals according to their own characteristics rather than according to their usefulness to people. Pliny the Elder, a Roman naturalist who lived during the first 100 years after Christ's birth, also collected many facts about plants and animals. He included the information in his 37-volume *Natural History*.

During the A.D. 100's, Galen, a Greek physician who practiced medicine in Rome, contributed greatly to advances in anatomy and physiology. He gained much of his knowledge from treating injured gladiators and dissecting apes and pigs.

The growth of biological knowledge slowed during the Middle Ages, a 1,000-year period in European history that began in the 400's. However, works by Hippocrates, Aristotle, Galen, and other ancient authorities were collected, preserved, and translated by Arab scholars in the Middle East. The Arabs also made major contributions of their own in biology. The works of the ancient Greek and Arab scientists eventually made their way to Europe. During the Middle Ages, the authority of the ancient writers was unquestioned, though their works contained many errors.

The Renaissance. From the early 1300's to about 1600, a new spirit of inquiry spread across western Europe. During this period, called the Renaissance, many anatomists and physiologists began to challenge the authority of the ancient writers. They believed that people should rely on

experimentation and observation rather than accept without question the ideas of the ancients. The emphasis on observation stimulated the development of a high degree of naturalism and accuracy in biological illustration. During the late 1400's and early 1500's, the great Italian artist Leonardo da Vinci made hundreds of drawings of the human body in which he paid careful attention to detail and proportion. Leonardo based his work on dissections of human corpses. The first scientific textbook on human anatomy was published in 1543. This work, titled *On the Structure of the Human Body*, was written by Andreas Vesalius, an anatomist born in what is now Belgium. Like Leonardo, Vesalius based his work on dissections he had made of human corpses. The book, richly illustrated with exceptionally lifelike drawings of human anatomy, corrected many of Galen's mistaken ideas.

One of the most important discoveries in physiology in the 1600's was made by William Harvey, an English physician. In 1628, Harvey published the results of his experiments showing how blood, pumped by the heart, circulates through the body.

Early discoveries with the microscope. The introduction of the microscope led to great discoveries in biology during the middle and late 1600's. In 1661, an Italian anatomist named Marcello Malpighi, with the aid of a microscope, became the first person to observe the movement of blood through the capillaries. In 1665, Robert Hooke, an English experimental scientist, published *Micrographia*, a book containing detailed drawings of many biological specimens as seen with a microscope. The book included the first drawings of cells. In the mid-1670's, Anton van Leeuwenhoek, a Dutch amateur scientist, discovered microscopic life forms, thus opening up a new world for investigation.

The origins of scientific classification. During the 1700's, Europeans came into increasing contact with distant parts of the world and thereby learned of many unfamiliar plants and animals.

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Naturalists realized that they needed a classification system that could include those plants and animals. In 1735, the Swedish naturalist Carolus Linnaeus (also called Karl von Linne) published a system of classification in which he grouped organisms according to structural similarities. His system forms the basis of scientific classification used today.

Classifying organisms according to structural similarities stimulated interest in comparative anatomy--the comparison of the anatomical structures of different organisms. The leading comparative anatomist of the late 1700's and early 1800's was Baron Cuvier of France. Cuvier noticed that most kinds of animals have one or another of a very few basic body types. He devised a system of classifying animals according to basic body types that is still used in modified form. Cuvier also applied the methods of comparative anatomy to another field he helped establish, paleontology--the study of prehistoric life.

The theory of evolution. Most biologists had long believed that each species of life had remained unchanged and no new species had appeared since the world began. However, biologists began to question those beliefs during the late 1700's. They noted that farmers had produced new varieties of plants and animals by selective breeding. In addition, voyages of exploration had revealed isolated groups of plants and animals that contained many species which varied only slightly from one another. Biologists wondered why there should be so many species with little variation. Such observations led many biologists to believe that species change over time and that some species had evolved (gradually developed) from others.

During the early 1800's, several biologists proposed explanations of how species evolve. The most convincing theory was eventually reached independently by two British naturalists--Charles Darwin and Alfred Russel Wallace. However, Darwin presented his ideas in a widely read book, and his work became better known.

Darwin detailed his theory of evolution in *The Origin of Species* (1859). According to Darwin, some organisms are born with traits that help them survive and reproduce. They pass the favorable traits on to their offspring. Other members of the same species that have unfavorable traits are less likely to survive and reproduce. The unfavorable traits eventually die out. Darwin proposed that species evolve as more and more favorable traits appear and are passed from generation to generation. He called the process natural selection.

Materialistic physiology and the cell theory. Many physiologists of the late 1700's had come to think of life as the total of the physical and chemical processes occurring in an organism. Unlike some other biologists, they did not believe that living things are guided in their functioning by any spiritual or supernatural forces. Instead, they felt that living things are nothing more than special combinations of materials and function like machines. Such views are called materialistic physiology

or mechanistic materialist physiology.

Antoine Lavoisier, a French chemist, applied the techniques of chemistry to physiology in the late 1700's. He compared respiration to the burning of a candle because both processes use oxygen and produce heat and carbon dioxide. Beginning in the mid-1800's, the French physiologist Claude Bernard introduced a new approach to materialistic physiology. He saw living things as highly organized sets of control mechanisms that work to maintain the internal conditions necessary for life. He pointed out that in a mammal, for example, such mechanisms keep body temperature constant in spite of variations in the temperature outside the organism.

Paralleling developments in physiology was a growing understanding of the cell. In the late 1830's, two Germans--the botanist Matthias Schleiden and the physiologist Theodor Schwann--proposed that the cell was the basic structural and functional unit of all plants and animals. In 1858, Rudolf Virchow, another German scientist, published his theory that all diseases were diseases of the cell. In combination, these ideas are called the cell theory.

Building on materialistic physiology and the cell theory, Louis Pasteur, a French chemist, and Robert Koch, a German physician, firmly established a new theory of disease during the middle and late 127

1800's. Through their studies, Pasteur and Koch proved what was called the germ theory. According to the theory, many diseases are caused by microscopic organisms.

The growth of modern biology. During the late 1800's, Darwin's theory of evolution had stimulated much speculation among biologists about the origin, nature, and development of organisms. By the early 1900's, however, many biologists strongly rejected the emphasis on theory and speculation. Instead, they stressed the value of carefully controlled experiments and the application of mathematical techniques to biology. That method of investigation helped lead to an enormous expansion of biological knowledge, particularly in the understanding of the chemical and molecular basis of life.

Genetics was established as a branch of biology in the early 1900's. It developed chiefly from experiments conducted during the mid-1800's by Gregor Mendel, an Austrian monk. On the basis of his experiments, Mendel discovered that physical characteristics are produced by basic hereditary units that transmit traits from generation to generation. About 1910, Thomas Hunt Morgan, an American biologist, found that Mendel's hereditary units--later called genes--are located on structures called chromosomes within cells. Biologists at the time also noted that changes in hereditary traits correspond to visible changes in chromosome structure.

During the 1940's, geneticists found that genes guide the manufacture of the proteins by which cells regulate their chemical processes. In 1953, biologists James D. Watson of the United States and Francis H. C. Crick of the United Kingdom proposed a model of the molecular structure of deoxyribonucleic acid (DNA), the material in chromosomes that controls heredity. Knowing DNA structure enabled biologists to understand the molecular basis of such life processes as heredity and genetic change.

Breakthroughs in genetics helped alter biologists' approach to the study of evolution. By the 1960's, many biologists were studying evolution in terms of changes in the kinds and numbers of genes in a population.

The field of ecology began to develop dramatically in the early 1900's. Scientists had long recognized the importance of the relationships among organisms and between organisms and their environment. But the development of ecology as a separate branch of biology occurred after the introduction of such techniques as statistical analysis of complex systems of relationships. Since the 1960's, concern about environmental effects of pollution has greatly stimulated research in ecology.

During the 1900's, neurobiologists--people who study the nervous system--have learned much about how nerve cells and nerve networks function. Their work has led to a better understanding of how the brain and central nervous system process information.

Current research and issues. The study of the human immune system--that is, the body's defense system against disease and foreign substances--is one area at the frontier of biological research. Scientists are learning how our bodies produce a seemingly endless variety of disease-fighting proteins called antibodies. Each antibody is tailored to combat one of many foreign substances called antigens. Biologists have discovered that the body can produce a great number of different antibodies because certain genes rearrange themselves to produce antibodies that attack specific antigens. The study of the immune system has helped combat AIDS, a disease that immobilizes the immune system.

Since the 1950's, biologists have been collecting evidence for the theory that life began in a series of chemical reactions early in the earth's history. They have produced biological molecules in chemical experiments that reproduce conditions thought to have existed on earth billions of years ago.

Since the 1970's, a growing number of biologists have questioned the idea that evolutionary change occurs only as a result of a gradual process. Instead, they accept the idea that evolution may proceed at times by abrupt changes leading to the replacement of one species by another. Although there is questioning over details, most biologists believe in the general outlines of evolution theory.

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However, some other people reject the theory because of the many gaps in our understanding of how particular species evolved. Still others object to the idea of evolution because it conflicts with their religious beliefs about the creation of life.

By the mid-1970's, scientists had learned how to remove genes from one species and insert them into another. The process is called genetic engineering. Genetic engineering offers many potential benefits in medicine, industry, and agriculture. For example, scientists have transferred to bacteria the human gene that produces insulin--a hormone that regulates the body's use of sugar. The bacteria then produce insulin, which can be used to treat people with diabetes. But some question the morality of interfering with the hereditary makeup of living things through genetic engineering. Genetic engineering has also caused concern that the release of genetically engineered organisms into the environment may have harmful effects. For this reason, scientists involved in genetic engineering guard against accidental release of such organisms.

In 1996, Scottish scientists led by biologist Ian Wilmut successfully cloned a mammal by taking an egg cell from an adult female sheep and replacing the cell's nucleus with one from another adult sheep. The sheep clone they produced was named Dolly. This marked the first time a mammal had been cloned in this way, and it sparked a debate about the potential cloning of humans.

In 1990, geneticists from around the world launched the Human Genome Project. This project seeks to obtain the sequence, or order, of all DNA in the genome of humans and other organisms. A genome consists of all genes on the chromosomes of a cell. By the late 1990's, Human Genome Project scientists had obtained sequences for the genomes of several species of yeast, a species of roundworm, and other living things.

Careers in biology

To prepare for a career in biology, students should take such high school and college courses as chemistry, mathematics, and physics as well as biology. A bachelor's degree is sufficient for some biology careers, but many positions require a graduate degree. Some people with a bachelor's degree teach in junior high and high schools. Others work as technicians in research laboratories. Many biologists with advanced degrees teach and conduct research at universities.

Job opportunities for biologists in agricultural research and in industry are increasing, especially in the areas of genetic engineering and ecology. Such biologists may work to develop new varieties of food crops or to create organisms capable of producing drugs.

Many government agencies responsible for public health, sanitation, and water quality employ biologists. Careers in biology also include work in zoos and botanical gardens. Some specialists in ecology and wildlife management work in state and national parks. In addition, some companies and government agencies hire biologists to study the environmental effects of pollution and of proposed construction projects.

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DEATH

Death is the end of life. Every living thing eventually dies, but human beings are probably the only creatures that can imagine their own deaths. Most people fear death and try to avoid thinking about it. But the awareness of death has been one of the chief forces in the development of civilization. Throughout history, people have continually sought new medical knowledge with which to delay death. Philosophers and religious leaders have tried to understand the meaning of death. Some scholars believe that much human progress results from people's efforts to overcome death and gain immortality through lasting achievements.

Medical aspects of death. Scientists recognize three types of death that occur during the life of all organisms except those consisting of only one cell. These types are necrobiosis, necrosis, and somatic death.

Necrobiosis is the continual death and replacement of individual cells through life. Except for nerve cells, all the cells of an organism are constantly being replaced. For example, new skin cells form

under the surface as the old ones die and flake off.

Necrosis is the death of tissues or even entire organs. During a heart attack, for example, a blood clot cuts off the circulation of the blood to part of the heart. The affected part dies, but the organism continues to live unless the damage has been severe.

Somatic death is the end of all life processes in an organism. A person whose heart and lungs stop working may be considered clinically dead, but somatic death may not yet have occurred. The individual cells of the body continue to live for several minutes. The person may be revived if the heart and lungs start working again and give the cells the oxygen they need. After about three minutes, the brain cells--which are most sensitive to a lack of oxygen--begin to die. The person is soon dead beyond any possibility of revival. Gradually, other cells of the body also die. The last ones to perish are the bone, hair, and skin cells, which may continue to grow for several hours.

Many changes take place after death. The temperature of the body slowly drops to that of its surroundings. The muscles develop a stiffening called rigor mortis. The blood, which no longer circulates, settles and produces reddish-purple discolorations in the lowest areas of the body.

Eventually, bacteria and other tiny organisms grow on the corpse and cause it to decay.

Defining death. Traditionally, a person whose breathing and heartbeat had stopped was considered dead. Today, however, physicians can prolong the functioning of the lungs and heart by artificial means. Various machines can produce breathing and a heartbeat even in a patient whose brain has been destroyed. These new medical procedures led many people to call for a new definition of death.

The Uniform Determination of Death Act, which was drafted in 1980, has been adopted by most states of the United States. Under this act, a person is considered dead when breathing and the heartbeat irreversibly stop, or when brain function totally and irreversibly stops, which is a condition also called brain death. The act permits physicians to use reasonable medical standards in applying this legal definition.

The brain-death definition of death raises important medical, legal, and moral questions. People who support this definition argue that it benefits society by making vital organs available for transplants. In most cases, the organs of a person who has died under the traditional definition are damaged and cannot be transplanted. But many vital organs remain alive and functioning in an individual whose body processes are maintained by machine, even though brain activity has stopped. Physicians can use these organs in transplants--if brain death is accepted as a legal definition.

Critics of the brain-death definition point out that there are many unanswered questions regarding this concept. Such questions include: Who should decide which definition of death to use? When has brain death reached the point where it cannot be reversed?

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The right to die. Many people believe that physicians should use every means to maintain a person's life as long as possible. But others argue that dying patients and their physicians have the right to stop treatment that would only temporarily extend life. Some people also feel that the patient's

family and physician have the right to stop such treatment when patients can no longer express their wishes. In 1990, the Supreme Court of the United States ruled that patients who have clearly made their wishes known have a right to discontinue life-sustaining medical treatment. Withdrawal of such treatment is sometimes called passive euthanasia.

Some people draw up a document called a living will, in which they express their wishes about what kind of care they want to receive when they are near death and unable to communicate. Most states have laws that recognize living wills under certain circumstances.

Some people believe that hopelessly ill patients should have the right not only to refuse treatment but also to request physician-assisted suicide. In physician-assisted suicide, a doctor helps a patient die painlessly and with dignity. Many nations and many states of the United States have laws against the practice. Physician-assisted suicide is technically illegal but widely practiced in the Netherlands. Supporters of physician-assisted suicide feel that life-extending medical techniques have created a need for new approaches to care at the end of life. They feel that such care should include help with dying if patients can think clearly and freely request assistance. Other people oppose physician assisted-suicide because it is a form of active euthanasia. In active euthanasia, fatally ill people are put to death with or without their consent. Opponents fear that physician-assisted suicide could open the door to other forms of active euthanasia.

Attitudes about death changed during the 1900's. About 1900, the majority of deaths were those of children who died of diphtheria, pneumonia, or some other infectious disease. Most people died at

home, surrounded by their families. People were familiar with dying and viewed death as a natural part of life.

Today, most people in industrial nations die from heart disease, cancer, stroke, or other diseases associated with aging. As a result, about 95 percent of all children reach adulthood without experiencing a death in their family. In addition, most deaths now occur in hospitals. Therefore, many young people have never been present at someone's death. This lack of experience makes it difficult for many people to talk openly about death or to be with a dying person.

The increasing number of deaths among the elderly has also affected attitudes about death. Many people have come to view the elderly as having "lived out their lives" and experience the death of an elderly person as a natural, inevitable event. The death of a child or a young adult, on the other hand, is considered unjust. Such a death generally has more complicated emotional consequences.

Traditionally, people have confronted death within a set of religious beliefs that gave it meaning apart from the natural world. Mourning rites and funeral customs have helped them deal with the grief that accompanies the loss of a loved one. But a growing number of people now view death more in terms of a biological process. On the other hand, some people find death a threatening prospect and choose to deny it. Still others regard death as the greatest possible challenge. They seek to delay the aging process or to defeat death itself through medical science or by other means.

During the mid-1900's, many psychologists and other people became interested in the special emotional needs of dying people. For example, studies showed that friends, relatives, and even doctors and nurses avoided dying patients because of their own feelings about death. As a result, many critically ill patients suffered greatly from loneliness. To help solve this problem, a number of medical schools, hospitals, colleges, and churches began to give courses in death education. Such courses were designed to help people become more knowledgeable about death and more responsive to the needs of the dying.

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CHOCOLATE

Chocolate is a food made from the seeds of a tropical tree called the cacao. The word cacao apparently comes from two Maya Indian words meaning bitter juice. The word chocolate came from two Maya words meaning sour water.

The cacao tree produces the seeds, or cacao beans, from which all chocolate is made. These trees flourish in a warm, moist climate. They live within an area about 20° latitude north and south of the equator. Most of the world's cacao beans come from the west coast of Africa, where Ghana, the Ivory Coast, and Nigeria are the largest producers. Brazil is the largest cacao bean producer in the Western Hemisphere.

The cultivated cacao tree grows about 25 feet (7.6 meters) high. It produces leaves, flowers, and fruit in all seasons of the year. The flowers are small. They grow singly and in clusters on the main stem of the branches and on the trunk. The ripe fruit, or pod, may be red, yellow, golden, pale green, or a combination of these colors. The melonlike pod contains 20 to 40 almond-shaped seeds. When these seeds are fermented and dried, they become the commercial cacao bean.

Because of a mistake in spelling, probably made by English importers many years ago, these beans became known as cocoa beans in English-speaking countries. This causes many people to think that the beans come from the coconut palm tree instead of the cacao tree.

Harvesting the cacao beans. Workers cut the pods from the trees with knives attached to long poles, or with machetes. They gather the pods into heaps, cut them open, and scoop out the beans. The beans are placed in piles, covered with banana leaves or burlap, and allowed to ferment for 7 to 10 days. Next, the beans are dried in the sun or in artificial heat to prevent molding. Then workers place them in bags for shipment.

Manufacturing chocolate. Chocolate manufacturers receive many types of beans. They blend them so they yield the flavor and color desired in the final product. The first steps in processing the seeds include cleaning, roasting, hulling, blending, and grinding them. Cacao seeds with the shells removed are called nibs. The nibs are quite dry, even though they contain about 54 per cent cocoa butter, the natural fat of the cacao bean. In the grinding process, the nibs are ground fine, and the cocoa butter is released. The mixture of cocoa butter and finely ground nibs forms a free-flowing substance known as chocolate liquor.

Chocolate products are all manufactured from the chocolate liquor. They include baking chocolate, cocoa, milk chocolate, and sweet and semisweet chocolate.

Baking chocolate is the commercial form of chocolate liquor. Manufacturers cool and solidify the

chocolate liquor into cakes. The bitter, unsweetened baking chocolate is used in many baked products.

Cocoa. In making cocoa powder, huge hydraulic presses force some of the cocoa butter out of the heated chocolate liquor. The mass remaining in the hydraulic presses is in the form of large, hard cakes. Manufacturers change this remainder into its final usable form by grinding it into fine reddishbrown powder. People can prepare a hot beverage from the cocoa powder by adding sugar, hot milk, and sometimes vanilla. Confectioners, bakers, ice cream manufacturers, and other food producers use cocoa in their products.

Milk chocolate probably ranks as the most popular of all chocolate products. Chocolate liquor, whole milk solids, and granulated sugar are the basic ingredients in this form of chocolate. Extra cocoa butter, obtained from cocoa powder production, is added to the chocolate liquor. First the ingredients are mixed well. Then the mixture passes through a series of large, steel roll refiners. The shearing and rubbing action of these rolls reduces the mass to a smooth paste. Machines called conches then process the chocolate for 72 hours. In these machines, a large cylindrical stone rolling on a stone bed pushes the chocolate back and forth. This rubbing action smooths off any rough

edges on the chocolate particles, helps develop the desired flavor, and finishes blending the entire mass. Milk chocolate is sold in the form of bars and as the coating on some candies.

Sweet chocolate and semisweet chocolate are processed in the same way as milk chocolate. But manufacturers do not add milk solids to the mixture in making these products. Manufacturers sell large amounts of both sweet and semisweet chocolate to confectioners for making chocolate-covered candies. Increasingly large amounts of semisweet chocolate are used to make homemade cookies, candy, cakes, and other items.

Food value of chocolate. Chocolate serves as both a confection and a food. It possesses a pleasing and widely popular flavor, and also ranks high in food value. Chocolate contains carbohydrates, fats, protein, and several vitamins and minerals. Many people whose work requires physical endurance, including soldiers, explorers, and athletes, rely on chocolate as a source of quick energy for carrying out their tasks.

History. Historians do not know how long the Maya Indians of Central America and the Aztec Indians of Mexico had cultivated cacao beans. But they cultivated the beans before Columbus arrived in America in 1492. Botanists believe the cacao tree originated in the Amazon-Orinoco river basin in South America. In this area and the upper Amazon tributaries, present-day botanists and geneticists are searching for original types of cacao, which may have resistance to the diseases that plague this tree in cultivation.

The cacao bean played an important role in the traditions, religion, and legends of the Aztec. They believed that one of their prophets had brought the seeds from paradise and sown them in his garden. The Aztec thought that by eating the fruit, the prophet acquired universal wisdom and knowledge. The Aztec used the cacao beans as money. They also ground the beans to make a rich beverage.

In 1528, Hernando Cortes, the conqueror of Mexico, took some cacao beans to Spain. In about 1606, cacao beans were introduced into Italy. Shortly after, people in Austria and France began to use the beans. Eventually, their popularity spread to England. By 1707, cocoa had become a fashionable beverage in London. Today, chocolate is popular in most of the world. Countries in which large amounts of chocolate are eaten include Belgium, Germany, Norway, Switzerland, the United Kingdom, and the United States.

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VEGETARIANISM

Vegetarianism is the practice of not eating meat. Vegetarians regard the flesh of all animals, including that of fish and poultry, as meat. Most vegetarians avoid eating meat because of moral or religious beliefs. They believe it is wrong to kill animals for food. Many vegetarians also think that eating meat is unhealthy.

Some vegetarians exclude milk and eggs, as well as meat, from their diet because these foods come from animals. Vegetarians are divided into three groups, based on their attitude toward milk and eggs. Lactoovo-vegetarians include milk and eggs, and foods made from milk and eggs, in their diet. Lacto-vegetarians do not eat eggs, but they drink milk and eat such milk products as butter and cheese. Vegans avoid milk and eggs and all foods made from these animal products.

A vegetarian diet must be well planned to replace the protein and other nutrients provided by meat.

Most lacto-ovo-vegetarians and lacto-vegetarians can easily plan a healthy diet because milk and eggs are good sources of high-quality protein. Milk also provides large amounts of calcium, which helps strengthen bones. Milk and eggs both contain vitamin B-12, which forms a part of red blood cells and helps the nerves function properly.

Vegans must plan their diet especially well because no single fruit, vegetable, or grain contains the nutritionally complete protein found in meat, milk, and eggs. Beans, nuts, peas, and many other vegetarian foods contain large amounts of protein. However, these foods must be eaten in particular combinations to provide the body with nutritionally complete protein. For example, beans and rice together provide complete protein, but neither food does when eaten alone. To obtain calcium, vegans must eat sesame seeds or certain green leafy vegetables, such as broccoli or spinach. Most vegans take vitamin B-12 tablets to obtain this nutrient.

Most vegetarian diets contain fewer calories than diets that include meat. As a result, vegetarians tend to be thinner than meat-eaters. Most vegetarians also consume less saturated fat and smaller amounts of a fatty substance called cholesterol than most meat-eaters do. Lower dietary levels of saturated fat and cholesterol result in lower levels of cholesterol in the blood. Medical research indicates that a high level of cholesterol in the blood is associated with heart disease. Some studies have shown that vegetarians in the United States are healthier and live longer than other Americans. Vegetarianism is practiced by some religious groups, including Hindus and Seventh-day Adventists. Some Americans practice vegetarianism because they believe that consumption of meat, especially beef, reduces the world food supply. They feel that grain used to fatten cattle would nourish more people if the grain were eaten directly by people. Some people also believe the land on which livestock graze should be used to grow grain. But many agricultural experts disagree. They argue that most grazing land is not suitable for farming.

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WEIGHT CONTROL

Weight control is the process of losing or avoiding excess body fat. Weight control depends on the relationship between the amount of food you eat and the energy your body uses to maintain itself or to exercise. This relationship is partly governed by heredity and other factors that people cannot control. But in general, the less you eat and the more you exercise, the less fat you will have.

Weight control is medically important because excess body fat is a major factor in many health problems. Excess fat that is severe enough to pose a medical risk is called obesity. People who carry this degree of excess fat are called obese. Obesity may also contribute to social and emotional difficulties.

Many people who are not medically obese still weigh more than they would like. People tend to regard unusually thin individuals, such as actors and fashion models, as ideals of personal appearance. But there is no single "best weight" for anyone. Bodies come in all shapes and sizes, and weight changes at different times of life. Many physicians use a measurement called body mass index (BMI) to determine if adults are obese. You can calculate your BMI by dividing your weight in kilograms by the square of your height in meters. For example, a woman weighing 130 pounds (59 kilograms) who is 5 feet 4 inches (1.6 meters) tall has a BMI of 59 divided by 2.56 (that is, 1.62), or about 23. Many doctors consider a BMI from 19 to 25 average, and a BMI above 26 or 27 obese.

Dangers of obesity

Obese people are more likely than thinner people to get certain diseases. Such diseases include appendicitis, cirrhosis, diabetes, coronary heart disease, and other diseases of the heart and blood vessels. Treatment of these diseases in people with obesity may be less likely to succeed. Obese patients with one of these diseases may have a better chance of recovery if they reduce.

Obese people have more falls and other accidents than thinner people because excess weight slows people down and hampers coordination. Obesity can also complicate surgery and recovery from injuries. Excess weight cuts down freedom of movement, especially in the elderly, and thus can lower general health because of lack of exercise. Decreased movement can also complicate treatment of obese patients with arthritis.

In many parts of the world, obese people experience discrimination. Fat people are often treated unkindly by others, including their classmates in school. They may have less social success than thinner people and find it harder to get jobs.

Causes of obesity

Eating too many calories. Food energy is measured in units called calories. Each food calorie technically equals 1,000 of the calories used to measure other kinds of heat energy (see CALORIE).

If you eat more calories than you burn, most of the excess will turn into body fat. If you eat fewer calories than you use, your body will burn its stored fat for energy. Whenever you eat about 3,500 more calories than you use, you will gain 1 pound (0.5 kilogram). You will lose a pound of body fat if you consume 3,500 fewer calories than you use. Some countries that use the metric system measure the heat energy from food in joules instead of calories. One food calorie equals about 4,182 joules. The amount of food you eat can play a much more important role in weight control than the kinds of food. People who are overweight, of average weight, or underweight may all eat the same kinds of food. Their weight differences often result from the amount they eat in relation to the amount of energy they use.

Certain centers in the brain control the sensations associated with appetite, hunger, and satisfaction. These centers normally make people eat an amount of food that provides the right amount of energy for their needs. The feeding centers make people want to eat. The satiety centers act as a brake on the feeding centers. They make people feel satisfied and stop eating.

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The feeding and satiety centers are extremely complicated mechanisms. Their function may be affected by emotional pressures or physical processes. For example, strong emotions, such as great disappointment, cause some people to stop all physical activity. At such times, these people eat more than they usually do and gain weight. Other people may respond to disappointment by moving around more, eating less, and losing weight.

Children and pregnant women need a surplus of calories for growth. But even these groups can gain body fat if their food intake is extreme. Some scientists believe that any period of intense overeating in childhood or later life can lead to development of excessive numbers of fat cells. These experts think that these cells store fat so readily that people who develop excessive numbers may be obese for the rest of their lives.

Physical inactivity is a leading cause of obesity among all age groups, but especially among children and teen-agers. Most obese young people do not eat more than young people of average weight. But they are so inactive that, even with a moderate appetite, they eat more than they need and accumulate excess fat.

Exercise burns up calories. The more vigorous the activity, the more calories it uses. A 150-pound (68-kilogram) person walking at 3 1/2 miles (5.6 kilometers) per hour will use up 502 calories--the number of calories in a milk shake--in 97 minutes. That person will use up the same number of calories in 61 minutes by riding a bicycle, or in 26 minutes by running.

The number of calories used is proportional to a person's weight. If you weigh 75 pounds, for example, you will burn half as many calories as a 150-pound person by doing the same exercise for the same length of time.

The appetite of active people can increase if they become very active. If they become inactive, their appetite will not necessarily decrease. Appetite tends to remain above a minimum level even if activity drops.

Heredity. Scientists have learned much about the relationship between heredity and obesity in animals, especially mice. This relationship is based on genes, the chemical units in cells that determine inherited characteristics. Genes determine whether excess weight is stored as lean or fat tissue. Scientists have discovered that mice and certain other animals have a gene that causes the satiety center not to operate. Other genes in some mice cause their bodies to overproduce certain hormones. As a result of these hormones, the mice make body fat too easily or use it up with difficulty. Still other genes cause some mice to become obese more quickly than others when physically inactive or when given a diet high in fat.

The role of genes in human obesity is an active area of study. Scientists suspected that genes might be involved in human obesity because the weight of children is often related to the weight of their parents. For example, in some studies of high school students, only approximately 8 percent of students with thin parents were obese. But if one or both parents were obese approximately 75 percent of the students were overweight. Further, the weight of adopted children does not appear to be related to the weight of their adoptive parents. In 1994, scientists announced the discovery of the first gene believed to be associated with obesity in human beings. Researchers have since found other genes that appear to play a role in human obesity.

Diseases and other causes. Obesity may result from a number of diseases. Some ailments of the endocrine glands cause these glands to release too much of a hormone into the bloodstream. The excess hormone disturbs the feeding and satiety centers of the brain. In addition, obesity can result

from damage to these brain centers caused by infection, injury, or a tumor.

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HOW TO CONTROL OBESITY

You should consult a physician and have a medical checkup before starting any extensive weight reduction program. The advice of a dietitian is also useful. An obese person may need psychological help as well, especially if the person is young and has been teased and made to feel guilty, hopeless, or worthless. Psychological treatment can help overcome these feelings so that obesity can be treated as a medical problem.

Diet. The first step in weight reduction is to develop a healthy diet that stops weight gain. Any reducing diet must provide fewer calories than a person uses. For example, people who eat 1,000 calories a day less than they use will lose about 2 pounds (0.9 kilogram) a week. Doctors generally advise most patients against trying to lose weight any faster.

The foods in a reducing diet must provide a well-balanced selection of all the nutrients needed for good health. There is no evidence that extreme diets--for example, "low carbohydrate" or "low protein" diets, or diets based on single foods--have any advantage over a balanced diet. For a complete discussion of well-balanced diets. In addition, the foods in a reducing diet should taste good and be easy to buy and to cook.

A weight reducer should aim to develop a realistic idea of the actual number of calories in various foods. Many people believe that such foods as baked potatoes and bread have many more calories than they do. People also underestimate the calories in such foods as steak.

Distribution of calories among meals and snacks is up to an individual. Some people can avoid hunger if they divide their calories among four or five light meals or snacks a day. Others can follow a diet better if they eat three meals a day and have no snacks.

Exercise. People on reducing diets must also increase their exercise. But an obese person--even one who is otherwise healthy--should not suddenly start a program of prolonged, strenuous exercise. An exercise program should be developed gradually to avoid dangerous strain on the heart or other body parts. One good way to start is to take daily walks and increase their length. More demanding exercises can be added as a person becomes fitter and thinner. A person should build up to five to six hours of exercise per week. Men over 40 years old, women over 50, and anyone with risk factors or symptoms of heart or lung disease should consult a physician before starting a vigorous exercise program.

Drugs. Doctors may prescribe drugs as part of a weight control program for carefully selected patients who are seriously obese. To be effective, these drugs must be combined with a reduced calorie diet and regular exercise. Patients should receive close medical supervision while taking any weight control medicine. Some such drugs have been linked with extremely serious side effects.

Researchers are continuing their efforts to develop safe, effective drugs to help control weight.

Surgery. Extremely overweight people whose obesity is life-threatening and who cannot reduce with other methods may need an operation to reduce the size of their stomach. In one such operation, called gastropasty or gastric stapling, a surgeon uses a large stapling device to close off most of the patient's stomach. After the surgery, the patient can eat only a small amount of food before becoming full.

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SUPERSTITION

Superstition is a traditional belief that a certain action or event can cause or foretell an apparently unrelated event. For example, some superstitious people believe that carrying a rabbit's foot will bring them good luck. Others believe that if a black cat crosses their path, they will have bad luck.

To yet other superstitious people, dropping a knife or fork on the floor means company is coming.

Such beliefs are superstitions because in each case the action and the event it foretells are traditionally thought to be connected. For instance, the rabbit's foot is associated with fertility.

Superstitions have existed in every human society throughout history. Most people, including highly educated individuals, act superstitiously from time to time. Many people may joke about avoiding bad luck by knocking on wood or not walking under a ladder. But they have such beliefs anyway.

Scholars once believed that all superstitions dated back to humanity's early history. But many superstitions have appeared in relatively recent times. According to a superstition in baseball, for example, a pitcher will give up a hit if anyone mentions that a no-hit game is being pitched.

Countless human activities are involved in superstitions. They include eating, sleeping, working, playing, getting married, having a baby, becoming ill, and dying. Times of danger and uncertainty

have brought many superstitions. Superstitions concern animals, clothing, lakes, mountains, names, numbers, the planets and stars, the weather, and parts of the body.

Kinds of superstitions. Many superstitions deal with important events in a person's life, such as birth, entering adulthood, marriage, pregnancy, and death. Such superstitions supposedly ensure that a person will pass safely from one stage of life to the next. For example, a person born on Sunday will always have good luck. A bride and groom will have bad luck if they see each other on their wedding day before the ceremony. A pregnant woman must eat the right food, or she will give her child an unwanted birthmark. After a person dies, the doors and windows of the room should be opened so the spirit can leave.

Some superstitions involve a type of magic. One form of such magic comes from the belief that similar actions produce similar results. Many people believe a newborn baby must be carried upstairs before being carried downstairs. In this way, the child will be assured of rising in the world and having success. The same principle appears in the custom of putting money in a purse or wallet being given as a gift. The giver wants to make sure the purse or wallet will always contain money.

A number of superstitions involve someone's taking a deliberate action to cause something to happen or to prevent something from occurring. Most of these causal superstitions involve ensuring good luck, avoiding bad luck, or making something good happen. For example, carrying a silver dollar supposedly brings good luck. Some people will not start a trip on a Friday, especially if it is the 13th day of the month. Friday and the number 13 are both associated with bad luck. According to a Japanese belief, the number 4 is unlucky. This is because shi, the Japanese word for 4, sounds like the Japanese word for death. Thus, many buildings in Japan have no fourth floor. According to another superstition, wedding guests throw rice at the newlyweds to ensure that the marriage will result in many children. In some cases, causal superstitions involve actions intended to give bad luck to someone. Witches supposedly perform some of these actions.

Other superstitions foretell an event without any conscious action by the person involved. Some of these sign superstitions foretell good or bad luck. For example, finding a horseshoe or a four-leaf clover means good luck. Breaking a mirror or spilling salt brings bad luck. Other sign superstitions foretell a certain event or condition. A ring around the moon means rain will soon fall. A howling dog means death is near. A person with red hair has a quick temper.

Some sign superstitions may be changed into causal superstitions. If a person hangs a horseshoe over a door, witches cannot enter. If a young woman pins a four-leaf clover to her door, she will marry the first bachelor who comes in the door. In some cases, a person may avoid the bad luck involved in a sign superstition by taking immediate action. For example, someone who has spilled salt may cancel the bad luck by throwing a pinch of salt over the left shoulder.

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The role of superstitions. Many people scoff at superstitions because they consider such beliefs to be unscientific. However, many scholars believe that some superstitions have a scientific basis. For example, people in England once used tea made from foxglove plants to treat some forms of heart disease. Today, physicians often prescribe digitalis, a drug made from dried leaves of the purple foxglove, for patients with weak hearts.

Some superstitions have a practical origin. For example, many people believe that lighting cigarettes for three individuals from one match will bring bad luck. This superstition may have originated among soldiers during World War I (1914-1918). At night, a match that stayed lit long enough to light three cigarettes provided a target for the enemy. Another superstition involves hanging a bag of garlic around a child's neck for protection from illness. The garlic-filled bag has no supernatural power. But its smell keeps away other children--including any who have a disease that the wearer of the bag might catch.

Most people have fears that make them insecure. Superstitions help overcome such fears by providing security. They reassure people that they will get what they want and avoid trouble. For example, millions of people believe in astrology and base important decisions on the position of the sun, moon, planets, and stars. Superstitions will probably have a part in life as long as people fear each other and have uncertainties about the future.

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RELATIVITY

Einstein's theory of relativity has caught the imagination of the average person more than any other physical theory in history. Yet the theory of relativity, unlike many other results of physical science, is not easily understood by the average person. We can understand the relativity theory fully only by

means of the mathematical formulas which make it up. Without mathematics, we can only state some of its basic ideas and quote, but not prove, some of its conclusions.

The relativity theory deals with the most fundamental ideas which we use to describe natural happenings. These ideas are time, space, mass, motion, and gravitation. The theory gives new meaning to the old ideas that these words represent. It is basically made up of two parts. One is the special, or restricted, relativity theory, published by Albert Einstein in 1905. The general relativity theory was put forward by Einstein in 1915.

Special theory of relativity

This theory is called the special relativity theory because it refers to a special kind of motion. This is uniform motion in a straight line, that is, with constant velocity.

Suppose we are on a smoothly running railroad train which is moving at a constant velocity. In this train you may drop a book, play catch, or allow a pendulum to swing freely. The book will appear to fall straight down when it is dropped; the ball will travel directly from the thrower to the catcher. All these activities can be carried on in much the same way and with the same results on the ground outside the train. So long as the train runs smoothly, with constant velocity, none of our mechanical activities will be affected by its motion.

On the other hand, if the train stops or speeds up abruptly, our activities may be changed. A book may be jarred from a seat and fall without being dropped. A ball will travel differently.

One way of stating the principle of this theory is to say that the laws of mechanics are the same for an observer in a smoothly moving train as for the observer on the ground. Physicists would say: If two systems move uniformly relative to each other, then all the laws of mechanics are the same in both systems. This principle may be called the classical relativity principle. This principle is as old as the ideas of mechanics and physics.

Suppose we have a long train much like the train in the previous example. But instead of rolling along at a normal speed, it will be moving uniformly at a speed of, let us say, 20,000 miles (32,000 kilometers) a second. Instead of having two persons playing catch on the train, we will have a radio antenna on the train sending out radio waves, or a flashlight sending out light signals. Observers on the train will measure the velocity of the radio waves and light signals. On the ground we will also have an antenna or flashlight, and observers measuring the velocity of the signals. Is the velocity of the radio or light waves the same for those on the ground as it is for those on the train? Physicists in the late 1800's would have answered, "No." They would have said the classical relativity principle holds true for mechanical activities, but not for those of electromagnetic waves--that is, not for radio or light waves.

A physicist would have said that radio and light waves travel through ether at a velocity of 186,282 miles (299,792 kilometers) per second. Ether was a substance that scientists imagined to fill all space, to account for the transmission of light in outer space. The physicist would have said that the stars, sun, planets, and our imaginary moving train move through the ether sea at different speeds. Thus, the velocity of light will be different for an observer on the sun, on the earth, and on the train. Just as the earth changes velocity during the year in which it completes its journey around the sun, the speed of light for the observer should change too.

Scientists believed that the ether through which all objects of the universe were believed to move provided a nonmoving frame of reference. All other motions could be judged from this frame of

reference. Ether was looked upon as a fluid or elastic solid. It was believed to occupy the spaces between the atoms that made up matter. It offered no resistance to the earth's movement.

Among the many experiments which helped destroy the ether theory, the most famous is that of Michelson and Morley in 1887. Their measurements of the speed of light showed that the motion of the earth as it moved around the sun had no influence upon the velocity of light. Therefore, light has a uniform velocity, regardless of the frame of reference. This experimental result seemed strange, since normally we expect the speed of an object to depend on how fast the observer is moving. Einstein asserted that the relativity principle was true for all phenomena, mechanical or electromagnetic. In other words, there was no special, or nonmoving, frame of reference for electromagnetic phenomena.

The basic ideas of the special relativity theory are found in a mathematical formulation of two postulates. The first is that the relativity principle is valid for all phenomena. The second postulate is that the velocity of electromagnetic waves, or light, in empty space is constant, and furthermore is independent of the velocity of its source or observer.

The following deductions have been made from these postulates by mathematical means.

According to the special relativity theory, a material body can only move with a velocity lower than that of light.

If a conductor on a fast-moving train compared his clock with the many clocks in the stations he passed, he would find that the rhythm of his clock is faster than the rhythm of the clocks on the ground. On the other hand, it will appear to the stationmasters that the rhythms of their clocks are faster than the rhythm of the conductor's clock on the train passing the station. This effect is small, and could be detected only if the velocity of the one clock that passes many others were not very small compared with the speed of light.

Two events judged as taking place at the same time by the observer in the train may not be simultaneous for the observer on the ground.

The length of every object resting in the train appears to the observer outside to be shortened in the direction in which the train is moving.

Perhaps the most important of these deductions is the fact that mass is not unchangeable. The mass of an object increases with its velocity. Theoretically, the mass of an object would become infinite if its velocity became the velocity of light. This mass increase has been observed with experiments. A small particle of matter accelerated to 86 per cent of the speed of light has twice as much mass as it does when it is at rest.

The theory also shows a relation between a body's mass and its energy (E equals m times c squared).

This relation has great practical importance in the liberation of the energy in the nucleus of an atom. When energy is liberated from the nucleus of the uranium atom and atoms of other elements are formed, the total mass of these atoms is less than the total mass of the uranium atom. This means that some of the mass of the nucleus of the uranium atom has been transformed into energy. The E equals m times c -squared law shows that the energy in a single uranium nucleus is 220,000,000,000 electronvolts, providing that all its mass could be converted to energy. However, splitting the uranium nucleus, a process known as fission, releases only 0.1 per cent of the total energy content. This amount is still about a million times greater than the energy released in the burning of chemical fuels.

Various experiments have proved the truth of many of these conclusions about relativity. In 1938, H. E. Ives used a hydrogen atom as a moving clock. He found that a fast-moving hydrogen atom does slow down in its rhythm, just as Einstein predicted the moving clock would do. This slowing down could be shown by a change in the frequency of the line given off in its spectrum. The changes of
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mass as predicted by the special theory of relativity are observed in machines that are used to accelerate electrons and nuclear particles to the high speeds necessary to study nuclear properties. The mathematician H. Minkowski gave a mathematical form to the special relativity theory in 1907. A line involves only one dimension. We can locate any point on a sheet of paper by measuring from that point to any two sides of the paper that are perpendicular to each other. Therefore, we can say that any point on a sheet of paper involves two dimensions. All points in space involve three dimensions: height, length, and breadth. But there is one other important fact involved. In physics as well as history we must deal with events. When and where did the French Revolution start, for example? When and where does the earth have the smallest velocity in its movement about the sun? Events must be characterized by four numbers, bringing in the idea of a fourth dimension. Three of these numbers answer the question where; one must answer the question when. Answering the question when involves the idea of time. Then we consider things in terms of four dimensions. This question of answering when and where an event took place becomes more complicated, according to the theory of special relativity, because rods can change their lengths, and clocks change their rhythms, depending on the speed at which they operate when they are in motion. Therefore, we must answer the questions when and where an event took place in terms of a definitely moving system, or in terms of the relationships between two moving systems. For example, if we know when and where an event took place for an observer on our swiftly moving train, and if we know the velocity of the train, we can find out when and where the same event took place for an observer on the ground. The mathematical formulation of the theory of special relativity tells us how to find these four numbers, characterizing an event in one system from an event in another. It tells us that the question when has no absolute meaning, that the answer to the question depends on the system we choose.

General relativity theory

The mathematical formulas which make up this general theory are much more difficult than those which are concerned with special relativity. The general relativity theory changes the old ideas about gravitation that have dominated physics since the days of Isaac Newton. According to Newton, two bodies attract each other with a force depending upon their mass and their distance apart. The gravitational influence of a star is felt at the same moment throughout the entire universe, even though it decreases with the distance from the star. But for electromagnetic waves, action spreads through space with great but perfectly definite velocity, that of light. Because of our knowledge of electromagnetic radiation, we tend to reject ideas that disturbances and actions that travel through space have infinite speed. We tend to believe that though they may travel at a very high speed, that speed is not limitless.

Einstein illustrated the basic idea of general relativity with an imaginary experiment. Suppose an elevator is at rest in space. If a ball is released within the elevator, it will float in space and not fall. If the elevator accelerates upward, an observer within the elevator will see the ball fall to the floor exactly as it would under the pull of gravity. The ball appears to fall because the floor of the elevator--as seen from outside the elevator--accelerates upward toward the ball. All the effects we associate with gravity would be seen by the observer in the elevator. Einstein called the phenomenon shown in this experiment the Principle of Equivalence. This principle states that it makes no difference whether an object is acted on by a gravitational force or is in an accelerated frame of reference. The result in both cases will be the same. From this principle, Einstein reasoned that matter in space distorts or "curves" the frame of reference of space. The result of this curvature is what we experience as gravity. Euclidian or "flat" geometry cannot describe curved space. Thus, Einstein used geometries called Riemannian geometries to describe the effects of gravitation.

According to Newton's theory, a planet moves around the sun because of the gravitational force exerted by the sun. According to the theory of general relativity, the planet chooses the shortest possible path throughout the four-dimensional world, which is deformed by the presence of the sun. This may be compared to the fact that a ship or an airplane crossing the ocean follows the section of

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a circle, rather than a straight line, in order to travel the shortest route between two points. In the same way, a planet or light ray moves along the "shortest" line in its four-dimensional world.

So far, three things have been discovered in which Einstein's theory of general relativity receives experimental proof as opposed to the theories of Newton. These differences are not great, but are measurable. In the first place, according to Newton's theory, the planet Mercury moves in an ellipse about the sun. According to Einstein's theory, Mercury moves along an ellipse, but at the same time the ellipse rotates very slowly in the direction of the planet's motion. The ellipse will turn about fortythree seconds of an arc per century (a complete rotation contains 360 degrees of an arc and $360 \times 60 \times 60$ seconds of an arc). This effect is rather small, but it has been observed. Mercury is nearest to the sun and the relativistic effect would be still smaller for other planets.

If we take a picture of part of the heavens during an eclipse of the sun and near the eclipsed sun, and then take another picture of the same part of the heavens a little later, the two photographs will not show identical positions for all the stars. This is so because, according to general relativity, a light ray sent by a star and passing near the rim of the sun is deflected from its original path because the sun's gravity curves space.

Physicists have known for more than a hundred years that when some elements are heated to incandescence they give off a pattern of colored lines which can be examined through a spectroscope. According to the Einstein theory, if we examine the spectral lines of an element on our earth with the spectral lines given off by the same element on the sun or on a star, the spectral lines of the element on the sun or star should be very slightly shifted toward the red end of the spectrum, compared with the spectral lines of the same element on our earth. Experiment has confirmed this shift. In 1960, two American physicists, R. V. Pound and G. A. Rebka, Jr., detected the red shift resulting from the earth's gravitational field. They measured the effect of altitude in the frequency of gamma rays.

Many scientists are doing research in general relativity and studying possible improvements on Einstein's theory. For example, the general theory predicts the existence of waves that "carry" the force of gravity, just as electromagnetic waves carry light. Experimenters have not yet been able to detect these gravitational waves. Scientists are also trying to combine electromagnetic and gravitational forces in a theory called the unified field theory.

Relativity and other ideas

The ideas of relativity form a framework which can embrace all laws of nature. Relativity has changed the whole philosophical and physical notions of space and time. It has influenced our views and speculation of the distant worlds and stars and of the tiny world of the atom. Some of this speculation is still going on. Does our universe, regarded as a whole, resemble a plane surface or a sphere? It is not possible to answer this question, because there are many different theories and much uncertainty about the distribution of matter in the universe.

All the theories try to describe the universe as a whole and are based upon the mathematical principles of general relativity. According to some theories, a light ray sent from an arbitrary point in space returns, after a very long time interval, to the point of departure, like a traveler in a journey

around our earth. Thus, if you were to start from your home and travel into space along a straight line, you would eventually return to the point from which you started. According to other theories, however, a light ray or a traveler would continue an endless journey through space. Such theories about the universe are developed to explain the motion and distribution of distant nebulae.

The relativity theory is, like all our theories, an invention of the human mind. New theories may eventually show limitations of the relativity theory and deal with problems that the relativity theory does not cover. But no physicist doubts that the relativity theory has brought much scientific progress.

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IMPERIALISM

Imperialism is the policy or action by which one country controls another country or territory. Most such control is achieved by military means to gain economic and political advantages. Such a policy is also called expansionism. An expansionist state that obtains overseas territories follows a policy usually called colonialism. An imperialist government may wish to gain new markets for its exports, plus sources of inexpensive labor and raw materials. A far-flung empire may satisfy a nation's desire for military advantage or recognition as a world power.

The rise and decline of vast empires--such as those of Persia, Rome, Byzantium, Great Britain, and Nazi Germany--form some of the basic outlines of world history. Imperialism has been the driving force behind most wars, territorial expansion, and cultural exchange.

History. First Sargon of Akkad and then the Egyptians, Assyrians, Babylonians, and Persians established large empires from more than 2,000 to more than 4,000 years ago in the Middle East. By the beginning of the Christian era, the Romans had created a vast empire from Asia Minor to what is now France and Great Britain. The western part of the empire collapsed in the A.D. 400's, but the eastern section, called the Byzantine Empire, survived until 1453. The Byzantine Empire fell to the Ottoman Turks, who created a powerful empire that included parts of the Middle East, southeastern Europe, and northern Africa. The western part of the Roman Empire was revived in name only as the Holy Roman Empire. It ruled much of central Europe from 962 to 1802. The Mongols, an Asian people, built the largest land empire in history in the 1200's. It extended from Southeast Asia to eastern Europe.

The new European nations of the 1400's and 1500's acquired colonial possessions as they spread Christianity and searched for markets and raw materials. For example, Portugal established a seagoing empire along the shores of the Indian Ocean and coasts of Southeast Asia. Spain established colonies in what is now Latin America and the southern United States. By the early 1700's, the British, French, and Dutch had colonized much of eastern North America. The Dutch gained control of the East Indies (now Indonesia), and the British began their rule of India. By the mid-1800's, many colonies in the New World had overthrown foreign rule. But Great Britain and other European powers maintained "informal empires" without actual governmental control. They did so by controlling the trade policies of some former Spanish colonies and by establishing new trade relations with African and Asian nations.

The late 1800's are often called the Age of Imperialism. During this period, Belgium, France, Germany, Great Britain, Italy, Portugal, and Spain divided up nearly all of Africa. European nations also took over large sections of Southeast Asia and many islands in the South Pacific. Spain surrendered Guam, Puerto Rico, and the Philippines to the United States after losing the Spanish-American War (1898). The determined pursuit of colonies and foreign trade by the major European powers strained international relations. This tension was one of the causes of World War I, which began in 1914 (see WORLD WAR I [Competition for colonies]).

During the 1930's, Germany, under the rule of Adolf Hitler, began a program of expansion in Europe. Germany gained territory both by negotiation and by armed seizure. In Asia, Japan annexed

Manchuria and waged war against China. For a brief period during World War II (1939-1945), Japan had an enormous empire in the Pacific, and Germany controlled much of Europe and North Africa. Germany and Japan were defeated in 1945 and lost their foreign territories.

Large-scale colonialism ended in the 1950's and early 1960's. European nations that were recovering from World War II had neither the money nor the will to continue the rule of colonies thousands of miles away. In addition, the people of many colonies demanded and won independence. Today, a few scattered territories, mostly islands in the Caribbean Sea and Pacific Ocean, are all that remain. However, the United States and other world powers still give economic and military assistance to former colonies. Some critics call this aid a form of imperialism. They say it can lead to indirect control of a nation's politics and economy.

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Motives. Many theories attempt to explain the motives for imperialism. One of the best-known theories focuses on economic profit as the chief reason for a nation to seek foreign territories. Industrialized nations can produce more manufactured goods than their people need or can afford to buy. Colonies may serve as markets for these unsold products. They also may provide cheap land, valuable natural resources, and investment opportunities for surplus capital. However, this theory does not fully explain imperialism because many colonies were not economically profitable.

Military strategy is another important motive for imperialistic activity. Since ancient times, nations have absorbed territory near their borders to protect themselves from foreign attack. Such territory serves as a buffer zone. In the late 1800's, many European powers had colonies throughout the world where their ships, both naval and merchant, could take on supplies.

Imperialism can also be encouraged by patriotism, religion, and a sense of cultural and racial superiority. During the late 1800's, a strong feeling of nationalism swept most European countries. Many people believed their nation's greatness depended on the size of its territory. They encouraged expansion and the planting of their nation's flag on foreign soil. In addition, many Europeans considered the peoples of Africa and Asia to be racially inferior. The lack of industrial development in these lands reinforced this prejudice. Many expansionists thought they had a God-given mission to take new territory and to spread Christianity and the benefits of European culture.

Effects of imperialism include certain benefits that a ruling nation may provide for territories that form part of its empire. For example, the colonial powers built new communications and transportation systems, established universities, and introduced modern medical practices. However, many nations took advantage of their colonies by exporting natural resources without providing economic return for most of the people. Many colonial administrations were insensitive to local customs and destroyed old ways of life.

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PIPE

Pipe is a device used for smoking tobacco. People have smoked tobacco in pipes for more than 2,000 years. Tobacco pipes were brought to Europe during the 1500's by explorers who learned about them from American Indians. The Indians smoked tobacco during religious ceremonies. The Indians also used the pipe as a symbol of peace.

Pipes consist of two main parts--a bowl and a hollow stem. The bowl holds tobacco, and the stem is connected to the bowl. Smoke from the burning tobacco is drawn into the mouth through the stem. Pipestems are made of plastic, hard rubber, or bone. The most common materials used for bowls are brier (also spelled briar), clay, meerschaum, and porcelain. In the United States, some pipes are made of corncobs.

Most pipes are named for the type of material used for the bowl. For example, a brier pipe has a bowl made from the hard wood that comes from the root of the brier shrub. This plant grows in such warm, dry countries as Greece, Italy, and Spain. Most brier pipes are produced in standard shapes and sizes, as well as a style known as freehand. Freehand pipes have unusual shapes. Brier pipes are made both by machine and by hand.

Meerschaum pipes are made from a white, claylike substance that is found underground in countries near the Mediterranean Sea. Although meerschaum is fragile, it can be carved easily. Meerschaum pipes are crafted into beautiful designs, figures, or scenes. The bowls range in length from about 1 inch to 2 feet (2.5 centimeters to 60 centimeters). Meerschaum changes to a rich brown color after being smoked for some time.

Porcelain pipes are popular in Europe. Many have hand-painted scenes on the bowls, and cherrywood stems. In the Middle East, the hookah, or water pipe, is popular. The hookah consists

of a bowl connected to a vase of water, and a long flexible stem. Before the smoke enters the smoker's mouth, it passes through the water to cool.

People have been collecting smoking pipes for hundreds of years, and there are pipe collector clubs throughout the world. Members of these clubs meet to buy, sell, and trade old and new pipes.

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TORTURE

Torture is the use of physical or mental pain, often to obtain information, to punish a person, or to control the members of a group to which the tortured person belongs.

Torture began as a legal procedure and was typically used to gain a confession for use as legal proof. Early Greek and Roman law permitted the torture of slaves, foreigners, and people considered dishonorable. During the A.D. 200's and 300's, torture in the Roman Empire spread to other classes of people and became more routine. Its use declined after the fall of the empire in the late 400's.

But in the 1100's, certain Roman legal procedures, including torture, were revived in many parts of Europe. Civil and religious courts legally employed torture to obtain confessions until about 1800. At that time, torture was abolished and widely criticized on moral and legal grounds.

Torture slowly reappeared during the 1800's and 1900's. Military forces, police forces, and other groups with public authority began to use torture illegally to punish and control people and to gain information about civil, military, and political matters. Since 1900, torture has especially increased during political revolutions, when leaders have placed political beliefs above human rights.

Forms of torture have long included stretching, burning, and beating the body and suffocating a person with water. Newer and more painful methods involve electric shocks, pain-causing drugs, or psychological techniques. Human-rights organizations firmly oppose the use of torture.

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TIGER

Tiger is the largest member of the cat family. People admire the tiger for its strength and beauty, but they also fear it because it has been known to kill and occasionally eat people. Yet wild tigers prefer to avoid human beings. Tigers that kill and eat people are most often sick or wounded animals that can no longer hunt their natural prey. A hungry tiger may also attack people if prey is extremely scarce.

Wild tigers are found only in Asia. Until the 1800's, many tigers lived throughout much of the southern half of the continent. Now only a few wild tigers remain in most countries, and none of the animals are left in Iran and Pakistan.

Tigers can live in almost any climate. They need only shade, water, and food. Tigers are found in the rain forests of Thailand; the hot, dry thorn woods of India; and the cold, snowy, spruce forests of Siberia. Tigers also live in mangrove swamps, marshes, and tall grasslands. In general, tigers like to be in shade. They seldom go into the open plains as lions do.

The body of a tiger. Most adult male tigers weigh about 420 pounds (190 kilograms) and are 9 feet (2.7 meters) long, including a 3-foot (0.9-meter) tail. Most adult tigresses (females) weigh about 300 pounds (140 kilograms) and are 8 feet (2.4 meters) long. The tiger's coat ranges from brownishyellow to orange-red and is marked by black stripes. Each tiger has a unique stripe pattern, which is as distinctive as a human fingerprint. The fur on the throat, belly, and insides of the legs is whitish. Many tigers, especially the males, have a ruff of hair around the sides of the face. The tigers that live in Siberia, where winters are bitterly cold, have shaggy winter coats.

Some tigers have chalk-white fur with chocolate-brown or black stripes. These tigers, called white tigers, are also distinctive because they have blue eyes. All other tigers have yellow eyes. White tigers are very rare in the wild. More than 100 white tigers live in the world's zoos. They are all descendants of a white cub caught in India in 1951. A normal-colored tigress can give birth to a litter in which some of the cubs are white.

Tigers and lions look similar except for the color and length of their hair. The two species have even mated in zoos and produced offspring called ligers or tigons.

How a tiger hunts. Tigers hunt large mammals, such as deer, antelope, wild cattle, and wild pigs.

They may even attack young rhinoceroses and elephants. They also catch such small animals as peafowl, monkeys, and frogs. At times, tigers attack porcupines, but the porcupine's quills may stick in the tiger's face and body, causing painful wounds. In many parts of Asia, tigers prey on domestic cattle and water buffalo, especially where hunters have greatly reduced the amount of wildlife.

The tiger usually hunts at night, wandering along animal trails and dry stream beds. A tiger depends chiefly on its sharp vision and keen hearing, but it may also use its sense of smell. After stalking

closely or waiting in cover, the tiger rushes at its prey in several bounds. Using its sharp claws, the tiger grasps the victim by the rump or upper body and pulls it down. Its large canine teeth are well suited for holding prey and for killing it.

Tigers are extremely swift for short distances. However, if a tiger fails to catch its prey quickly, it usually will give up because it soon tires. As long as a week may go by without a successful hunt. After a kill, the tiger drags the carcass (dead body) to thick cover. The tiger's neck, shoulders, and forelegs are very powerful. A tiger may drag the body of a 500-pound (230-kilogram) water buffalo for 1/4 mile (0.4 kilometer). The tiger stays near the carcass until it has eaten everything except the large bones and stomach. A tiger may eat at least 50 pounds (23 kilograms) of meat in a night. A tiger often takes a long drink of water and a nap after a meal.

The life of a tiger. Adult tigers usually live alone but are not unfriendly with one another. Two tigers may meet on their nightly rounds, rub heads in greeting, and then part. Several may share in eating a killed prey.

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Adult males often claim their own territory and try to keep other males out. In areas with abundant prey, such territories may average about 20 square miles (52 square kilometers). The male tiger marks trees in his territory with his scent and urine. The scent tells other tigers that the territory is occupied. A male's territory overlaps the territories of two or more females. Female territories are smaller than a male's. Each tiger wanders alone, but they communicate with each other. In addition to scent, they communicate with sounds, including a roar that can be heard for up to 2 miles (3.2 kilometers) or more. Some tigers do not have territories and travel widely.

A tigress usually bears her first cubs when she is 3 1/2 to 4 years old. She carries the young within her body for about 3 1/2 months. She then gives birth to from one to six cubs, though usually two or three. Newborn cubs are helpless and weigh about 2 to 3 pounds (0.9 to 1.4 kilograms). Tiger cubs, like kittens, are playful. They are wholly dependent on their mother for food until they are about a year old. Even then, they cannot kill a large animal. Cubs become fully independent at about 2 years old. Female cubs then often settle down in a territory near their mother. Males tend to roam far from their birthplace. Tigers live up to 20 years in the wild.

Tigers are good swimmers. They may swim across rivers or between islands. On hot days, they may cool off in water. Tigers can climb trees but usually do not.

Tigers and people. People have greatly reduced the number of tigers by killing them and by clearing the forests in which they lived. Scientists generally recognize eight varieties of tigers. Of these, three varieties are now extinct and several other varieties are rare. Only about 20 South China tigers and about 200 Siberian tigers survive in the wild. Several countries, especially India and Nepal, protect tigers in nature reserves. The survival of wild tigers depends on such efforts.

Tigers are easy to breed and raise in zoos. Cubs are popular with zoo visitors. Adult tigers are often trained to perform in circuses. They jump through hoops and are even ridden. Today, enough tigers are born in captivity that no more need to be captured for zoos.

Scientific classification. Tigers belong to the genus *Panthera* in the cat family, *Felidae*. All tigers are of the same species, *P. tigris*.

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BAT

Bat is the only mammal that can fly. Bats have a furry body, and their wings are covered by smooth, flexible skin. Most species of bats live in attics, caves, or other sheltered places. Some species live in trees. Bats seem uncommon in many regions because they roost in dark places and come out only at night, when most people are asleep. Bats hang upside down when they are resting.

There are more than 900 species of bats. Bats live in all parts of the world except Antarctica and the Arctic. Most kinds make their home in the tropics, where they can find food the year around. About 40 species of bats live in Canada and the United States.

Through the centuries, people have passed on many superstitions and mistaken ideas about bats.

For example, the expression "'blind as a bat'" is false. All species of bats can see, probably about as well as human beings. The beliefs that bats carry bedbugs and get tangled in people's hair are also untrue. Bats tend to be timid. At night, they will try to fly out a window if they find themselves in a room.

Many people in Western countries fear bats, but these animals are well liked in China and Japan. A number of Oriental artists have portrayed bats as signs of good luck, happiness, and long life.

Most bats are harmless to people. But bats may have rabies. For this reason, bats should not be

handled.

Bats perform a valuable service for people by eating large numbers of insects. In addition, bat guano (manure) has commercial value as fertilizer. Some caves have been the home of bats since prehistoric times and have large deposits of guano.

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TRADE

Trade is buying and selling goods and services. Trade occurs because people need and want things that others produce or services others perform.

People must have such necessities as food, clothing, and shelter. They also want many other things that make life convenient and pleasant. They want such goods as cars, books, and television sets.

They want such services as haircuts, motion pictures, and bus rides. As individuals, people cannot produce all the goods and services they want. Instead, they receive money for the goods and services they produce for others. They use the money to buy the things they want but do not produce.

Trade that takes place within a single country is called domestic trade. International trade is the exchange of goods and services between nations. It is also called world trade or foreign trade.

Trade has contributed greatly to the advance of civilization. As merchants traveled from region to region, they helped spread civilized ways of life. These traders carried the ideas and inventions of various cultures over the routes of commerce. The mixing of civilized cultures was an important development in world history.

Trade and specialization

Trade is vital both in developed and in developing nations. The economic systems of most countries have a high degree of specialization, or division of labor.

Specialization means that each worker concentrates on one job, such as being a farmer, mechanic, or doctor. Factories concentrate on making one product, such as washing machines, canned soup, or shirts. Countries, cities, and regions also concentrate on producing certain goods and services. For example, Australia specializes in raising livestock, and Japan in industrial products. Oregon specializes in producing lumber, Pittsburgh in steelmaking, and Florida in growing oranges. Specialization makes trade necessary. Because people do not produce everything they need themselves, they become dependent on others. They sell their labor or products for money, and use the money to buy other goods and services that they need.

Trade helps people enjoy a higher standard of living. People can obtain more goods and services at lower cost through specialization and exchange. If workers concentrate on the job they are best fitted to perform, they can produce more than if they try to do several different jobs. If factories specialize, they can use mass-production methods and complicated machines and tools to produce more. If regions specialize, they can use their most plentiful resources. They can build up a supply of skilled labor and specialized capital (goods used to produce other goods).

Carrying on trade

The use of money. To make trading easier, people have developed monetary systems. Large-scale trade is possible only if money is used as a medium of exchange. Without money, people would have to exchange certain goods and services directly for other goods and services. This system of trade is called barter. Using barter, a banana grower who wanted a horse would have to find a horse owner who wanted some bananas. The two traders would then have to agree on how many bananas a horse was worth.

People will accept money for things they want to sell because they know it will be accepted by others in exchange for the things they want to buy. The amount of money exchanged for a particular product is the price of that product. The price of something is the value placed on it by those who are buying and selling it.

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The use of markets. Trade takes place in markets. In earlier days, buyers and sellers actually met and bargained with one another at markets. In Europe during the Middle Ages, for example, farmers came to town with their produce on market day. The townspeople shopped around the market and negotiated directly with the seller. Today, most trade is more complicated.

Often, producers and consumers do not deal directly with one another. Instead, goods are passed on from producers to consumers by people called middlemen.

Two kinds of middlemen are wholesalers and retailers. Wholesalers buy goods from producers and sell them mainly to other business firms. For example, a wholesaler of vegetables buys large

amounts of vegetables from the growers and then sells them to grocers. This kind of trade is called wholesale trade. The grocers sell the vegetables to customers who eat them. This type of trade in which merchants sell goods mainly to the final consumer is called retail trade.

It is no longer necessary for buyers and sellers to meet face-to-face. Goods and services can be bought and sold by mail, telephone, or computer. Often, buyers and sellers do not even see the product being traded. They transact their business on the basis of description or sample. For example, a buyer of drapes will usually examine a small swatch (sample) of cloth before making a purchase. Cotton, wheat, and many other farm products are classified by grade. Buyers know exactly what they will get if they specify a particular grade, such as "Number 2 hard ordinary wheat." Agricultural goods are often traded at organized markets called commodity exchanges .

The geographic extent of trade varies widely. In some cases, the buyers and sellers are from all parts of the world. Trade in such basic foods and raw materials as coffee, sugar, wheat, copper, oil, and rubber is international in scope. For example, the United States is a leading producer of wheat. It sells large amounts of wheat to India, Pakistan, Japan, Brazil, the Netherlands, and many other countries.

Trade in other products may be conducted on a local, regional, or national basis. For example, the trade in hominy grits is concentrated in the Southern States of the United States. The market for such familiar products as automobiles, clothing, furniture, and television sets is usually national in scope.

In earlier days, local trade was much more important than it is today. This was partly because transportation facilities were limited and goods could not be moved on a large scale. Also, perishable food could not be preserved for very long. Perishable items had to be consumed near their place of production. But technological advances have removed these trade barriers. Trains, trucks, airplanes, and pipelines make it possible to move large quantities of goods easily and cheaply. Vegetables, meats, and other perishables can be refrigerated or frozen and shipped all over the world. Even flowers can be flown by airplanes to distant markets.

Also in earlier days, people's tastes and preferences varied more from one locality to another. Today, mass advertising in magazines and newspapers and on radio and television has persuaded people all over the nation to use the same products. Millions of people drink the same kinds of soft drinks, use the same detergents, drive the same cars, and wear the same kinds of clothes and shoes. Thus, technological advances have created national markets, and nationwide trade has taken the place of much purely local trade.

Trade in the United States is carried out mainly by private persons and businesses. Government plays a less important role than do private individuals and groups and is more important as a buyer than as a seller. The sellers of goods range from such giant businesses as the General Motors Corporation, which sells millions of automobiles and trucks each year, to small neighborhood shops that sell such goods as bakery products or flowers.

Large amounts of goods and services are purchased by individual consumers, who buy such things as dresses, transistor radios, food, and haircuts. Businesses buy the raw materials and capital equipment they need for production from other businesses. The various governments in the United States

also buy many goods and services. For example, purchases of the federal government include interstate highways, missiles, and the services of members of the armed forces.

The way in which trade is organized and carried on in the United States is the nation's economic system. This system is often called capitalism, free enterprise, or private enterprise. Trade--buying and selling goods and services in the market--is an essential part of a free economy. In the free market, consumers help determine prices and thus what will be produced. Their willingness to pay for what they want indicates to producers what ought to be produced. In China and other countries with centrally planned economies, government planners make the basic economic decisions about what will be produced and about the prices of the products.

The development of trade

Early trade. For thousands of years, families produced most of the things they needed themselves. They grew or hunted their own food, made their own simple tools and utensils, built their own houses, and made their own clothes. Later, people learned that they could have more and better goods and services by specializing and trading with others. As civilization advanced, exchanges became so common that some individuals did nothing but conduct trade. This class became known as merchants. The most famous early land merchants were the Babylonians and, later, the Arabs.

These traders traveled on foot or rode donkeys or camels. The Phoenicians were the chief sea traders of ancient times.

Trade was very important during the hundreds of years the Roman Empire ruled much of the world. Roman ships brought tin from Britain, and slaves, cloth, and gems from the Orient. For more than 500 years after the fall of the Roman Empire in A.D. 476, little international trade took place.

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ALCHEMY

Alchemy is a blend of pseudoscience, magic, and mystical philosophy. It was popular from the time of early Christianity until about 1700. Alchemists tried to change less costly metals into silver and gold. They also tried to find the elixir of life (a substance that would cure disease and lengthen life). They failed to find it, but their work in preparing and studying chemical substances helped the science of chemistry develop.

Some alchemists were only fakes. But others were learned people who had more philosophical goals. They felt that if they learned how to make gold from lesser metals, they could also perfect other things. They considered gold the perfect metal because of its beautiful luster and its resistance to rusting.

Some alchemy was practiced in China and India before the birth of Christ. But it developed into a major system in Egypt during the next 300 years. The Greek-speaking scholars of Alexandria used it in trying to explain how Egyptian artisans made things. Greek-Egyptian alchemy spread through Syria and Persia to the Arabs. It spread to Western Europe during the 1100's and 1200's.

Alchemists drew their theories of matter from the ancient Greeks. They believed that all matter was made up of a single, formless substance. Alchemists thought this substance became the four elements--earth, air, fire, and water--when combined with hot or cold and wet or dry. They thought they could change one substance into another merely by changing the balance of these elements, a process called transmutation. This theory led them to try producing gold from other metals. In the early 1500's, Swiss scientist Paracelsus tried to substitute sulfur, mercury, and salt for earth, air, fire, and water. Alchemists also searched for the philosopher's stone (a magical substance that was supposedly able to make the transmutation process easier).

Gold's lasting quality led many persons to believe that they would find the secret of long life or even immortality if they could discover how to make gold from lesser substances. The Chinese once believed that eating from golden dishes prolonged life.

Alchemy was associated with many religious beliefs. It was believed that the techniques used to make gold were symbolically related to death, corruption, regeneration, and resurrection. Alchemy and astrology became closely related because of the belief that each heavenly body represented and controlled a certain metal. Some thought the sun represented gold; the moon, silver; Mars, iron; Venus, copper; Jupiter, tin; Saturn, lead; and Mercury, the metal mercury, also called quicksilver. Alchemists believed that the positions of these bodies influenced the success or failure of their work.

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HAYDN

Haydn, Joseph (1732-1809), was an Austrian composer. He ranks among the most important composers to lead the development of instrumental and vocal music during the middle and late 1700's. Many of his compositions helped set standards for musical style and taste in the late 1700's. Haydn wrote over 80 string quartets and established many of the basic characteristics of that form. He also wrote many other chamber works, mainly trios. His symphonies are numbered through 104, but he probably wrote about 108. His later symphonies are among the most complex and mature works of his day. Haydn gave many of them titles associated with an aspect of the symphony. For example, Symphony No. 94 is called the Surprise because it includes an unexpected loud chord shortly after the soft beginning of the second movement. Among Haydn's other instrumental works are overtures, concertos, incidental music for theater works, sonatas, and pieces for harpsichord or piano.

Haydn wrote a number of cantatas and oratorios, the most significant being his oratorio The Creation (1798). He also composed masses for chorus, soloists, and small orchestra. Haydn wrote several operas, but they are seldom performed today.

Franz Joseph Haydn was born in Rohrau, near Vienna. At the age of 8, he was admitted to the choir of St. Stephen's Cathedral as a soprano. After his voice changed, he continued to live in Vienna while working as a teacher and free-lance musician. He also studied music, notably with the Italian composer Nicola Porpora.

In 1761, Haydn began his employment with the Esterhazy family, who were wealthy Hungarian nobility. For about 30 years, he was responsible for composing and performing most of the music at the Esterhazy court. In that position, Haydn wrote many chamber works, keyboard pieces, and symphonies, and almost all his operas. In 1781, Haydn met the young Wolfgang Amadeus Mozart, and the two seem to have become close friends who admired each other's compositions. After Prince Nikolaus Esterhazy died in 1790, Haydn made Vienna his permanent home. In 1791, he visited England at the invitation of the music promoter Johann Peter Salomon to present a number of concerts. While returning to Vienna, Haydn stopped in Bonn, Germany, where he met the young Ludwig van Beethoven and agreed to accept him as a pupil. In 1794, Haydn returned to London to present more concerts. During his London visits, he wrote 12 symphonies (numbers 93 to 104), known as his London symphonies.

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CALENDAR

Calendar is a system of measuring and recording the passage of time. A major scientific advance occurred when people realized that nature furnishes a regular sequence of seasons. The seasons governed their lives, determined their needs, and controlled the supply of their natural foods. They needed a calendar so they could prepare for the hardships of winter.

Before the invention of the clock, people watched the sun, the moon, and the stars to tell time. The daily rising of the sun provided a short unit of time, the solar day. The cycle of seasons roughly indicated a longer unit of time, the solar year. But early people did not know that the earth's revolution around the sun caused the different seasons. The changing position and shape of the moon was easier for them to observe. As a result, the early calendars used the interval between the successive full moons, called the lunar month, as an intermediate unit of time.

We now know that the lunar month lasts about $29\frac{1}{2}$ days. Twelve such months amount to about 354 days. This interval is almost 11 days shorter than the true solar year, which has 365 days, 5 hours, 48 minutes, and 46 seconds. But a year of 13 lunar months would amount to about $383\frac{1}{2}$ days and would be more than 18 days longer than the solar year. The solar year, therefore, does not equal any whole number of lunar months.

The discrepancy between whole lunar months and days in a solar year explains the confusion over calendar keeping during thousands of years. A calendar based on 12 lunar months becomes out of step with the seasons. Some people who used lunar calendars kept them roughly in step with the seasons by making some years 12 months long and other years 13 months long.

Some calendars today

Most people in the Western world use the Gregorian calendar, worked out in the 1580's by Pope Gregory XIII. It has 12 months, 11 with 30 or 31 days. The other month, February, normally has 28 days. Every fourth year, called a leap year, it has 29 days. However, century years that cannot be divided evenly by 400 lose the extra day, though they are leap years. For example, February had 28 days in 1900 but 29 days in 2000.

The Gregorian calendar is based on the year of Jesus Christ's birth, according to a dating system started in 532 by the monk Dionysius Exiguus. In this system, the year of Christ's birth was A.D. 1., and the year before that was 1 B.C. The abbreviation A.D. stands for *anno Domini* (in the year of our Lord), and B.C. means *before Christ*. But modern scholars believe Christ was born no later than 1 B.C. He was born during the lifetime of Herod the Great, who died in either 4 B.C. or 1 B.C. An alternative system uses Gregorian numbering, but does not refer to Christ. In that system, C.E. (common era) replaces A.D., and B.C.E. (before the common era) replaces B.C. See A.D.;B.C.. The Christian church calendar is regulated partly by the sun and partly by the moon. Immovable feasts include Christmas and such feasts as the Nativity of the Blessed Virgin. They are based on the solar year. Such days as Ash Wednesday, Palm Sunday, and Easter are called movable feasts, because their dates vary from year to year, according to the phases of the moon.

The Hebrew calendar begins with an estimated moment of the world's creation. Hebrew tradition has placed this moment at 3,760 years and 3 months before the birth of Jesus Christ. To find a year in the Hebrew calendar, we must add 3,760 to the date in the Gregorian calendar. For example, 2000 in the Gregorian calendar is 5760 in the Hebrew calendar. But this system will not work to the exact month, because the Hebrew year begins in September or October in the Gregorian calendar. By November 2000, for instance, the Hebrew year will have become 5761.

The Hebrew year is based on the moon and normally consists of 12 months. The months are Tishri, Heshvan, Kislev, Tebet, Shebat, Adar, Nisan, Iyar, Sivan, Tammuz, Ab, and Elul. They are alternately

30 and 29 days long. Seven times during every 19-year period, an embolismic or extra 29-day month, called Veadar, is inserted between Adar and Nisan. At the same time, Adar is given 30 days

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instead of 29. These additions keep the Hebrew calendar and holidays in agreement with the seasons of the solar year.

The Islamic calendar begins with Muhammad's flight from Mecca to Medina. This flight, called the Hijra, took place in A.D. 622 by the Gregorian calendar.

The Islamic year is based on the moon, and has 12 months, alternately 30 and 29 days long. These months are Muharram, Safar, Rabi I, Rabi II, Jumada I, Jumada II, Rajab, Shaban, Ramadan, Shawwal, Zulkadah, and Dhul-Hijja.

The Islamic year is much shorter than the solar year, with only 354 days. As a result, the Islamic New Year moves backward through the seasons. It moves completely backward in a course of 32 1/2 years. The Islamic calendar divides time into cycles 30 years long. During each cycle, 19 years have the regular 354 days, and 11 years have an extra day each. This method of counting time makes the Islamic year nearly as accurate in measuring the lunar year as the Gregorian year is in measuring the solar year. The Islamic calendar would be only about one day off every 2,570 years with respect to the moon. The Gregorian calendar would be only a little more accurate with respect to the sun.

The Chinese calendar begins at 2637 B.C., the year in which the legendary Emperor Huangdi is said to have invented it. This calendar counts years in cycles of 60. For example, the year 2000 in the Gregorian calendar is the 17th year in the 78th cycle. The years within each cycle are broken down into repeating 12-year cycles. In these cycles, each year is named after 10 Chinese constellations and 12 animals. The animals are the rat, ox, tiger, hare, dragon, snake, horse, sheep, monkey, rooster, dog, and pig. The year 2000 is the year of the dragon.

The Chinese year is based on the moon and generally consists of 12 months. Each month begins at new moon and has 29 or 30 days. A month is repeated seven times during each 19-year period, so that the calendar stays approximately in line with the seasons. The year starts at the second new moon after the beginning of winter in the Northern Hemisphere. Thus, the Chinese New Year occurs no earlier than January 21 and no later than February 20.

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BLUES

Blues are a kind of music that developed in America from the various musical expressions of African Americans. The blues are an extremely flexible type of music, and various musicians have created individual styles of performing them. The blues contributed greatly to the development of jazz. Such jazz musicians as Duke Ellington, Charlie Parker, and Jack Teagarden have often included variations of the blues in their music. In addition, some classical music and numerous rock, folk, and country music compositions also show the influence of the blues.

The basic blues design is a 12-bar form that is divided into three sections of four bars each. Most blues lyrics consist of several three-line stanzas. The second line of each stanza repeats the first, and the third line expresses a response to the first two. Many blues lyrics reflect loneliness or sorrow, but others declare a humorous or defiant reaction to life's troubles.

Blues may have developed after the American Civil War (1861-1865) from short solo calls and wails called field hollers. Field hollers were used as a form of communication among black plantation workers in the South. In the late 1800's, country, or "down-home," blues developed in the Mississippi Delta region. These songs were sung by a male singer, usually with the accompaniment of a guitar. Blind Lemon Jefferson and Mississippi John Hurt were well-known singers of country blues.

The blues became more widely known in the early 1900's. A bandleader named W. C. Handy began to publish blues songs that won wide popularity. Handy's compositions include "Memphis Blues" (1912) and "St. Louis Blues" (1914). In the 1920's, Bessie Smith emerged as one of the most talented and popular of the classic blues singers. Recordings by Bessie Smith, Mamie Smith, Ethel Waters, and others helped bring urban blues to a larger audience. In the 1930's, boogie-woogie, a blues-influenced style of piano music, became popular.

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WORDSWORTH, WILLIAM

Wordsworth, William (1770-1850), is considered by many scholars to be the most important English romantic poet. In 1795, Wordsworth met Samuel Taylor Coleridge. The two men collaborated on

Lyrical Ballads (1798), a collection of poems frequently regarded as the symbolic beginning of the English romantic movement. Wordsworth wrote most of the poems in the book.

In the preface to the second edition of Lyrical Ballads (1800), Wordsworth outlined ideas about poetry that have since been identified with romanticism. He argued that serious poems could describe "situations from common life" and be written in the ordinary language "really used by men." He believed such poems could clarify "the primary laws of our nature." Wordsworth also insisted that poetry is "emotion recollected in tranquility" and that a poet is "a man speaking to men," different from his fellows only in the degree of his sensitivity but not in any essential way.

Wordsworth has frequently been praised for his descriptions of nature. However, he rightly claimed that his primary interest was the "mind of man." In fact, a key section of his poem *The Prelude*: or, *Growth of a Poet's Mind* insists that love of nature leads to the love of humanity. His finest poems, including the "Lucy" lyrics (1798-1799), "Michael" (1800), "Resolution and Independence" (1802), and "The Solitary Reaper" (1807), dramatize how imagination creates spiritual values out of the memory of sights and sounds in nature.

Early life. Wordsworth was born in Cockermouth, which is now in the county of Cumbria. His mother died in 1778, his father in 1783. Relatives provided for his education. Wordsworth entered Cambridge University in 1787, the year he wrote his first significant poem. During a summer vacation in 1790, he visited France, then in turmoil because of the French Revolution. After graduating from Cambridge in 1791, he returned to France and became a supporter of the revolution. He returned to England in December 1792. Although liberal in his youth, he later became politically and religiously conservative. As a result, he was severely criticized by poets Lord Byron and Robert Browning and others as a traitor to his own youthful principles. Wordsworth was appointed poet laureate in 1843.

Later career. Wordsworth married Mary Hutchinson in 1802. They had five children. Wordsworth was deeply saddened by the drowning death of his brother John in 1805. His sadness was reflected in his poem "Elegiac Stanzas Suggested by a Picture of Peele Castle" (1806). This poem may have marked the end of Wordsworth's youthful creative period. It seems to reject his early optimistic belief, stated in "Tintern Abbey," that "nature never did betray the heart that loved her." In 1807, Wordsworth published one of the most famous poems in English literature, "Ode: Intimations of Immortality." In this piece, Wordsworth praised childhood and urged individuals to rely on intuition. Wordsworth's masterpiece is his long autobiographical poem, *The Prelude*. He wrote it between 1798 and 1805, but he continued to revise it for the rest of his life. The poem was published in 1850, shortly after his death. The revisions that Wordsworth made in *The Prelude* between 1805 and 1850 clearly indicate how his values changed as he aged. In its best passages, *The Prelude* achieves a remarkable combination of simplicity and grandeur.

Wordsworth wrote most of his best poetry before 1807. But he wrote several important works, notably *The Excursion* (1814), later. This long poem discusses virtue, education, and religious faith. Wordsworth also wrote 523 sonnets, many of which compare with those of William Shakespeare and John Milton.

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ARMENIA

Armenia is a country in southwestern Asia. It is a rugged, mountainous land that lies in the Caucasus Mountain region. Yerevan is the country's capital and largest city.

Present-day Armenia and what is now eastern Turkey make up historic Armenia, the original homeland of the Armenian people. This land was conquered many times in its long history. By 1915, the Turks had driven most Armenians out of western Armenia, which became eastern Turkey.

In 1920, Russian Communists took control of eastern Armenia. This area became part of the Transcaucasian Republic of the Soviet Union in 1922. In 1936, it became a separate Soviet republic called the Armenian Soviet Socialist Republic. Armenia remained under Soviet control until 1991, when the people voted to become an independent nation.

Several million Armenians live outside Armenia. The strong national identity of Armenians worldwide helped keep the Armenian culture alive during the years of Soviet control.

Government. In 1995, the Armenian people voted to adopt a new constitution. The most powerful official in Armenia's national government is the president, who is elected by the people to a five-year term. The president appoints a prime minister. The prime minister heads a cabinet, which helps carry out government functions. Cabinet members are appointed by the president. A one-house legislature called the National Assembly makes Armenia's laws.

Armenia's main units of local government are regions, cities, and city regions (regions within cities). Each of these political units has a governing council, whose members are elected by the people. All Armenians 18 years old or older may vote.

Armenia's highest court is called the Court of Cassation. There are also courts of appeal for criminal, military, civil, and economic cases.

About 60,000 people serve in Armenia's armed forces. All males must serve an 18-month term, starting at the age of 18.

People. About 90 percent of Armenia's people are Armenians. Kurds and Russians make up the country's largest minority ethnic groups.

Most of Armenia's people live in urban areas, in apartment buildings. Many people in smaller cities and villages live in single-family houses. Armenians place great importance on hospitality and on close family ties. Often, more than two generations of a family live together. In the cities, many women hold jobs outside the home, but they still do most of the housework and shopping.

Most people in Armenia speak the Armenian language. Armenian is unlike any other language and has its own alphabet.

Armenia was the first country in the world to make Christianity its official religion. It did so in the early 300's. Today, most Armenians belong to the Armenian Church, an Eastern Orthodox Church. Armenians enjoy such foods as barbecued shish kebab, bean salads, a thin bread called lavash, and dolma (cabbage or grape leaves stuffed with rice and meat). Fruit juices, wine and cognac, and tan (a mixture of water, yogurt, and salt) are popular beverages.

Chess and backgammon are popular forms of recreation in Armenia. Yerevan has many theaters for motion pictures, concerts, and drama. It also has an opera house and a symphony hall.

Armenians enjoy such sports as basketball, tennis, and soccer. During the summer, many Armenians vacation at Lake Sevan--a popular resort area--or at summer homes in the countryside.

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Armenia has a rich artistic tradition. Its people have excelled at such crafts as rug weaving and metalwork. The making of decorative carved stone monuments called khatchkars is a purely Armenian art form. Armenian architecture through the ages has produced beautiful stone churches, many with domed roofs. Armenia also has a highly developed tradition of religious music dating to the Middle Ages. Many Armenian craftworkers and artists carry on old traditions today.

Nearly all adults in Armenia can read and write. The government requires children to attend school from the ages of 6 to 16. A student may then attend a technical school or go on to higher education at a university or specialized institute. Armenia has a number of schools of higher education.

Land and climate. Armenia lies on the Armenian Plateau, a rugged highland that extends from the Little Caucasus Mountains southwest into Turkey. The land is broken by mountains and deep gorges. Armenia has an average altitude of 5,000 feet (1,500 meters) above sea level. The highest mountain ranges stand in central Armenia. The country's highest point, Mount Aragats, rises 13,419 feet (4,090 meters). The lowest altitudes are in the northeast and southeast.

Much of the Armenian Plateau was formed millions of years ago by volcanic activity. For this reason, most of Armenia is covered with volcanic stones. Faults--fractures in the earth's rocky outer shell--crisscross the plateau, and earthquakes sometimes occur in Armenia.

Armenia has about 100 mountain lakes. Lake Sevan, in the east, is the largest. It covers about 5 percent of Armenia. The country also has a number of small, fast-flowing rivers and streams. The longest river, the Aras, separates Armenia from Turkey on the west and from Iran on the south. The streams and rivers serve as a source for irrigation and energy. A chain of hydroelectric power stations stands along the Razdan River, between Lake Sevan and Yerevan.

Most of Armenia's vegetation consists of grasses and shrubs. Some forests of beech, hornbeam, juniper, and oak are found in the northeast and southeast.

The country's climate is dry, with long cold winters and short hot summers. January temperatures usually range from 10 to 23 °F (-12 to -5 °C) and can fall below -22 °F (-30 °C). July temperatures average about 50 °F (10 °C) in the mountains and about 77 °F (25 °C) elsewhere.

Armenia receives a yearly rainfall of about 8 to 31 inches (20 to 80 centimeters), rising with elevation. The highest peaks are snow-covered all year.

Economy. Manufacturing and mining account for about two-thirds of the value of Armenia's economic production. The chief industries make chemicals, electronic products, machinery, processed food, synthetic rubber, and textiles. Armenia is a leading distiller of cognac. The country's main industrial centers are Alaverdi, Kapan, Kirovakan, Gyumri, and Yerevan. Copper is Armenia's

most important mineral. Armenian mines also produce gold, lead, and zinc.

Service industries account for about a fourth of Armenia's economic production. These industries include education, health care, and government activities.

Agriculture accounts for about 10 percent of the production. Farm products include apricots, barley, peaches, potatoes, quinces, walnuts, wheat, and wine grapes. Crop production benefits from Armenia's many areas of fertile black topsoils called chernozem soils. The Aras River Valley is the chief farming region. Herders raise cattle and sheep on mountain slopes.

Armenia has several railways and an extensive road and highway system. But relatively few people own cars. Buses and trolleys are the main forms of transportation in most cities and towns. Yerevan has a subway. An international airport also operates at Yerevan.

About 90 newspapers are published in Armenia. The country's radio and television studios are located in Yerevan.

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History. People lived in historic Armenia by 6000 B.C. The earliest societies in the region were probably tribal groups that lived by farming or raising cattle. In the 800's B.C., a coalition of several tribes formed the kingdom of Urartu. The Urartians introduced irrigation and built fortresses, palaces, and temples. In the 600's B.C., ancestors of the Armenians migrated--probably from the west--to the Armenian Plateau. They settled with the native population. In the 500's B.C., Urartu was conquered by the Medes, a people from what is now Iran.

Soon after Urartu fell to the Medes, the Medes were conquered by the Persians. Armenia was under Persian and then Greek rule for hundreds of years. But it maintained a degree of independence.

King Tigran II, who came to power in 95 B.C., built an independent Armenian empire that reached from the Caspian Sea to the Mediterranean Sea. The Romans defeated Tigran in 55 B.C., and Armenia became part of the Roman Empire.

In the early A.D. 300's, Armenia became the first nation to adopt Christianity as its state religion.

The Armenian alphabet was developed in the early 400's by an Armenian cleric. In 451, Armenians under Vartan Mamikonian defended their religion against the Persians in the Battle of Avarair.

Arabs conquered Armenia in the 600's. In 884, an independent Armenian kingdom was established in the northern part of the region. Seljuk Turks conquered Armenia in the mid-1000's, but Armenians established a new state in Cilicia on the Mediterranean coast. This last Armenian kingdom fell to Mameluke invaders in 1375.

Ottoman rule. By 1514, the Ottoman Empire had gained control of Armenia. The Ottomans ruled western Armenia until their defeat in World War I in 1918. Persians gained control of eastern Armenia in 1639. They ruled it until 1828, when it was annexed by Russia. During the 1800's, the growth of nationalism among Turks, Armenians, and other peoples caused conflicts.

During the late 1800's, Armenians under Ottoman rule suffered increasingly from discrimination, heavy taxation, and armed attacks. From 1894 through 1896, the Ottomans and Kurds, under Sultan Abdul-Hamid II, carried out a campaign to wipe out Armenians. Hundreds of thousands of Armenians were killed.

Armenia became a battleground between the Ottoman Empire and Russia during World War I (1914-1918). The Ottomans feared that the Armenians would support the Russians. In 1915, the Ottoman government deported the Armenians who were living in western Armenia into the deserts of what is now Syria. About 1 million Armenians died from lack of water and starvation or were killed by Ottoman soldiers or Arabs and Kurds. A large number of survivors fled to Russian Armenia, where, in 1918, an Armenian republic was established.

Soviet rule. Conflicts resurfaced between the Armenian republic and the Ottoman Empire. Armenia's leaders reluctantly turned to Communist Russia for protection. In December 1920, eastern Armenia became a Communist republic. The Ottomans kept the rest of Armenia. In early 1922, Armenia joined Azerbaijan and Georgia to form the Transcaucasian Republic. This republic was one of four that joined to form the Soviet Union in late 1922. In 1936, Armenia, Azerbaijan, and Georgia became separate republics of the Soviet Union.

Joseph Stalin became dictator of the Soviet Union in 1929. He ruled by terror, allowed little expression by nationalist groups, and had many political and cultural leaders killed. After Stalin's death in 1953, the Soviet Union became more tolerant of national differences. Armenia began to develop into a more modern, European-style society while preserving its ethnic culture.

Before the beginning of Soviet rule in the 1920's, most Armenians had lived in rural areas and worked as farmers or herders. Also, because the region lies on ancient trade routes, many Armenians had

become merchants or traders. Under Soviet rule, Armenia became industrialized. The Soviet government built many factories and modern apartment buildings in Armenia's cities. Many rural people moved to the cities.

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Nagorno-Karabakh, an autonomous oblast (self-governing region) in neighboring Azerbaijan, has long been a source of dispute between Armenia and Azerbaijan. The region is separated from Armenia by a narrow strip of Azerbaijan's territory. Until the late 1980's, a large majority of the people of Nagorno-Karabakh were Armenians and a minority were Azerbaijanis. In 1988, large numbers of Armenians demonstrated in Yerevan and other cities, demanding that Nagorno-Karabakh be made part of Armenia. The protests soon led to fighting between Armenians and Azerbaijanis. After the fighting began, about 400,000 Armenians fled to Armenia from Azerbaijan. About 200,000 Azerbaijanis--almost all those who lived in Armenia--fled to Azerbaijan.

On Dec. 7, 1988, a severe earthquake struck Armenia. It killed about 25,000 people and destroyed much property. The destruction caused by the earthquake, along with the large number of refugees from Azerbaijan, led to a severe shortage of housing and jobs in Armenia.

Independence. In 1990, non-Communists won control of Armenia's government. The republic's legislature then declared that Armenia's laws took precedence over those of the Soviet Union. In early 1991, the Armenian legislature scheduled a referendum on independence to be held in September.

In August 1991, conservative Communist officials failed in an attempt to overthrow the Soviet Union's president, Mikhail S. Gorbachev. In the upheaval that followed, several republics declared their independence. In September, the Armenian people voted for independence from the Soviet Union. In October, Levon Ter-Petrosyan was elected president. In December, Armenia joined other former republics in an association called the Commonwealth of Independent States. The Soviet Union was formally dissolved on December 25.

During the Soviet period, the government owned most of Armenia's businesses, factories, and farmland. But in January 1991, the government began a program to introduce more elements of a free-enterprise system. By the time the Soviet Union broke up, the government had sold about three-fourths of the farmland to private owners. Today, most farmland and many small businesses are privately owned. The government is in the process of selling some medium-sized and large businesses and industries that are owned by the state.

Recent developments. In 1994, Armenia and Azerbaijan declared a cease-fire in the fighting over Nagorno-Karabakh. In 1996, Levon Ter-Petrosyan was reelected president of Armenia. However, many Armenians protested that the election had been marred by fraud. In February 1998, Ter-Petrosyan resigned, and Armenia's prime minister, Robert Kocharian, became acting president. In March 1998, Kocharian was elected to a term as president.

In October 1999, gunmen entered the parliament building and assassinated Prime Minister Vazgen Sarkisyan and several other government officials. The gunmen were arrested, and Kocharian appointed replacements for the slain officials.

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ZEUS

Zeus was the ruler of the gods in Greek mythology. Zeus was a sky and weather god, especially associated with rain, thunder, and lightning. The Greeks believed he was all-knowing and all-seeing. The Greeks considered Zeus a father figure and a protector, especially of guests and strangers. The Roman god Jupiter was equivalent to Zeus.

Zeus was the son of Cronus and Rhea, members of an earlier race of ruling gods called the Titans. Zeus and the other children of Cronus defeated the Titans. Zeus then took Cronus' place and ruled from his home on Mount Olympus. He headed a family of 12 major gods and goddesses called the Olympians. Some lesser gods also lived on Olympus. Zeus's brothers were the gods Hades and Poseidon. Hades ruled the underworld, and Poseidon ruled the seas. The goddesses Demeter, Hera, and Hestia were Zeus's sisters.

At the time Zeus was introduced in Greece, the religion of that area was based on fertility. Each community had a major fertility goddess and a male god associated with her. Zeus eventually took the place of many of these male gods, and became the husband or lover of the goddesses. Later, Hera became Zeus's wife, and other goddesses took a lesser status.

Zeus had many love affairs with goddesses and mortal women and fathered many children. His children included the goddess Aphrodite; the gods Apollo, Dionysus, and Hermes; and the mortal

heroes Perseus and Heracles (Hercules in Latin). Zeus alone gave birth to the goddess Athena. In art, Zeus is depicted as bearded and majestic, often holding a thunderbolt. The eagle and the oak tree were symbols associated with Zeus.

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MIGRATION

Migration, in biology, is the movement of animals to a place that offers better living conditions. Many kinds of animals regularly migrate to avoid unfavorable changes in weather or food supply, or to take advantage of better living conditions elsewhere. Human beings also migrate, but they do so for political and social reasons as well as biological ones.

Biologists use the term migration to describe several types of movements. Some biologists, particularly those who study insects, refer to one-way journeys as migrations. Such movements take place when animals leave an area in search of better living conditions, and neither they nor their descendants necessarily return to the original area.

Other biologists refer to the long-term historical changes in the distribution of animals as migrations. But most biologists define migrations as regular, round-trip movements between two areas. Each area offers more favorable living conditions than the other at some point in the animals' lives. This article discusses such regular, round-trip migrations.

Migrations take place on land, in water, or in the air. Some animals migrate only short distances. For example, many frogs and toads make yearly migrations of only a few miles or kilometers between their breeding and nonbreeding homes. Other migrations cover thousands of miles or kilometers. Arctic terns rank among the animals that migrate farthest. These birds travel as much as 22,000 miles (35,400 kilometers) in a year.

Types of migrations. Most migratory animals make (1) daily migrations or (2) seasonal migrations. Other migratory animals make only one or a few round-trip journeys during their lifetime.

Daily migrations take place among many of the small, drifting animals that live in the ocean. These zooplankton swim hundreds of feet or meters below the surface during the day. Each night, they migrate to the upper levels of the water.

Seasonal migrations take place twice a year. They occur in connection with periodic changes in temperature or rainfall. There are three main kinds of seasonal migrations: (1) latitudinal migrations, (2) altitudinal migrations, and (3) local migrations.

Bats, seals, some whales, and most migratory birds perform latitudinal migrations. That is, they migrate in basically a north-south direction. Some mountain-dwelling animals make altitudinal migrations up and down the mountain slopes. For example, mountain quail and mule deer spend summer in high elevations and move to lower areas in winter. Many tropical birds and mammals make local migrations. They move to moister regions of the tropics during the dry season and return to their original homes when the rainy season begins.

Less frequent migrations are made by some animals. For example, salmon are born in freshwater streams but soon migrate to the oceans. After several years, they return to their freshwater birthplaces to breed. Pacific salmon die soon afterward, but some Atlantic salmon swim back to the ocean and return to their birthplaces to breed as many as three times. Female sea turtles also make a number of migrations during their lifetime. Every two or three years, mature female green turtles and loggerhead turtles swim up to 1,400 miles (2,300 kilometers) to the beach where they hatched. There they lay their eggs.

Why animals migrate. Migration enables many species to take advantage of favorable weather and abundant food supplies in areas with changing environments. In some parts of the world, for example, food is plentiful in summer but becomes scarce during the cold winter months. Many animals that live in these regions migrate to warmer climates in the fall. They return in the spring when the weather warms up.

Many migrations are related to reproduction. Numerous animals migrate to breeding areas where their young have the best chance for survival. Migratory birds breed in their summer homes, where

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the food supply is most abundant. Humpback whales, on the other hand, migrate from their polar feeding grounds to give birth in tropical or subtropical waters. The warm waters provide little food for the adults, but the newborns could not survive in the polar seas.

What triggers migrations. Many animals begin their migrations after unfavorable environmental conditions set in. But among other species, the factors that trigger migrations are more difficult to explain. Many migratory birds, for example, leave their winter homes in the tropics while conditions

there are still favorable. Among such species, migration may be triggered by environmental changes that are associated with the onset of warm weather and increased food in their northern breeding grounds. Experiments show that changes in daylength stimulate the migrations of many species of birds. In spring, the increasing hours of daylight trigger the release of certain hormones in the bodies of the birds. Hormones are chemical substances that regulate many body functions. In this case, the hormones stimulate preparations for the northward trip.

Besides using environmental clues, many seasonal migrators probably have an inborn "calendar" that tells them when to migrate. Some birds show seasonal migratory behavior even when kept under constant conditions in a laboratory. An inborn timing mechanism may trigger the migration of salmon and other animals that migrate at different stages of their life.

How migrating animals find their way. Research has shown that animals use a number of ways to gather directional information during migrations. Many are guided by the sun, the moon, and the stars. Such travelers must be able to allow for the movements of these heavenly bodies in determining direction. Others follow landscape features, such as rivers or mountain ranges.

Animals rely on more than visual cues when they migrate. Salmon find their way back to their birthplace by recognizing the odors of their home streams. Some animals are guided by changes in temperature, moisture, wind direction, or the earth's magnetic field. Sea dwellers may use information from ocean currents.

Many animals use more than one compass during their migrations. According to many biologists, some species of birds are guided by the sun and the earth's magnetic field during the day, and by the stars and the magnetic field at night. On cloudy days and nights, these birds may use the magnetic field alone to find their way.

Sometimes, migrating animals are forced from their normal route into an unfamiliar area. In some cases, the "lost" animals seem to be able to determine where they are and how to reach their original destination. This process is called navigation. Although there are many examples of what appears to be navigation by animals, scientists know little about how this process works.

Some of the most convincing evidence of animal navigation comes from experiments with shearwaters, sparrows, and homing pigeons. Scientists captured these birds and took them to unfamiliar areas up to thousands of miles or kilometers away. Most of the birds successfully returned to the original capture point.

Other experiments indicate that although young animals are able to migrate, they may not be able to navigate from unfamiliar areas. For example, European starlings normally migrate in a southwest direction from their breeding grounds around the Baltic Sea to wintering areas bordering the English Channel. Scientists captured both adult and young starlings that had reached the Netherlands during a migration. They took the birds to Switzerland and released them. The adult starlings corrected for the move and reached their normal wintering grounds. But the young birds, which were making their first migration, continued to fly southwest. The young birds ended up in Portugal, Spain, and southern France.

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PARSLEY

Parsley is a biennial vegetable, sometimes considered as an herb. It is closely related to caraway. The most popular variety produces a low-growing rosette of finely curled and crumpled green leaves. Another variety of parsley produces plain leaves. The fresh leaves are used mainly to decorate meat dishes and salads. The leaves of parsley can also be dried and used in soups.

A special kind of parsley grown in Germany, and occasionally in America, is called Hamburg parsley. This plant produces a long root that may be stored for winter use. Hamburg parsley is used as a soup flavoring.

Parsley is an excellent source of all vitamins. It is especially rich in vitamins A and C and in the minerals iron and calcium. But it is usually eaten in such small quantities that it has little effect on a person's health.

Parsley seed is sown in greenhouses, hotbeds, or open beds. It sends up leaves slowly and unevenly. The plants are moved to the garden about a week before the last spring frost. From 6 to 10 plants are enough for a family. A few leaves at a time are picked off the plant. Sometimes parsley plants are potted and grown indoors in a sunny window during winter.

Parsley was first grown in Sardinia and southern Italy. Early Romans used parsley to fashion garlands that crowned their military heroes and athletic heroes.

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NIGHTINGALE, FLORENCE

Nightingale, Florence (1820-1910), was the founder of the nursing profession as we know it today. British soldiers who were wounded in the Crimean War called her "The Lady with the Lamp" when she walked the halls of their hospital at night. The light that Nightingale carried has come to mean care for the sick, concern for the welfare of the ordinary soldier, and freedom for women to choose their own work.

Early years. Florence Nightingale was named for Florence, Italy, where she was born on May 12, 1820, while her wealthy British parents were living abroad. Her childhood was spent on the family estates in England with her mother, father, and sister Parthenope. The girls' mother, Frances, taught her daughters the social graces and how to run a large household. Their father, William, tutored them in languages, history, and philosophy.

At the age of 16, Florence thought she heard the voice of God telling her she had a special mission in life. She suspected this mission had something to do with helping other people. Florence had always enjoyed caring for the babies of her parents' visitors and for sick farmers on her father's estates. Nightingale followed her own sense of purpose by turning down suitors, declining many parties, and spending much time studying health and reforms for the poor. Her mother could not accept such behavior, which was not considered proper for a wealthy young woman.

Her family's opposition initially prevented Nightingale from working in a hospital. She took a step toward independence when she entered the Institution of Deaconesses, a Protestant school for training nurses, in Kaiserswerth, a town near Dusseldorf, Germany. She later studied in Paris. At 33, she became superintendent of a women's hospital in London.

Service in Crimea. Britain and France went to war with Russia in the Crimea, now part of Ukraine, in 1854. The British people were angry when they heard that their troops had been sent to battle without enough supplies, to die under terrible conditions. The secretary of war asked Florence Nightingale to take charge of nursing. She sailed for the Crimea with 38 nurses.

Nightingale and the other nurses stepped ashore in the mud of Scutari, across from Constantinople (now Istanbul), in late 1854. They faced a job that seemed impossible. Wounded troops had just arrived from the Battle of Balaklava, where the charge of the "Light Brigade" had taken place. About 250 of the British cavalrymen had been killed or wounded in the battle in 20 minutes.

The hospital was an old Turkish barracks, rat-infested, dirty, and poorly furnished. Many of the wounded lay on floors, bleeding and neglected. There were not enough cots, mattresses, or bandages, and no washbasins, soap, or towels. Nightingale found a few men well enough to clean the place, and she put them to work at once. She set up a nursing schedule for patient care and work. At night, her lamp burned as she walked the miles of corridors or wrote countless reports and letters demanding supplies from British military officials. When the hospital was running smoothly, she started classes to teach convalescent soldiers to read and write.

At first, doctors and officials resented the "dictatorship of a woman." But they eventually came to respect her tireless efforts and professional skills.

While on a visit to the front lines, Nightingale became seriously ill and nearly died. By that time, she had become famous, and even Queen Victoria kept an anxious watch on her recovery.

After she returned to the Scutari hospital, Nightingale was urged to go to England to get her strength back. She replied firmly that she was "ready to stand out the war with any man." Nightingale's success at Scutari became so widely recognized that she was given charge of all the British Army hospitals in the Crimea. By the end of the war, Nightingale had saved many lives and had brought about worldwide reforms in hospital administration and in nursing.

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Return to England. England greeted her arrival in 1856 with big celebrations. Instead of attending them, Nightingale went quietly home to her family, and then moved to London. The strain of overwork and her Crimean illness had injured her health. Nightingale became a semi-invalid and seldom left her rooms. Instead, the world came to her.

Ministers, heads of government, authors, reformers, and politicians came to ask her advice.

Nightingale's report of over 1,000 pages to the British War Department brought about the formation of the Royal Commission on the Health of the Army in 1857. By correspondence and constant reading, she made studies of health conditions in India. Another Royal Commission was appointed in 1859, resulting in the establishment of a Sanitary Department in India in 1868.

In 1860, Nightingale used donations of about \$222,000 to found the Nightingale Training School for Nurses at St. Thomas's Hospital in London. She became a world authority on scientific care of the

sick. The United States asked Nightingale's advice for setting up military hospitals during the American Civil War (1861-1865). Nightingale received many honors and was the first woman to be given the British Order of Merit.

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CIRCUMCISION

Circumcision is the surgical removal of the skin that covers the head of the penis. An uncircumcised penis has a loose fold of skin called the foreskin or prepuce that covers the glans (head of the penis). A physician removes the foreskin by cutting around the penis where the foreskin is attached. The word circumcise means cut around.

Most circumcisions are performed within a few days of birth. The doctor first discusses the procedure with the parents. The operation is not medically required, and the parents must give permission to perform the operation. The surgery is often performed without an anesthetic (painkilling drug). However, many physicians now recommend using some type of anesthetic.

Research shows that circumcision provides some health benefits. Most physicians believe the operation makes the glans and penis easier to clean and thus helps prevent infection. Uncircumcised males are more prone to infections of the urinary tract, the structures that produce and eliminate urine. Circumcised males may also have a lower risk of infection with many sexually transmitted diseases, including syphilis, gonorrhea, and HIV, the virus that causes AIDS. A painful condition called phimosis (pronounced fy MOH sihs) occurs when the foreskin tightens around the head of the penis, often as a result of scarring due to infection. Circumcision prevents this condition, which can block the flow of urine.

Circumcision also greatly reduces the risk of developing cancer of the penis. This type of cancer is relatively rare, occurring in approximately 1 out of 400 uncircumcised males.

Today, circumcision is performed largely for cultural or religious reasons. Many parents choose to have their sons circumcised because the father is circumcised, or because the operation is common where they live. Many ancient societies performed it when a boy matured into a young man.

Circumcision was a sign that the youth should assume the religious duties of an adult.

The Bible includes many references to circumcision as a sign of membership in the Jewish community. Circumcision became an important rite in Judaism. A traditional Jewish circumcision is performed by a person called a mohel (pronounced MOY ehl) on the eighth day after the baby's birth. Muslims also regard circumcision as part of their religion. Muslim boys are circumcised sometime between infancy and about 14 years of age.

A procedure sometimes called female circumcision is practiced by many ethnic groups, particularly in Africa and the Middle East. The procedure, which is also known as female genital mutilation, involves the partial or complete removal of the clitoris, a sensitive part of the female genitals, and the surrounding tissue. In cultures where the operation is performed, it is considered an important part of a woman's preparation for marriage. Because there is no health benefit from the procedure, the practice is condemned by many human rights organizations and medical authorities. Risks associated with the procedure include blood loss, infection, lasting pain, and a reduced ability to enjoy sexual relations.

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POULTRY

Poultry are birds that are raised to provide meat and eggs for human food. Chickens are by far the most common kind of poultry raised throughout the world. Other important species include turkeys, ducks, geese, guinea fowl, pheasants, pigeons, and quail. Some birds are particularly prized by certain peoples. For example, guinea fowl are an important species in France.

Although poultry are used primarily for food, they also provide several important by-products. Manufacturers use the feathers of ducks and geese to stuff pillows and insulated clothing. Farmers use poultry manure as fertilizer. Eggs are used not only as food but also in making paint, vaccines, and other products.

Chickens, ducks, and turkeys are the most common kinds of poultry raised in the United States and Canada. In the late 1990's, U.S. farmers earned about \$22 billion a year from the sale of poultry meat and eggs. Canadian farmers earned about \$1.4 billion (in U.S. dollars) annually from poultry and eggs.

People in the United States consume an average of 65 pounds (29 kilograms) of poultry yearly. About 80 percent of the poultry consumed comes from chickens. The rest comes mainly from turkeys. Canadians eat an average of 61 pounds (28 kilograms) of poultry a year. People in the

United States eat an average of about 240 eggs each per year. Canadians average 235 eggs annually. Almost all the eggs eaten in Canada and the United States are chicken eggs. People in some other countries also eat the eggs of ducks, geese, and other fowl.

California, Indiana, Iowa, Ohio, and Pennsylvania lead the United States in egg production. Leading producers of chickens for use as meat include Alabama, Arkansas, and Georgia. Minnesota and North Carolina are the chief turkey-producing states. Other leading producers include Arkansas, California, Missouri, and Virginia. Long Island produces about a fourth of the ducks in the United States.

Ontario and Quebec produce the majority of the poultry products in Canada.

Raising poultry. Most of the poultry produced in the United States comes from large commercial farms that raise only these birds. Some of the farms have flocks of more than a million birds. A small percentage of U.S. poultry is raised in flocks that consist of 5,000 or fewer birds. Many small poultry farmers also do other kinds of farming. Most commercial poultry farmers buy baby birds from hatcheries, which hatch eggs in incubators.

Female chickens raised to produce eggs are called laying hens. They begin to lay eggs when they are about 21 weeks old. The birds are kept in long, low buildings called laying houses, each of which may hold as many as 50,000 hens. In many of these houses, the hens live in cages that have a sloped floor so the eggs can roll out. In highly automated laying houses, mechanical devices carry feed and water to the hens, and a conveyor belt carries the eggs to a central collecting room. The hens are kept in the laying house for about 12 months after they start to lay eggs. Then they are either kept in laying houses for another season, or are sold for slaughter and replaced with young birds.

Chickens raised only for their meat are called broilers or fryers. Most broilers are raised indoors on a dirt or concrete floor that is covered with litter. Litter is straw, wood shavings, or some other material that absorbs moisture, keeping the birds clean. Broilers eat and drink from automatic feeders and water containers.

Geese, turkeys, and some other birds require more space because they are larger than chickens. Most of these birds are raised outdoors in pens or fenced fields. However, many turkey farmers raise their birds indoors. Most ducks are also raised indoors. Pheasants, quail, and other birds are cared for much as broilers are, but most farmers raise them in smaller flocks.

Poultry feed consists of a mixture of ingredients that promotes rapid growth or high egg production. The main ingredient is corn, wheat, sorghum, or some other grain. The grain is mixed with protein

171 supplements, such as soybean meal or meat by-products. Vitamins and minerals are also added. A broiler eats an average of 1 pound (0.45 kilogram) of feed per week. A laying hen consumes about 4 pounds (1.8 kilograms) of feed for every dozen eggs that she lays.

Diseases and parasites are a major problem of poultry farmers. Many birds are kept in a small area, and so disease can spread quickly through a flock, causing severe losses. Therefore, farmers vaccinate their birds, add drugs to the water or feed, and keep the flocks as clean as possible. Respiratory ailments of poultry include Newcastle disease, infectious bronchitis, and laryngotracheitis. Marek's disease and leukosis, which kill many birds, result from tumors caused by viruses. Parasites cause a disease called coccidiosis.

Breeding is another important aspect of poultry raising. Breeders have developed types of birds that produce more meat or eggs than other types. For example, turkeys raised in the United States have an extremely broad breast that yields much white meat.

Marketing poultry and eggs. Poultry raised for meat are marketed at various weights and ages. For example, broilers reach a market weight of about 4 pounds (1.8 kilograms) when they are about 8 weeks old. Turkey market weights vary widely, depending on type. A typical hen turkey reaches its market weight of about 15 pounds (6.8 kilograms) at 15 weeks old. Tom turkeys weigh about 24 pounds (11 kilograms) at 17 weeks. Ducks are ready for market when they are 7 or 8 weeks old and weigh approximately 6 pounds (2.7 kilograms).

Poultry that have reached market size are sent to processing plants to be slaughtered, inspected, and graded. Then they are shipped to supermarkets. More than 90 per cent of the broilers sold in the United States and Canada are sold fresh. About 70 per cent of the turkeys are processed and sold as specialty meat. Most of the whole turkeys are sold frozen, chiefly at Thanksgiving and Christmas. About 40 per cent of all ducks and geese are sold frozen.

Egg farmers generally sell their eggs directly to supermarkets or to wholesalers. Most eggs are sold to consumers fresh, though some are used in such processed food items as cake mixes and noodles.

Eggs must be washed, graded, and packed in cartons to prepare them for marketing. Inspectors determine the quality of the interior of an egg by candling. This technique involves examination of the egg while shining a strong light through it from behind. Eggs are stored and shipped under refrigeration to ensure their freshness.

During the 1970's, the poultry industry developed several new kinds of processed meats from poultry. These meats included "frankfurters" made of chicken and "ham" made of smoked turkey. The poultry meats were generally cheaper and less fatty than the products made from beef or pork.

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UNIVERSE

Universe consists of all matter and all light and other forms of radiation and energy. It consists of everything that exists anywhere in space and time.

The universe includes the earth, everything on the earth and within it, and everything in the solar system. The solar system contains nine major planets along with thousands of comets and minor planets called asteroids. It also contains the sun, the star around which the planets revolve.

All stars, including the sun, are part of the universe. Some other stars also have planetary systems.

In addition to planets and stars, the universe contains gas, dust, magnetic fields, and high-energy particles called cosmic rays.

Stars are grouped into galaxies. The sun is one of more than 100 billion stars in a giant spiral galaxy called the Milky Way. This galaxy is about 100,000 light-years across. A light-year is the distance that light travels in a year--about 5.88 trillion miles (9.46 trillion kilometers).

Galaxies tend to be grouped into clusters. Some clusters appear to be grouped into superclusters.

The Milky Way is part of a cluster known as the Local Group. This cluster is about 3 million lightyears in diameter. Also in the cluster are two giant spirals known as the Andromeda Galaxy and M33 and about 30 small galaxies, also known as dwarf galaxies. The Local Group is part of the Local Supercluster, which has a diameter of about 100 million light-years.

Size of the universe

No one knows whether the universe is finite or infinite in size. Studies of the sky indicate that there are at least 100 billion galaxies in the observable universe. Measurements show that the most distant galaxies observed to date are about 12 billion to 16 billion light-years from the earth. They are observed in every direction across the sky.

Astronomers determine the distance to a faraway object by measuring the object's red shift. This phenomenon occurs when an object that is moving away from an observer emits (gives off) light. Red light has the longest wavelength of any visible light--that is, the longest distance between successive wave crests. The observer sees light from a receding object at wavelengths longer than those that would be seen by an observer who was moving with the object. The observed change in wavelength is the object's red shift. The amount of red shift depends upon the speed at which the object recedes from the observer. The larger the red shift is, the more rapidly the object is moving away.

Among the most distant objects ever observed are tremendously bright objects called quasars.

Individual quasars are as much as 1,000 times brighter than the entire Milky Way. No one knows the structure of quasars, because a quasar appears pointlike in a photographic image. However, a quasar seems likely to contain a giant black hole in its center. A black hole is an object whose gravitational field is so strong that nothing--not even light--can escape from it. Matter is apparently falling into the massive black hole in the center of the quasar, radiating energy before being swallowed up.

Astronomers interpret the red shifts that have been measured as evidence that the universe is expanding. That is, every part of the universe is moving away from every other part. The matter within a particular object does not expand, however. For example, the stars in a galaxy do not move away from one another because gravity holds the galaxy together. But the galaxies are moving away from one another. The expansion of the universe is a basic observation that any successful theory of the universe must explain.

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Changing views of the universe

In ancient times, people of many cultures thought that the universe consisted of only their own locality, distant places of which they had heard, and the sun, moon, planets, and stars. Many people thought that the heavenly bodies were gods and spirits. But the Polish astronomer Nicolaus Copernicus suggested in 1543 that the earth is like the other planets and that the planets revolve

around the sun. Later astronomers showed that the sun is a typical star.

The development of the telescope, the photographic plate, and the spectroscope (an instrument that analyzes light) led to a great increase in knowledge. Astronomers discovered that the sun is moving within a large system of stars, the Milky Way. About 1920, astronomers realized that not all of the fuzzy patches of light seen in the night sky are part of the Milky Way. Rather, many of these objects, called nebulae, are other galaxies. The discovery of the red shift of distant galaxies led to the theory of the expanding universe.

The big bang theory provides the best explanation of the basic observations. According to it, the universe began with an explosion--called the big bang--10 billion to 20 billion years ago. Immediately after the explosion, the universe consisted chiefly of intense radiation and particles. This radiation, along with some matter, formed a rapidly expanding region called the primordial fireball. After thousands of years, the fireball consisted mostly of matter, largely in the form of hydrogen gas. Today, faint radio waves coming from all directions of space are all that remain of the radiation from the fireball.

In time, the matter broke apart into huge clumps. The clumps became galaxies, many of them grouped into clusters and superclusters. Smaller clumps within the galaxies formed stars. Part of one of these clumps became the sun and the other objects in the solar system.

The best available evidence indicates that the galaxies will move apart forever. This evidence and the universe's current rate of expansion indicate that the present age of the universe is about 15 billion to 20 billion years. This estimate agrees with observations of the oldest stars in groups known as globular star clusters.

Astronomers do not rule out the possibility, however, that all the galaxies will come together again in about 70 billion years. This would happen if the universe contained more of a yet unobserved substance called dark matter than the matter that is seen in galaxies. The gravitational pull of the dark matter would slow the expansion. All the material in the universe would eventually collapse, then explode again. The universe would enter a new phase, possibly resembling the present one.

The search for dark matter is a major area of research.

The steady state theory offers another explanation of basic observations. According to this theory, the universe has always existed in its present state. As the galaxies move apart, new matter appears between them and forms new galaxies. However, the existence of the faint radio waves that come from all directions of space does not favor this theory.

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MILKY WAY

Milky Way is the galaxy that includes the sun, the earth, and the rest of our solar system. The Milky Way Galaxy contains hundreds of billions of stars. Huge clouds of dust particles and gases lie throughout the Galaxy. Milky Way also refers to the portion of the Milky Way Galaxy that can be seen by the naked eye. On clear, dark nights, it appears as a broad, milky-looking band of starlight stretching across the sky. Dark gaps in the band are formed by dust and gas clouds that block out light from the stars that lie behind them.

Shape of the Galaxy. The Milky Way is shaped like a thin disk with a bulge in the center. Stars, dust, and gases fan out from the central bulge in long, curving arms that form a spiral (coiled) pattern. For this reason, astronomers classify the Milky Way as a spiral galaxy. To someone far above the Milky Way, the Galaxy would resemble a huge pinwheel. However, because of our location inside the Galaxy, we see only the hazy light from the strip of stars around the earth.

The flat part of the Milky Way disk contains many young stars and small, irregularly shaped groups of stars called open clusters, also known as galactic clusters. It also has most of the Galaxy's dust and gases. A vast number of older stars are in the central bulge of the disk. The bulge and disk are surrounded by a sphere of stars known as a halo. The halo contains relatively old stars in dense, ball-like groups called globular clusters.

Size of the Galaxy. The diameter of the Milky Way is about 100,000 light-years. A light-year is the distance that light travels in one year--about 5.88 trillion miles (9.46 trillion kilometers). The Milky Way is about 10,000 light-years thick at the central bulge and much flatter toward the edges of the disk. Our solar system is located in the outskirts of the Galaxy, about 25,000 light-years away from the center. The distance between the stars in our section of the Milky Way averages about 5 lightyears. Stars in the galactic center are about 100 times closer together. Most astronomers estimate that the total mass of the Milky Way is more than 100 billion times that of the sun (see MASS). Much of the mass is concentrated toward the center of the Galaxy.

The center of the Galaxy. All stars and star clusters in the Milky Way orbit the center of the Galaxy, much as the planets in our solar system orbit the sun. For example, the sun completes an almost circular orbit of the center once about every 250 million years. Almost all the bright stars in the Milky Way orbit in the same direction. For this reason, the entire galactic system appears to rotate about its center.

The clouds of dust and gases in the Milky Way prevent us from seeing very far into the center of the Galaxy. However, astronomers studying radio waves and infrared rays--which can penetrate the clouds--have discovered that the central region gives off enormous amounts of energy. Studies with radio and infrared telescopes have also revealed a powerful gravitational force that seems to come from the exact center of the Galaxy. Some astronomers believe that the Milky Way's center is a massive black hole, an invisible object whose gravitational pull is so great that not even light can escape from it. They think the center's energy is generated when the black hole swallows gas and other matter from the surrounding Galaxy.

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CONCENTRATION CAMP

Concentration camp is a place where people are imprisoned, and in some cases killed, without legal proceedings. Many countries have imprisoned people in concentration camps because of their political views, religious convictions, ethnic background, or social attitudes. The best-known camps were those operated by the Nazis during the Holocaust, a campaign of systematic murder waged against Jews and others during World War II (1939-1945). The Nazis imprisoned and killed millions of people in such camps, first in Germany and later in German-occupied Europe.

Nazi concentration camps were created soon after Adolf Hitler came to power in Germany in 1933. The Nazis established the first permanent camp in Dachau, Germany, near Munich, in March 1933. Nazi camps held socialists, Communists, and other political prisoners; Jews; homosexuals; priests and ministers; and many others. After World War II started in September 1939, the Nazis increasingly used camp inmates for slave labor.

In 1941, the Nazis began to build Vernichtungslager (death camps). These camps were established for the purpose of killing Jews with poison gas and other methods. By the end of 1942, the Nazis had created six death camps, all in German-occupied Poland--Auschwitz, Belzec, Chelmno, Majdanek, Sobibor, and Treblinka.

The most notorious of these death camps was the camp at Auschwitz. During World War II, the Nazis murdered about 11/4 million people there. The victims included Jews, Poles, Gypsies, and Soviet prisoners of war.

Auschwitz was not just a death camp. It also contained a slave labor complex. When prisoners arrived at Auschwitz, the Nazis took their clothes and other possessions. The camp officials sent the old and the very young, women with children, the handicapped, and the weak directly to gas chambers. Able-bodied prisoners worked in the slave labor complex. When they became weak or ill, the guards killed them or forced them to work until they died. After the prisoners were dead, the Nazis removed any gold teeth from the corpses and burned the bodies.

Other concentration camps. From 1942 to 1946, the United States government imprisoned more than 110,000 Japanese Americans, including more than 70,000 U.S. citizens, in camps called internment camps. The United States and Japan were at war, and U.S. officials believed, with little evidence, that Japanese Americans threatened national security.

In the Soviet Union, concentration camps were part of the Gulag prison system. Gulags housed people who spoke out against the Communist government. At least 17 million people were sent to Gulags in the Soviet Union from 1928 to 1953. More than 12 million prisoners died at a Soviet camp called Perm-36 in the Ural Mountains. Communist governments in Vietnam, North Korea, and China have also held thousands of political prisoners in gulags.

The term concentration camp was first used in 1900 to describe the open-air camps in South Africa where the British kept Boer prisoners of war. The British fought the Boers, South African settlers of mainly Dutch ancestry, during the Boer War (1899-1902).

Throughout history, many countries at war have established concentration camps to imprison members of enemy groups or nations. In the mid-1990's, for example, during the conflict in Bosnia-Herzegovina, each of the warring factions--Serbs, Muslims, and Croats--established concentration camps.

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ADOLESCENT

Adolescent refers to a person who is experiencing the period of development between childhood and adulthood. This period is often called adolescence. Many experts in human development believe adolescence begins at about the age of 10. They recognize adolescence as a period of growth with many distinctive features. These features involve changes in the individual's body, thinking abilities, psychological concerns, and place in society.

Human beings, like all mammals, go through a series of physical and biological changes, called puberty, that prepares them for sexual reproduction. As a biological phenomenon, therefore, adolescence has always existed as a period in human development. However, adolescence as a separate psychological and social stage is a concept that was developed in industrialized nations during the mid-1800's.

The "invention" of adolescence

Before the 1800's, adults did not make important distinctions among children of different ages. However, new patterns of work and family life came with industrialization in the 1800's. Individuals from age 12 to 16 were greatly affected by these changes. As work shifted away from farming and became less tied to the family, young people needed a new kind of preparation for adulthood. Children in working-class families often took jobs in mines, factories, and mills. Others were apprenticed to craftworkers to learn a trade. Adolescents in middle-class families were expected to attend school, where they were grouped with others of the same age. At school, they could be better educated for a rapidly changing workplace.

By the early 1900's, adolescence in some societies and some social and economic classes had become a lengthy period of preparation for adulthood. During this time, young people remained grouped with people their own age, often referred to as their peers, and were economically dependent on adults. This role is still what is expected of adolescents in most societies today. How society regards adolescence has a tremendous impact on the psychological and social development of individuals. Before the 1800's, the lives of adolescents did not revolve around socializing with their friends. There was no such thing as a "teen culture." Young people seldom felt compelled to take a certain action, adopt certain values, or otherwise conform to be accepted by the group. Today, social pressure from people their own age, known as peer pressure, is a major influence on many adolescents.

Before adolescence became defined as a distinct developmental stage, most young people did not struggle to develop a clear sense of self or to sort out what they would become in the future. Most young people had few real choices open to them. Today, psychological experts use the term identity crisis to refer to the psychological distress many adolescents feel as they seek a sense of purpose and an acceptable role in the world. Peer pressure, popular culture, and identity crises may seem to make up the core of adolescence, but they are actually consequences of how adolescence is defined today.

Physical development

Puberty is the most obvious sign that an individual has entered adolescence. Technically, puberty refers to the period during which the individual becomes capable of sexual reproduction. More broadly, however, puberty is used as a collective term for all the physical changes that occur in a growing girl or boy as the individual passes from childhood to adulthood.

The physical changes of adolescence are triggered by hormones (chemical substances in the body) that act on specific organs and tissues. In boys, a major change is increased production of the hormone testosterone, while girls experience increased production of the hormones called estrogens. In both sexes, a rise in growth hormone produces a growth spurt. During this spurt, which lasts two or more years, an individual commonly grows 2 to 4 inches (5 to 10 centimeters) taller per year.

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Sexual development. Many of the most dramatic changes of puberty involve sexual development. Internally, adolescents become capable of sexual reproduction. Externally, as secondary sexual characteristics appear, girls and boys begin to look more like mature women and men. The term secondary sexual characteristics refers to a variety of physical traits, such as body shape, voice, and facial hair.

Not everyone goes through puberty at the same time or rate. In Western industrialized societies today, the adolescent growth spurt occurs, on average, between the ages of 12 and 14 in boys, and 10 and 12 in girls. But some young people start puberty when they are 8 or 9, and others not until they are in their mid-teens. Generally, girls begin puberty about two years earlier than boys. The duration of puberty also varies greatly, from 1 1/2 to 6 years in girls and from 2 to 5 years in boys.

Adolescent "awkwardness." Because different parts of the body grow at different rates during puberty, many adolescents temporarily look and feel awkward. For many years, psychologists believed that puberty was stressful for young people. According to one theory, changes in hormones made young adolescents moody, irritable, and depressed. We now know that most emotional disturbances in adolescence result from changes in the teen-ager's roles and relationships. Adolescents can minimize difficulties associated with adjusting to puberty by knowing what changes to expect and having healthy attitudes toward them.

The timing of puberty may affect an adolescent's social and emotional development in important ways. Because early-maturing boys and girls appear older physically, people often treat them as if they were more mature psychologically than they are. Early maturers will more likely engage in risky behavior during early adolescence, such as experimentation with drugs, sex, or delinquency. Many psychologists believe these risky actions result from the influence of older teen-agers, who befriend early maturers more often than they befriend younger-looking adolescents.

Because of the emphasis many boys place on athletics, early-maturing boys may have temporary advantages over their peers. As a result, during the first years of adolescence, early-maturing boys tend to be more popular, have higher self-esteem, and have more self-confidence than average- or late-maturing boys.

In contrast, the effects of early maturation on girls are more mixed. Early-maturing girls tend to be more popular with their peers. But they are also more likely to feel awkward and self-conscious, perhaps because they are uncomfortable with the attention, both welcome and unwelcome, their new appearance draws.

Over time, puberty has begun at younger and younger ages. Part of the trend is due to improvements in nutrition and health care. The trend appears to be leveling off, however.

Intellectual development

Compared with children, adolescents begin to think in ways more like adults. Their thinking becomes more advanced, more efficient, and generally more effective. These improvements appear in five chief ways.

(1) An adolescent's thinking is less bound to concrete events than that of a child. Children's thinking focuses on things and events that they can observe directly in the present. Adolescents can better compare what they observe with what they can imagine.

(2) During adolescence, individuals become better able to think about abstract things. Adolescents have an increased interest in relationships, politics, religion, and morality. These topics involve such abstract concepts as loyalty, faith, and fairness.

(3) Adolescents think more often about the process of thinking itself. As a result, they can develop better ways to remember things and to monitor their own thinking.

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(4) Adolescents have the ability to think about things in several ways at the same time. Adolescents can give much more complicated answers than children to such questions as "What caused the American Civil War?" Adolescents have more sophisticated, complicated relationships with others because they can better understand other people's feelings. They also understand that social situations can have different interpretations, depending on one's point of view.

(5) Children tend to see things in absolute terms. Adolescents often see things as relative. They are more likely to question statements and less likely to accept "facts" as unquestionably true. This change can be frustrating to parents, who may feel that their adolescent children question everything just for the sake of argument. However, such questioning is normal and helps teen-agers develop individuality and personal convictions.

One by-product of these changing aspects of intellectual development is the tendency for adolescents to become self-conscious and self-absorbed. This tendency is sometimes called adolescent egocentrism. Intense self-consciousness sometimes leads teen-agers mistakenly to believe that others are constantly watching and evaluating them. A related problem is an adolescent's incorrect belief that his or her problems are unique. For example, a teen-ager who has just broken up with a girlfriend or boyfriend may say that nobody else could possibly understand what he or she is feeling, even though such breaking up is a common experience.

Psychological development

Identity and self-esteem. As individuals mature, they come to see themselves in more sophisticated, complicated ways. Adolescents can provide complex, abstract psychological descriptions of themselves. As a result, they become more interested in understanding their own personalities and

why they behave the way they do. Teen-agers' feelings about themselves may fluctuate, especially during early adolescence. However, self-esteem increases over the course of middle and late adolescence, as individuals gain more confidence.

Some adolescents go through periods when they genuinely wonder what their "real" personality is. Adolescents who have gone through a prolonged identity crisis may feel a stronger sense of identity as a result of taking the time to examine who they are and where they are headed.

Independence and responsibility. During adolescence, individuals gradually move from the dependency of childhood to the independence of adulthood. Older adolescents generally do not rush to their parents whenever they are upset, worried, or need assistance. They solve many problems on their own. In addition, most adolescents have a great deal of emotional energy wrapped up in relationships outside the family. They may feel just as attached to their friends as to their parents. By late adolescence, children see their parents, and interact with them, as people--not just as a mother and father. Unlike younger children, adolescents do not typically see their parents as all-knowing or all-powerful.

Being independent also means being able to make one's own decisions and behave responsibly. In general, decision-making abilities improve over the course of the adolescent years, with gains in being able to handle responsibility continuing into the late years of high school.

During childhood, boys and girls are dependent upon and relate closely to their parents rather than their peers. During early adolescence, conformity to parents begins to decline, while peer pressure and conformity to peers increase. Peer pressure is particularly strong during junior high school and the early years of high school.

Adolescents yield more often to peer pressure when it involves day-to-day social matters, such as styles of dress, tastes in music, and choices among leisure activities. But teen-agers are mainly influenced by their parents and teachers when it comes to long-range questions concerning educational or occupational plans, or decisions involving values, religious beliefs, or ethics.

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Becoming independent involves learning how to cope with peer pressure. During middle adolescence, individuals begin to act the way they think is right, rather than trying to impress their friends or please their parents.

Social development

Relationships with peers change in four important ways during the teen-age years: (1) There is a sharp increase in the amount of time adolescents spend with their peers compared to the time they spend with adults or their families. (2) Peer groups function much more often without adult supervision than they do during childhood. (3) In most societies, there is much more contact with peers of the opposite sex. (4) Adolescents tend to move in much larger peer groups than they did in childhood. Crowds tend to dominate the social world of the school.

The increased importance of peers during early adolescence coincides with changes in an individual's need for intimacy. As adolescents begin to share secrets with their friends, a new sense of loyalty and commitment grows between them. An adolescent's discovery that he or she thinks and feels the same way as someone else becomes an important basis of friendship and helps in the development of a sense of identity.

Dating and sex. In industrialized societies, most young people begin dating sometime during early to mid-adolescence. Dating can mean a variety of activities, from gatherings that bring males and females together, to group dates, in which a group of boys and girls go out jointly. There can be casual dating in couples or serious involvement with a boyfriend or girlfriend.

Most adolescents' first experience with sex does not involve another person. Many boys and girls report having sexual fantasies about someone they know or wish they knew. It is also fairly common for adolescents to masturbate (handle or rub their sex organs).

By the time many adolescents have reached high school, they have had some experience with intimate sexual contact, such as kissing, caressing, or sexual intercourse. During the 1970's and 1980's, more adolescents became sexually active than in the past and they became sexually active at an earlier age. Surveys in the late 1990's, however, indicated that the trend toward becoming sexually active at an early age might be leveling off. Many individuals and religious groups consider sexual activity outside of marriage to be morally wrong. They also urge adolescents to avoid sexual activity for health reasons.

Family relationships change most about the time of puberty. Conflict can increase between parents and adolescents, and closeness between them diminishes somewhat. Changing adolescent views on

family rules and regulations may contribute to increased disagreement between young people and their parents.

Although young people may distance themselves from their parents as they enter adolescence, this period is not normally a time of family stress. Most conflicts take the form of minor arguments over day-to-day issues. In many families, the decline in closeness between parents and children in early adolescence results from the adolescent's increased desire for privacy. In addition, teen-agers and parents may express affection for each other less often. Generally, this distancing is temporary, and family relationships become closer and less conflict-ridden during middle and late adolescence.

Certain constants remain in family life. Among the most important is an adolescent's need for parents who are both nurturing and demanding. This combination of warmth and strictness is associated with healthy psychological development. Children raised by loving parents who maintain clear and constant personal and social standards are more likely to have good feelings about themselves than children brought up by harsh or lax parents. Adolescents raised with both warmth and firmness are more likely to excel in school, to have close and satisfying relationships with others, and to avoid trouble with drugs and delinquency.

Special problems and challenges

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Adjusting to school life. A young person's move from elementary school to middle school or junior high school can be difficult. In elementary school, the child had a single homeroom teacher who knew him or her personally. In middle school or junior high, the child usually has a different teacher for each subject. In elementary school, children are rewarded for trying hard. In middle or junior high school, grades are based more on performance than on effort. In elementary school, children work under close supervision all day. In middle school or junior high, young people must learn to work more independently.

For such reasons, many students are temporarily disoriented during the transition between schools. Their self-esteem falters, and their grades may drop off slightly. Their interest in school activities declines. They may feel anonymous, isolated, and vulnerable. Parents can help by talking to the child before school begins about the differences he or she will experience.

Alcohol and drug abuse. Many adolescents in industrialized countries experiment with alcohol, tobacco, and marijuana. Adolescents may experiment with such substances because of a desire to fit in with their friends. Many adolescents see smoking, drinking, and using drugs as a key to popularity. Other reasons adolescents experiment with drugs and alcohol include boredom, and a desire to feel grown-up--that is, they see drugs as a way to prove they are adults and no longer under adult control.

Young people who abuse drugs and alcohol are more likely to experience problems at school, to suffer from psychological distress and depression, to have unsafe sex, and to become involved in dangerous activities. Alcohol and drugs often contribute to automobile accidents, the leading cause of death among American teen-agers. Adolescent substance abusers also expose themselves to longterm health risks that result from drug addiction or dependency.

Pregnancy. Some young women become pregnant before the end of adolescence. Adults can help adolescents prevent unwanted pregnancies. For example, parents and teachers can provide sex education to instruct young people in how to deal with their sexual feelings before they become sexually active. Adults also can make adolescents feel more comfortable about discussing sexual matters so that young people will examine their own behavior seriously and thoughtfully.

Establishing a sexual identity. Normal developmental tasks of adolescence include learning to think of oneself as a sexual being, to deal with sexual feelings, and to enjoy a new kind of closeness with another person. Part of this involves developing a sexual identity. Sexual identity includes sexual orientation--that is, whether a person is sexually attracted to the opposite sex or the same sex.

People who are primarily attracted to members of their own sex are called homosexual, gay, or, if they are women, lesbian. People who are attracted to the opposite sex are called heterosexual or straight. No one factor determines sexual orientation.

At some time, almost all young adolescents worry that they might be homosexual. At the age when children enter puberty, they still spend most of their time with members of the same sex. As a result, many adolescents begin to experience sexual feelings before they have much contact with the opposite sex. This does not mean that all of these young adolescents have homosexual desires.

Their sexual development is just ahead of their social development.

Unfavorable attitudes toward homosexuality may cause significant psychological distress for

adolescents who experience gay and lesbian feelings, especially if they encounter hostility from those around them. The psychological tasks of adolescence, such as developing a sense of identity, present great challenges for all teen-agers. These challenges may be intensified for those adolescents attracted to members of the same sex. They may have to resolve these issues without the social support available to their heterosexual peers.

Eating disorders. Some adolescents, especially females, become so concerned about weight control that they take drastic and dangerous measures to remain thin. Some overeat and then force themselves to vomit to avoid gaining weight. This pattern is associated with an eating disorder called
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bulimia. Young women with a disorder called anorexia nervosa actually starve themselves to keep their weight down. Adolescents with eating disorders have an extremely disturbed body image. They see themselves as overweight when they are actually underweight. Bulimia and anorexia nervosa are rare before the age of 10. It was once believed that eating disorders were more common in North America and Western Europe than in other parts of the world, and were more common among the prosperous and well educated. However, research in the late 1990's found these disorders to be common among all social and economic levels, and in many countries throughout the world.

Although the incidence of anorexia and bulimia is small, many adolescents, especially females, remain unhappy with their body shape or weight. Many girls whose weight is normal by medical and health standards believe they are overweight. A majority of adolescent girls report that they would like to be thinner. Most believe that being thinner would make them happier, more successful, and more popular.

Delinquency. Violations of the law are far more common among adolescents and young adults than in any other age group. Violent crimes and crimes against property peak during high school.

Violent crime is a serious concern to youths as well as to adults. Adolescents are the age group most likely to become victims of such crimes as theft, robbery, rape, and assault. However, adolescents may also commit such violent crimes. Delinquents who repeatedly commit serious crimes typically come from disrupted or badly functioning families, and they frequently abuse alcohol or drugs.

Hostile, neglectful, or unfit parents may mistreat children and fail to instill in them proper standards of behavior or the psychological foundations of self-control.

Risk taking. Many adolescent health problems result from behaviors that can be prevented. These behaviors include substance abuse, reckless driving, unprotected sex, and violence. One particular concern is sexually transmitted diseases, such as AIDS, among teen-agers. Some people mistakenly consider AIDS a homosexual disease, but the virus can be transmitted from male to female or female to male. The virus is also transmitted through needles and syringes that are used in taking drugs. It may even be spread by tattooing or body piercing if the instruments were previously used on an infected person.

Suicide. The suicide rate among teen-agers has risen dramatically since the mid-1900's. Four factors in particular place an adolescent at risk for a suicide attempt: (1) suffering from low self-esteem or an emotional problem, such as depression; (2) being under stress, especially in school or because of a romantic relationship; (3) experiencing family disruption or family conflict; and (4) having a history of suicide in the family or a friend who has committed suicide.

Any threat of suicide demands immediate professional attention. Anyone who suspects an adolescent is considering suicide should immediately call a suicide hot line or the emergency room of a local hospital.

Planning for the future

Career planning is part of the identity development process during adolescence. Occupational plans develop in stages. Prior to adolescence, children express career interests that are often little more than fantasies and have little bearing on the plans they eventually make. In adolescence, individuals begin to develop self-concepts and ideas about work that will guide them in their educational and occupational decisions. Although adolescents may not settle on a particular career at this point, they do begin to narrow their choices according to their interests, values, and abilities.

One problem all young people face in making career plans is obtaining accurate information about the labor market and the best ways of pursuing positions in various fields. One goal of career education is to help adolescents make more informed choices about their careers and to free them from misinformation that inhibits their choices

Education is essential today for anyone who wants a well-paying job with a promising future. Young people need at least a high school education to compete in the job market. Those who want to go into a craft or trade usually need a two-year course of college study.

Most of the better jobs go to individuals with at least some college education. However, getting a job is not the only reason for going to college. College plays a critical role in a young person's psychological development. College not only provides occupational advantages but also affects where individuals will live, who they will marry, who their lifelong friends will be, and, most important, who they become.

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MULTIPLE BIRTH

Multiple birth is the birth of more than one infant from the same pregnancy. Twins, triplets, quadruplets, and quintuplets are all examples of multiple birth. Most animals give birth to more than one offspring at a time. Human beings usually have only one baby at a time. This article discusses multiple births in human beings.

Kinds of multiple births. Most multiple births in humans involve twins. Twins occur about once in every 89 births. By contrast, triplets occur about once in every 7,900 births, and quadruplets occur about once in 705,000 births. The two most commonly recognized types of twins are fraternal and identical. Fraternal twins may be of the same sex or consist of a brother and a sister, with each individual having a different genetic makeup. Identical twins are always of the same sex and have an identical genetic makeup. They generally are more difficult to tell apart physically than are fraternal twins.

Researchers have found that the rate at which identical twins occur--about 4 times in every 1,000 births--is fairly constant. The birth rate of fraternal twins, however, is highly variable. For example, fraternal twins occur more frequently among black people, particularly black Africans, than among people of European ancestry, including white Americans. Fraternal twins are least common among Asians. Scientists do not know why such variations exist.

How multiple births occur. In pregnancies that produce a single infant, one of the mother's ovaries releases an egg that joins with a sperm from the father. The fertilized egg, called a zygote, develops into a baby.

In multiple births, the process of development is somewhat different. For example, in pregnancies involving fraternal twins, also called dizygotic twins, the mother's ovaries release two eggs at about the same time. Each egg is fertilized by a separate sperm, producing two zygotes, each with different genetic characteristics. As a result, fraternal twins may look no more alike than brothers or sisters who are not twins. Identical twins, also called monozygotic twins, originate from a single zygote. Early during the mother's pregnancy, the zygote's cell mass divides into two parts. The two parts develop into separate individuals who have the same genetic makeup. Scientists believe that conjoined twins, formerly called Siamese twins, develop from a zygote that fails to separate completely.

Multiple births involving three or more infants occur through processes that are similar to those involving the development of twins. For example, if the mother's ovaries release three, four, or five eggs and each of the eggs becomes fertilized, fraternal triplets, quadruplets, or quintuplets will be born. A zygote that divides into more than two parts will result in the birth of identical triplets, quadruplets, or quintuplets. If two eggs are fertilized and one of the eggs splits in two, the mother will give birth to triplets consisting of identical twins and one nonidentical baby.

Fertility drugs may raise the chances of a multiple birth. In women, these drugs stimulate production of eggs, and several eggs may be released at the same time. Fertility drugs may be used alone or as preparation for a procedure called in vitro fertilization. In this procedure, several mature eggs are removed from a woman's ovaries and combined with sperm in a laboratory dish. The doctor then places several successfully fertilized eggs directly into the woman's uterus or fallopian tubes.

Inserting several eggs increases the likelihood of a successful pregnancy, but also increases the chance of a multiple birth.

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ARABIC LANGUAGE

Arabic language is one of the world's most widely used languages. It is the official language of many Arab nations in the Middle East and northern Africa, including Egypt, Iraq, Jordan, Lebanon, Saudi Arabia, and Syria.

There are two types of Arabic, spoken and written. Spoken Arabic consists of dialects in different

areas of the Arabic-speaking world. These dialects can be roughly divided into Gulf, Iraqi, Levantine, Maghrebi, North Egyptian, Saudi, South Egyptian and Sudanese, and Tunisian. These dialect areas can be subdivided further. Written Arabic serves as the standard written language of all Arab nations. It is the descendant of the language of the Quran, the sacred book of the Islamic religion. Arabs use a spoken form of written Arabic for radio and TV news broadcasts, and in plays and motion pictures. This form also serves as a common spoken language for Arabs who speak different dialects.

Arabic belongs to the Semitic language groups, and is thus related to Hebrew and Ethiopic. The Arabic alphabet has 28 symbols. The alphabet is written from right to left or from the top of the page to the bottom. The alphabet appears in the ALPHABET article. Many English words come from Arabic. They include alcohol, algebra, check, checkmate, lute, magazine, and tariff.

No one knows when Arabic originally developed, but people of the Arabian Peninsula were the first to use it. During the A.D. 600's, Islam spread throughout southwestern Asia and northern Africa, and the Arabic language was introduced in these areas.

Since the mid-1900's, many Arab countries have played an increasingly important role in world affairs. As a result, Arabic has become a major language in international business and politics.

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MUSEUM

Museum is a place where a collection of objects illustrating science, art, history, or other subjects is kept and displayed. At various museums, visitors can learn how people lived and worked in early times, what makes a work of art a masterpiece, or how electricity works. Some people also consider the term museum to apply to such educational institutions as planetariums, botanical gardens, zoos, nature centers, and even libraries.

A museum collects, cares for, and researches the objects it displays. It also keeps a study collection of undisputed objects. These objects--sometimes called artifacts--are often studied by students and researchers.

Kinds of museums

There are three main kinds of museums: (1) art museums, (2) history museums, and (3) science museums.

Art museums preserve and exhibit paintings, sculpture, and other works of art. The collections of some art museums include work from many periods. Famous museums of this type include the Louvre in Paris and the Metropolitan Museum of Art in New York City.

Some museums specialize in artworks of one period. For example, the Museum of Modern Art in New York City displays works created since the late 1800's. Other museums exhibit only one type of art.

The Museum of International Folk Art in Santa Fe, N. Mex., for example, specializes in folk art from around the world.

Many art museums also have special exhibits. They borrow works of art from individuals or other museums for such exhibits, which usually last several weeks.

History museums illustrate the life and events of the past. Their collections include documents, furniture, tools, and other materials. Many cities and states have historical societies that operate history museums. Most of these museums have exhibits on local history.

Other types of history museums include living history museums. Museums of this type include living history farms, historic houses, and historic villages. These museums show how people lived or worked during a certain period. On living history farms, workers demonstrate how crops were planted and harvested in earlier times. Historic houses, such as Mount Vernon, George Washington's home near Alexandria, Va., have been restored to their original condition and are open to the public. Williamsburg, a historic village in Virginia, has restored and reconstructed buildings that date from the 1700's. In this village, costumed interpreters demonstrate how early colonists performed such tasks as cooking, making shoes, and printing newspapers.

Science museums have exhibits on the natural sciences and technology. Museums of natural history exhibit displays of animals, fossils, plants, rocks, and other objects and organisms found in nature. Most of them, including the National Museum of Natural History in Washington, D.C., have exhibits on ecology and the evolution of human beings. Many museums of natural history have special exhibits on dinosaurs and other topics.

The exhibits in science-technology museums explain the operations of various types of machines and industrial methods or trace the development of a particular field of technology. Visitors to the Museum of Science and Industry in Chicago can take a guided tour through a realistic reproduction of

a coal mine. The National Air and Space Museum in the Smithsonian Institution in Washington, D.C., has exhibits on the history of aviation and space travel.

Other types of museums feature exhibits on only one subject. The Circus World Museum in Baraboo, Wis., has the world's largest collection of circus wagons. The National Baseball Hall of Fame and

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Museum in Cooperstown, N.Y., shows highlights of baseball history and displays the uniforms of famous players. Other museums specialize in such subjects as automobiles, clocks, and dolls. Museums that display materials from several fields of study are called general museums. Children's or youth museums have exhibits designed to explain the arts and sciences to young people. A few museums display reproductions or copies of objects. For example, some historical museums have life-sized figures sculptured from wax or plastics. Most of these figures are realistic likenesses of important people in history. The figures are dressed in appropriate costumes and placed in lifelike settings.

Functions of museums

Museums perform three main functions. These institutions (1) acquire new materials, (2) exhibit and care for materials, and (3) provide various special services.

Acquisition of materials. Every new object that a museum adds to its collection is called an acquisition. Many acquisitions are gifts from people who collect such items as paintings, precious stones, or sculpture. Other gifts include items that have been kept in a family for many generations, such as a quilt or a journal of an ancestor.

Sometimes a museum buys an item needed to fill a gap in one of its collections. Museum employees may find new materials on archaeological expeditions or field trips. Museums also borrow materials or entire exhibits from other museums. Acquisitions are received by the museum registrar, a staff member who records the description of each object. Every acquisition is photographed and given a number. Museum officials determine the value of each object and insure it for that amount.

Exhibition and care of materials. Various members of the museum staff prepare the materials for exhibition. The museum curator may conduct research to learn more about objects. Museum conservators clean, preserve, or restore objects before they are exhibited.

The curator decides how materials are displayed. For example, a new object may be added to an existing exhibit or become part of a special exhibit. It may be hung on a wall or placed in a case. Designers plan and create displays. They build cases and furniture for the displays and set up lights and electric wiring. Preparators create display backgrounds and prepare materials for exhibit. Every exhibit receives a label that gives visitors some information about it. Descriptions of all objects appear in the museum's catalog as well.

Museums also protect their exhibits from loss or damage. The doors and windows of many museums have alarms in addition to locks. Exhibit cases are locked, and some may be connected to alarms.

Guards patrol museums. Museums may use special light bulbs and devices that control humidity and temperature to protect objects from environmental damage.

Special services. Many museums have an education department that gives lectures and classes on the museum's collection. Most museums offer gallery talks, guided tours, and other programs for children and adults. Other activities provided by museums include art festivals, concerts, and hobby workshops. Many museums publish bulletins and pamphlets that describe current and future exhibits. Museums also furnish scholars with research materials and the use of special laboratories and libraries. Evaluation specialists determine how well the museum meets the educational needs of the public. Some museums serve as places where local artists can exhibit their work.

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FASHION

Fashion, in its broadest sense, is a particular style that is popular for a few months or years. We speak of fashions in automobiles, furniture, or interior design, as well as in music, literature, and art. But most commonly, fashion refers to a style of clothing that is worn at a given time but is expected to change. For example, women's fashions changed frequently during the 1800's. At various times, women wore high-waisted dresses, enormous puff-sleeves, big hoop skirts, and bustles (cushions that padded the seat of a skirt). Often, fashions in several areas are linked, giving rise to a period style. The music, dance, and clothing of the 1960's is an example of a period style.

Although fashion usually refers to dress, it does not mean the same thing as clothing. People have worn clothing since at least 20,000 B.C., but people have only been concerned with fashion since the late Middle Ages (A.D. 1300-1500). Before then, people wore clothes that reflected the long-standing

customs of their communities, and clothing styles changed extremely slowly. Fashion, however, causes styles to change rapidly for a variety of historical, psychological, and sociological reasons. A clothing style may be introduced as a fashion, but the style becomes a custom if it is handed down from generation to generation. A fashion that quickly comes and goes is called a fad.

The origins of fashion. True fashions began to appear in northern Europe and Italy when a system of social classes developed in the late Middle Ages. At this time, the people of Europe began to classify one another into groups based on such factors as wealth, ancestry, and occupation. The clothes people wore helped identify them as members of a particular social class. Before the late Middle Ages, only wealthy and powerful individuals concerned themselves with the style of their clothes. But when the class system developed, the general population began to compete for positions within society. Fashion was one means by which people competed with one another.

One of the first true fashions appeared among young Italian men during the Renaissance (1300-1600). While their elders dressed in long traditional robes, young Italian males began wearing tights and short, close-fitting jackets called doublets. German soldiers set another early fashion when they slashed their luxurious silk clothes with knives to reveal another colorful garment underneath. Before the 1800's, many countries controlled fashion with regulations called sumptuary laws.

Sumptuary laws controlled the amount of money people could spend on private luxuries. Many such laws were designed to preserve divisions among the classes and regulated fashion according to a person's rank in society. In some countries, only the ruling class could legally wear silk, fur, and the colors red and purple. In Paris in the 1300's, middle-class women were forbidden by law to wear high headdresses, wide sleeves, and fur trimmings.

Other sumptuary laws forced people to buy products manufactured in their own country to help the country's economy. For example, an English law in the 1700's prohibited people of all classes from wearing cotton cloth produced outside of England. But the lure of fashion caused many people to break this law. The cloth was so popular that people risked arrest to wear it.

Why people follow fashion. People follow fashion for many reasons. Often, people imitate the style of a person or group with whom they identify. In the past, most fashions originated in the upper classes and trickled down to the lower ones. Ordinary people sometimes hoped to raise their social position by following the fashions of privileged people. In a way, this still happens. But today, such celebrities as singers and athletes, rather than aristocrats, set fashions.

Fashion involves more than simply imitating another person's style. It is a form of nonverbal communication that provides a way for people to express their identities and values. For example, in the 1960's, many young people rejected adult values by rejecting mature styles of clothing. Large numbers of young people adopted an international youth style that included miniskirts and mod jackets. These fashions probably appealed to young people because, at first, many adults disapproved of them. Eventually, adults began copying them.

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Another reason people follow fashion is to make themselves more attractive. When the standard of beauty changes, fashion changes with it. For example, when physical fitness became a popular standard of good looks in the 1980's, people began to wear exercise and athletic clothing more often.

Why fashions change. Fashions considered appropriate for men and women have changed as standards of masculinity and femininity have changed. Until the late 1700's, upper-class European men dressed as elaborately as women. It was acceptable for men to wear bright-colored or pastel suits trimmed with gold and lace, hats decorated with feathers, high-heeled shoes, and fancy jewelry. But by the mid-1800's, men had abandoned color and decoration in favor of plain, dark-colored wool suits. People considered this new fashion democratic, businesslike, and masculine. Until the early 1900's, European and American women rarely wore trousers, and their skirts almost always covered their ankles. By the 1920's, however, standards of feminine modesty had changed to the point that women began to wear both trousers and shorter skirts.

A clothing style may become fashionable over time with many different groups. For example, people began wearing blue jeans during the mid-1800's as ordinary work clothes. For decades, they were worn chiefly by outdoor laborers, such as farmers and cowboys. In the 1940's and 1950's, American teen-agers adopted blue jeans as a comfortable, casual youth fashion. Young people during the 1960's wore blue jeans as a symbol of rebellious political and social beliefs. By the 1970's, people no longer considered jeans rebellious, and expensive designer jeans had become fashionable.

Contrary to popular belief, political events seldom cause fashions to change. However, political events do sometimes speed up changes that have already begun. For example, during the French

Revolution (1789-1799), simple clothing replaced the extravagant costumes made fashionable by French aristocrats. But simple styles had become popular years earlier when men in England started wearing practical, dark suits instead of elegant, colorful clothes. English people identified these plain suits with political and personal liberty. Because many French people admired English liberty, this style was already becoming fashionable in France before the revolution.

Occasionally, foreign wars or voyages of exploration have introduced people to new styles of clothing. For example, European soldiers brought back rich silks and other fabrics from the Crusades, military expeditions to the Middle East during the 1100's and 1200's.

The Industrial Revolution that occurred during the 1700's and 1800's caused rapid changes in the development of fashion. The invention of mechanical looms, chemical dyes, artificial fabrics, and methods of mass production made fashions affordable to many more people. In addition, new means of mass communication spread European and American fashions throughout the rest of the world. The Industrial Revolution caused people throughout the world to dress more and more alike. The fashion industry. Since the 1800's, the fashion industry has operated on two levels: couture and ready-to-wear. Couture refers to expensive, one-of-a-kind clothes created for rich customers by high-fashion designers called couturiers. Before couturiers design new fashions, they try to guess which styles will be popular in the future. Couture designs that prove successful are later copied by manufacturers of ready-to-wear. Ready-to-wear clothing is produced in large quantities and sold for lower prices.

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DANCE

Dance is the movement of the human body in a rhythmic way. Dance serves many functions in human society. It is an art form, a social activity, a type of communication, and a form of recreation. People can dance by themselves, in couples, or in large groups. The dance can be spontaneous or performed in established movements. It can tell a story, explore an emotion, or serve as a form of self-expression. Many people dance as a career, but anyone can dance simply by moving in rhythm. Dance is among the oldest human art forms. Dancing extends beyond the human species itself. For example, many animals perform complex dances during courtship.

Dance differs from other kinds of rhythmic movement, such as dribbling a basketball, because in dance the movement itself is the goal of the activity. Music usually accompanies dance, providing the rhythm, tempo, and mood for the movements.

In modern societies, many people enjoy dancing simply for entertainment. Each generation creates new dances as an expression of its own sense of life and fun. For example, rock dancing arose about 1960 with the popularity of rock music. This type of dance was created primarily by and for young people. Rock dances such as the twist did not require partners to touch each other while they danced. The dancing was free-spirited and individual, allowing each dancer to create his or her own steps spontaneously. Rock dancing stressed pure emotion underscored by the strong beat of the music.

Why people dance

Religious reasons. For thousands of years, human beings have danced for religious reasons. Many religions involve some form of dance. Many religious dances are forms of prayer. Believers dance as they pray for rain, for the fertility of crops, and for success in war or in hunting. Such dances often imitate or pantomime some movement. For example, dancers may imitate the movement of the animal to be hunted, or a hunter's actions in stalking it. They may wear elaborate costumes and masks or makeup to depict deities or animals.

Religious dance also may attempt to create a state of ecstasy (intense joy) or trance in the worshiper. Dance may also be used as one part of a religious occasion or ritual. One example is the dancing of Jews at the festival of Simhat Torah. Another example is the dancing and whirling of members of a Muslim religious order called dervishes. Dancing was a formal element in Christian worship until the A.D. 1100's, when religious leaders began to prohibit it because they believed it was too worldly an activity. However, spontaneous dance has become a common element of worship among some Protestant denominations.

Social reasons. Dancing plays an important role in social functions. All societies have characteristic forms of dance. Such dancing may take place at ceremonial occasions or at informal gatherings. Like traditional foods and costumes, dance helps members of a nation or ethnic group recognize their connection to one another and to their ancestors. By dancing together, members of a group express their sense of common identity or belonging.

Dance can strengthen social connections. By dancing together, people share an intimate physical experience that is cooperative and harmonious. Social dances tend to form patterns, such as circles and chains, and to involve the mingling of couples. Examples include square dancing and line dancing. These patterns tend to reinforce a sense of unity. Because dancing involves physical contact, it also serves as a symbol of social bonds, such as when the bride and groom dance the first dance at a wedding reception.

Dance is especially important during courtship, which is one reason it is so popular among young people. Like some animals, people dance as a way of attracting a possible mate by displaying their beauty, grace, and vitality.

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Recreational reasons. Many people dance for fun. Dancing allows individuals to feel their body moving freely, to release energy, and to express exuberance and joy. Dancing is also good exercise. It allows people to test the limits of what their bodies can do, as they fling their arms out, kick up their legs, and stretch and twist their bodies.

Artistic reasons. In nearly all societies, dance is an important art form. Its unique powers of selfexpression and representation come from the fact that dance uses the body directly, without words, images, or sounds. Dance refines and enlarges the natural human tendency to express feelings physically. The skip of joy becomes a ballerina's leap. A stomp of rage can develop into complex patterns of stamping and clapping, as in the flamenco dance of Spain.

When a dance is performed before an audience, it can serve as a form of drama, all the more powerful because it is silent. Spoken theater can better represent complex social situations, but dance can more directly convey deep emotions and spiritual states.

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RAP

Rap music is a form of popular music that is generally spoken or chanted at a fast pace rather than sung. Rap is performed over musical accompaniment that emphasizes rhythm rather than melody. Often this accompaniment consists of short segments of earlier recorded music combined in new patterns.

Rap music first developed in the mid 1970's in New York City, and soon in other urban areas, primarily among African American teen-agers. The style soon spread throughout the United States and much of the world. Some critics believe rap replaced rock music as the creative force in music of the 1980's and 1990's. But the lyrics of some rap songs have caused controversy. Critics have charged that such lyrics promote racism and violence and show contempt for women.

The biggest inspiration for rap came from disc jockeys in Jamaica who would talk, or toast, over recorded music they played in clubs. The style, known as dub, produced popular records that featured disc jockeys talking over instrumental backing and electronic effects. A Jamaican-born disc jockey known as DJ Kool Herc is often credited with introducing rap into New York City. He and other disc jockeys used records playing on two turntables, switching rapidly from one to the other to mix and match beats between two songs.

The first rap hit was "Rapper's Delight" (1979) by the Sugar Hill Gang. "The Breaks" (1980) by Kurtis Blow helped to spread rap's popularity among a wider audience. Much early rap was primarily concerned with a dance and party spirit. However, "The Message" (1982) by Grandmaster Flash and the Furious Five took a harder look at social issues in its portrayal of black inner-city life. Acts such as Public Enemy and Ice Cube have popularized styles of rap that are even more militant and radical. A style known as gangster rap or gangsta rap has emphasized gunplay and other outlaw aspects of urban life. Popular rappers have included Hammer, Dr. Dre, Ice-T, Run-DMC, the Beastie Boys, and Arrested Development.

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BATMAN

Batman is a famous comic book hero who dedicates himself to fighting crime in a costume that features a black bat mask and a flowing cape. The character first appeared in 1939 in a Detective Comics comic book. Bob Kane was the artist, and Bill Finger wrote the stories. In 1940, a teen-aged assistant called Robin joined Batman to form a crime-fighting team. In 1961, a young female assistant called Batgirl joined Batman and Robin.

Batman was really Bruce Wayne, a wealthy playboy. As a boy, he witnessed his parents' murder by a criminal. That memory drove him to become a crime fighter as an adult. Robin was really Dick Grayson, also an orphan whose parents were murdered. Bruce Wayne became Dick's guardian. As

Robin, Dick wore a colorful red and green costume with a yellow cape.

Batman and Robin fought a gallery of colorful villains, including the Penguin, the Joker, Two-Face, and Catwoman. The team were skilled acrobats and employed an arsenal of weapons and gadgets in their crime fighting. Their equipment included the Batmobile and the Batplane, which were stored in the Batcave, and Batman's all-purpose utility belt.

The popularity of Batman led to motion-picture serials in the 1940's. Batman also starred in a primetime television series from 1966 to 1968. Adam West played Batman, and Burt Ward was Robin.

Celebrities made guest appearances as Batman's adversaries, notably Frank Gorshin as the Riddler, Cesar Romero as the Joker, Julie Newmar as Catwoman, and Burgess Meredith as the Penguin. The series had humorous scripts that often poked fun at the superhero and his opponents.

In the late 1980's and the 1990's, the Warner Brothers studio made a series of full-length Batman motion pictures. Unlike the light-hearted TV series of the 1960's, the Batman movies featured a film noir style, marked by a brooding atmosphere and many nighttime scenes. The films were *Batman* (1989) and *Batman Returns* (1992), both directed by Tim Burton and starring Michael Keaton, and *Batman Forever* (1995) and *Batman & Robin* (1997), directed by Joel Schumacher and starring Val Kilmer and George Clooney, respectively. Both the television program and the motion pictures stimulated a flood of Batman merchandise, especially models of the Batmobile.

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JACK LONDON

London, Jack (1876-1916), was an American author, journalist, and political activist. He became the most widely read American author. Much of London's fiction can be read as juvenile adventure stories. But his best work also dealt with complex adult themes.

John Griffith London was born in San Francisco. His childhood was marked by emotional and economic deprivation. Between the ages of 16 and 19, he held many jobs connected with the sea. In 1897, London traveled to Canada to seek his fortune in the gold rush in the Yukon Territory. The trip to the Klondike region of the Yukon was a major turning point in London's life. He found materials there that would allow him to express his major literary theme, the struggle for survival of strong men driven by primitive emotions. London's first Klondike stories, collected in *The Son of the Wolf* (1900), made him a best-selling author.

London was fascinated with environmental determinism, which states that the world shapes us in ways we are powerless to resist. This is the theme of London's two great animal novels. *The Call of the Wild* (1903) describes the adventures of Buck, a dog taken from California to the Yukon. Buck learns to be brutal in order to survive. *White Fang* (1906) reverses the story. It portrays a wolf who, through the power of a human master's love and kindness, turns from a savage beast into a loyal domestic animal. Among London's other major novels are two that portray strong, brutal men who scorn conventional social attitudes--*The Sea Wolf* (1904) and the autobiographical *Martin Eden* (1909). In these and many other novels and essays, London attacked capitalism. His understanding and sympathy for the poor are strong elements in such works as *The People of the Abyss* (1903), a journalistic report on the poor and homeless living in London, England.

London's life and work were filled with contradictions. He upheld a socialist ideal of collectivism, but he also held a cruelly individualistic notion of the survival of the fittest. He praised democracy, but he saw his own success as illustrating the rightness of the concept of the superman who stands above ordinary humanity and prevails by force of will. This philosophy had been developed by the German philosopher Friedrich Nietzsche. London advocated brotherhood, but he believed that people of the "Anglo-Saxon" or "Teutonic" races were superior to "colored" people.

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RIP VAN WINKLE

Rip Van Winkle is the title character of one of the most famous short stories in American literature. The author, Washington Irving, published "Rip Van Winkle" in his collection *The Sketch Book of Geoffrey Crayon, Gent.* (1819-1820). Irving based the story on a German folk tale, "Peter Klaus," setting it in the Catskill Mountains of New York. Irving's picturesque descriptions of the Hudson River Valley scenery help create the story's dreamy mood.

Rip, a cheerful but lazy man, is married to a nagging wife in American colonial times. One day he takes his dog and gun into the mountains to hunt. He meets an odd little man in old-fashioned Dutch clothing who gets Rip to help him carry a keg of liquor up the mountain. Other little men are there playing a game of ninepins. Rip samples the liquor and falls asleep.

Rip awakens 20 years later and returns to his village. There he finds that his wife has died, his

children have grown, and the American Colonies have become an independent nation. At first, everyone laughs at Rip's story. But his story seems confirmed when the oldest villager assures everyone that the ghosts of the English explorer Henry Hudson and his crew keep a watch on the Catskills. Rip becomes a popular storyteller.

The tale is an outstanding piece of comic literature. It also deals with such themes as change, aging, independence, and the importance of the imagination.

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PYRAMIDS

Pyramids are large structures with square bases and four smooth, triangular-shaped sides that come to a point at the top. Several ancient peoples used pyramids as tombs or temples. The most famous pyramids are those built about 4,500 years ago as tombs for Egyptian kings. These Egyptian pyramids are among the Seven Wonders of the Ancient World.

Egyptian pyramids

The ruins of 35 major pyramids still stand near the Nile River in Egypt. Each was built to protect the body of an Egyptian king. The Egyptians thought that a person's body had to be preserved and protected so the soul could live forever. The Egyptians mummified (embalmed and dried) their dead and hid the mummies in large tombs. From about 2700 to 1700 B.C., the bodies of Egyptian kings were buried inside or beneath a pyramid in a secret chamber that was filled with treasures of gold and precious objects.

Many scholars believe that the pyramid shape has a religious meaning to the Egyptians. The sloping sides may have reminded the Egyptians of the slanting rays of the sun, by which the soul of the king could climb to the sky and join the gods.

Funeral ceremonies were performed in temples that were attached to the pyramids. Most pyramids had two temples that were connected by a long stone passageway. Sometimes a smaller pyramid for the body of the queen stood next to the king's pyramid. Egypt has at least 40 smaller pyramids that were used for queens or as memorial monuments for kings. The king's relatives and officials were buried in smaller rectangular tombs called mastabas. These buildings had sloping sides and flat roofs. The first pyramids. Imhotep, a great architect and statesman, built the first known pyramid for King Zoser about 2650 B.C. Zoser's tomb rose in a series of giant steps, or terraces, and is called the Step Pyramid. This pyramid still stands at the site of the ancient city of Memphis, at Saqqarah, near Cairo. The first smooth-sided pyramid was built about 2600 B.C. It still stands at Medum. It began as a stepped pyramid, and then the steps were filled in with casing stones to give the building smooth, sloping sides. Other pyramids built during a period of Egyptian history called the Old Kingdom (2686-2181 B.C.) can be seen at Abusir and Dahshur. During the Middle Kingdom (c. 2052-1786 B.C.), pyramids were built at Hawara, Illahun, Lisht, and Dahshur--near what is now Cairo. The remains of these pyramids are still impressive.

The Pyramids of Giza (Al Jizah) stand on the west bank of the Nile River outside Cairo. There are 10 pyramids at Giza, including three of the largest and best preserved of all Egyptian pyramids. They were built for kings about 2600 to 2500 B.C. The largest was built for King Khufu (called Cheops by the Greeks). The second was built for King Khafre (Chephren), and the third for King Menkaure (Mycerinus). A huge statue of a sphinx, called the Great Sphinx, was probably built for Khafre. It stands near his pyramid.

The pyramid of Khufu, called the Great Pyramid, contains more than 2 million stone blocks that average 2 1/2 tons (2.3 metric tons) each. It was originally 481 feet (147 meters) tall, but some of its upper stones are gone now and it stands about 450 feet (140 meters) high. Its base covers about 13 acres (5 hectares).

A study of the Great Pyramid shows how these gigantic structures were built. The ancient Egyptians had no machinery or iron tools. They cut big limestone blocks with copper chisels and saws. Most of the stones came from quarries nearby. But some came from across the Nile River, and others came by boat from distant quarries. Gangs of men dragged the blocks to the pyramid site and pushed the first layer of stones into place. Then they built long ramps of earth and brick, and dragged the stones up the ramps to form the next layer. As they finished each layer, they raised and lengthened the ramps. Finally, they covered the pyramid with an outer coating of white casing stones. They laid

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these outer stones so exactly that from a distance the pyramid appeared to have been cut out of a single white stone. Most of the casing stones are gone now, but a few are still in place at the bottom

of the Great Pyramid.

The burial chamber is inside the Great Pyramid. A corridor leads from an entrance on the north side to several rooms within the pyramid. One of the rooms is called the Queen's Chamber, although the queen is not buried there. The room was planned as the king's burial chamber. But Khufu changed the plan and built another burial chamber, called the King's Chamber. The Grand Gallery, a corridor 153 feet (47 meters) long and 28 feet (8.5 meters) high, leads to Khufu's chamber. It is considered a marvel of ancient architecture.

No one knows how long it took to build the Great Pyramid. The ancient Greek historian Herodotus said that the work went on in four-month shifts, with 100,000 workers in each shift. Scholars now doubt that account and believe that about 100,000 men worked on the pyramids for three or four months each year. Farm laborers built the pyramids. They worked on the tombs during periods when floodwaters of the Nile covered the fields and made farming impossible.

Thieves broke into most of the pyramids, stole the gold, and sometimes destroyed the bodies. Later Egyptian kings stopped using pyramids, and built secret tombs in cliffs. But some kings of the Kushite kingdom in Nubia, south of Egypt, built pyramids long after they were no longer used in Egypt.

American pyramids

Indians of Central and South America also built pyramids. They built stepped pyramids that had flat tops. They used the flat tops as platforms for their temples.

The Moche Indians of Peru built large brick pyramids. The Temple of the Sun, near what is now Trujillo, on Peru's northern coast, has a terraced brick pyramid on top of a stepped platform. The ancient Maya of Central America built pyramid-shaped mounds of earth with temples on top.

Indians of central Mexico also built big stepped pyramids. For example, Indians constructed the great pyramids of the Sun and Moon that still stand at Teotihuacan, near Mexico City. The Toltec Indians built a stepped pyramid at Cholula that is one of the largest structures in the world. The Spanish conquerors destroyed most pyramids of the later Aztec Empire in Mexico. These pyramids were built in steps or terraces like the other American pyramids and had temples on top. Two of the greatest were at Tenochtitlan (now Mexico City). Mound building Indians of North America built some pyramid-shaped mounds, but they were not true pyramids.

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BOSPHORUS

Bosporus is a strait located in northwestern Turkey that connects the Black Sea and the Sea of Marmara. It is part of a waterway that flows from the Black Sea to the Mediterranean Sea. The Bosporus is 19 miles (31 kilometers) long. Istanbul lies along the strait.

The Bosporus has great commercial importance. The strait is an important outlet for ships of nations that border the Black Sea. Turkey owns the land on both sides of the Bosporus. At the Straits Convention in 1841, it was agreed that no war vessels could pass through the Bosporus and Dardanelles straits without Turkey's consent. In 1923, the Treaty of Lausanne opened the straits to ships of all countries. In the Montreux Convention of 1936, Turkey regained control of the waterway. The Bosporus gets its name from Greek words meaning ox ford, probably because it was so narrow in some places that cattle could cross. According to a Greek myth, the beautiful maiden Io swam the Bosporus in the form of a white cow. Darius I, a Persian king, built a famous bridge of boats across the Bosporus on his expedition into Thrace about 513 B.C.

A bridge across the Bosporus--the first since the bridge of boats built by Darius I--was completed in 1973. Called the Bosporus Bridge, it links the Asiatic and European sections of Istanbul. A second bridge, called the Fatih Sultan Mehmet Bridge, was completed in 1988 and also connects the two parts of Istanbul.

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LEONARDO DA VINCI

Leonardo da Vinci, (1452-1519), was one of the greatest painters and most versatile geniuses in history. He was one of the key figures of the Renaissance, a great cultural movement that had begun in Italy in the 1300's. His portrait Mona Lisa and his religious scene The Last Supper rank among the most famous pictures ever painted.

Leonardo, as he is almost always called, was trained to be a painter. But his interests and achievements spread into an astonishing variety of fields that are now considered scientific specialties. Leonardo studied anatomy, astronomy, botany, geology, geometry, and optics, and he designed machines and drew plans for hundreds of inventions.

Because Leonardo excelled in such an amazing number of areas of human knowledge, he is often called a universal genius. However, he had little interest in literature, history, or religion. He formulated a few scientific laws, but he never developed his ideas systematically. Leonardo was most of all an excellent observer. He concerned himself with what the eye could see, rather than with purely abstract concepts.

Leonardo's life

Early career. Leonardo was probably born outside the village of Vinci, near Florence in central Italy. The name da Vinci simply means from Vinci. At that time, Florence and its surrounding villages and farms made up a nearly independent area called a city-state. Florence was also a commercial and cultural center. Leonardo was the illegitimate son of Ser Piero da Vinci, a legal specialist, and a peasant woman named Caterina. Ser Piero's family raised the boy in Vinci.

During the late 1460's, Leonardo became an apprentice to Andrea del Verrocchio, a leading painter and sculptor in Florence. He remained with Verrocchio as an assistant for several years after completing his apprenticeship. Verrocchio and Leonardo collaborated on the painting *The Baptism of Christ* about 1472.

From about 1478 to 1482, Leonardo had his own studio in Florence. During this period, he received an important commission to paint a church altarpiece now known as the *Adoration of the Kings*.

Years in Milan. Leonardo never finished the *Adoration of the Kings* because he left Florence about 1482 to become court artist for Ludovico Sforza, the Duke of Milan. Leonardo lived in Milan until 1499. He had a variety of duties in the duke's court. As a military engineer, he designed artillery and fortresses. As a civil engineer, he devised a system of locks for Milan's canals and designed revolving stages for pageants. As a sculptor, he planned a huge monument of the duke's father mounted on a horse.

About 1483, Leonardo painted the *Madonna of the Rocks*. This painting is his earliest major work that survives in complete form. During his years in Milan, he also created his famous wallpainting *The Last Supper*.

Return to Florence. In 1499, the French overthrew Ludovico Sforza and forced him to flee Milan. Leonardo also left the city. He visited Mantua, where he made a famous drawing of Isabella d'Este, the wife of the Duke of Mantua. He also visited Venice briefly before returning to Florence.

Leonardo's paintings during his stay in Milan had made him famous, and the people of Florence received him with great respect. The early work Leonardo had done in Florence before he left for Milan had strongly influenced a number of young artists, including Sandro Botticelli and Piero di Cosimo. These artists had become the leaders of the next generation of Florentine painters. The work Leonardo was to create after his return to Florence would inspire yet another generation of artists. This generation included Andrea del Sarto, Michelangelo, and Raphael.

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When Leonardo returned, Florence was building a new hall for the city council. The Florentine government hired Leonardo and Michelangelo to decorate the walls of the hall with scenes of the city's military victories. Leonardo chose the *Battle of Anghiari*, in which Florence had defeated Milan in 1440. His painting showed a cavalry battle, with tense soldiers, leaping horses, and clouds of dust. In painting the *Battle of Anghiari*, Leonardo tried an experimental technique that did not work. The paint began to run, and he never finished the project. The painting no longer exists. Its general appearance is known from Leonardo's sketches and from copies made by other artists. About 1503, while working on the *Battle of Anghiari*, Leonardo painted the *Mona Lisa*, probably the most famous portrait ever painted.

Last years. In 1513, Pope Leo X gave Leonardo rooms for his use in the Vatican Palace. Leonardo did little painting during his later years. However, about 1515, he completed *The Deluge*, a series of drawings in which he portrayed the destruction of the world in a tremendous flood. These drawings are the climax of Leonardo's attempts to visualize the forces of life and nature.

Renaissance rulers competed to surround themselves with great artists and scholars. In 1516, Francis I, the king of France, invited Leonardo to become "first painter and engineer and architect of the king." He provided Leonardo a residence connected to the Palace of Cloux at Amboise, near Tours. Leonardo devoted his time to doing anatomical drawings, drafting architectural plans, and designing sets for court entertainments. He died on May 2, 1519.

Leonardo's works

Drawings and scientific studies. Leonardo used drawings both as a tool of scientific investigation and as an expression of artistic imagination. He changed forever the art of drawing. He made drawings

in much greater numbers than any artist before him, and he was one of the first artists to use sketches to work out his artistic and architectural compositions. Drawing was indispensable to Leonardo's processes of observation, creation, and invention.

Physical sciences. Leonardo was interested in mechanics (the science of motion and force), and many of his ideas and designs were far ahead of their time. For example, he drew plans for aircraft, including a helicopter, and for a parachute. Like many Renaissance artists, Leonardo sometimes worked as an engineer or military architect. He produced designs for a variety of war machines, among them tanks, machine guns, and movable bridges.

Life sciences. Leonardo studied anatomy by dissecting human corpses and the bodies of animals. He made scientific drawings that clarify not only the appearance of bones, tendons, and other body parts, but also their function. These drawings are considered the first accurate portrayals of human anatomy.

Leonardo tried to understand the human body as a mechanism. As his studies progressed, he also tried to understand the forces of life that animated the body. His drawings of anatomy, for example, extended to investigations of human reproduction and embryology and the circulation of the blood. None of these things were understood at the time. His anatomical drawing of a female, which he made about 1508, is his attempt, partly erroneous in detail, to illustrate the body's circulatory and other systems in a single image.

Like other artists, Leonardo was interested in the proportions of the human body. He drew a famous study of human proportions based on the statement of the Roman architect Vitruvius that the "wellshaped man" fits into the perfect shapes of the square and circle. According to Vitruvius, the parts of the body are related to one another in ratios of whole numbers, and these ratios should be used in the design of architecture. Leonardo's drawing of the Vitruvian man, done about 1487, is one of the most famous images in European art.

Leonardo also worked to understand the relation between the life of the human body and that of the larger world. For Leonardo, principles of proportion similar to those that shaped the human body

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also governed the growth of trees, the flight of birds, and the flow of water. When Leonardo drew the leaves of a plant, he intended the lines to show living energy responding to light, water, and soil. The mystery of life was the unifying theme of his work.

Leonardo's notebooks. Leonardo planned to write books on many subjects, including painting, human movement, and the flight of birds, but he never completed any of them. The writings exist in partial drafts and fragments in notebooks. Leonardo's notebooks also include his scientific observations and ideas for inventions, as well as detailed drawings. Most of the notebooks were not published until nearly 400 years after Leonardo's death. By the time his scientific and technical investigations became widely known, other people had come up with the same ideas.

Paintings. For much of his life, Leonardo was interested in optics, which is concerned with the properties of light. Leonardo carefully analyzed such things as the pattern of light and shadow on a sphere before a window. The understanding he gained from such study is evident in the rich effects of light, dark, and color in such paintings as the Mona Lisa and The Virgin and Child with Saint Anne (early 1500's).

Leonardo also explored the techniques of perspective, which painters use to create an illusion of depth on a flat surface. Florentine artists began to use these techniques in the early 1400's. Linear perspective is based on the optical illusion that parallel lines seem to converge as they recede toward one point, called a vanishing point. Aerial perspective is based on the fact that light, shade, and color change with an object's distance from the viewer.

Early paintings. Verrocchio and Leonardo shared the work of painting The Baptism of Christ, which is reproduced in the John the Baptist, Saint, article in the print version of The World Book Encyclopedia. Leonardo painted the left angel, the distant landscape, and possibly the skin of Christ. Leonardo's parts of the painting, with their soft shadings and shadows concealing the edges, are an early example of the sfumato (smoky) quality of his paintings. Verrocchio's figures, on the other hand, are defined by hard lines typical of early Renaissance painting. Leonardo's more graceful approach marked the beginning of the High Renaissance style, which did not become popular in Italy until about 25 years later.

Leonardo's Adoration of the Kings exists today in an unfinished form, with the figures visible only as outlines of contrasting light and dark areas. This kind of composition is called chiaroscuro, a word which combines the Italian words for light and dark. Chiaroscuro is characteristic of the High

Renaissance style.

The Adoration of the Kings shows three kings worshiping the newborn Christ child. Leonardo abandoned the traditional treatment of this popular subject. Earlier versions showed the figures in profile, with the Virgin Mary and Jesus on one side of the painting and the kings on the other. To give the Holy Family more emphasis, Leonardo placed them in the center, facing the viewer. The kings and other figures form a semicircle around Mary and Jesus. Leonardo sharply contrasted foreground and background. Strong light-dark contrasts and simple geometric forms were basic features of Leonardo's mature style as a painter.

In the Adoration of the Kings, Mary and the Christ child are arranged in a pyramid shape. Leonardo also used this arrangement in other paintings, including the Madonna of the Rocks and The Virgin and Child with Saint Anne. In The Virgin and Child with Saint Anne, the gazes of all the figures are concentrated on one side of the pyramid, giving it a new psychological and dramatic unity.

The Last Supper. Leonardo finished painting The Last Supper about 1497. He created the famous scene on a wall of the dining hall in the monastery of Santa Maria delle Grazie. The painting shows the final meal of Jesus Christ and His 12 apostles. Jesus has just announced that one of them will betray him.

When painting The Last Supper, Leonardo rejected the fresco technique normally used for wallpaintings. The technique requires an artist to mix dry pigments with water and brush them onto
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damp, freshly laid plaster. An artist who uses the fresco method must work quickly. But Leonardo wanted to paint slowly, to revise his work, and to use shadows--all of which would have been impossible in fresco painting. He developed a new technique that involved coating the wall with a compound he had created. But the compound, which was supposed to hold the paint in place and protect it from moisture, did not work. Soon after Leonardo completed the picture, the paint began to flake away. The Last Supper still exists, but in poor condition, though many attempts have been made to restore it.

Leonardo also changed the traditional arrangement of the figures. Christ and His apostles are usually shown in a line, with Judas, the betrayer, set apart in some way. Leonardo painted the apostles in several small groups. Each apostle responds in a different way to Christ's announcement that one of them will betray Him. Jesus sits in the center of the scene, apart from the other figures. Leonardo's composition creates a more active and centralized design than earlier artists had achieved. The composition, in which the space recedes to a point behind the head of Christ, is one of the great examples of one-point perspective in Italian Renaissance painting. Leonardo used linear perspective to focus attention on the painting's religious and dramatic center, the face of Jesus Christ.

Mona Lisa, shown in this article, is probably a portrait of the young wife of a rich Florentine silk merchant, Francesco del Giocondo. Mona Lisa is a shortened form of Madonna Lisa (my lady, Lisa). The woman is also often called La Gioconda, which is the feminine form of her husband's last name. The portrait shows a young woman seated on a balcony high above a landscape. Leonardo used a pyramid design to place the woman simply and calmly in the space of the painting. Her folded hands form the front corner of the pyramid. Her breast, neck, and face glow in the same light that softly models her hands. The light gives the variety of living surfaces to an underlying geometry of spheres and circles, which includes the arc of her famous smile. Behind the figure, a vast landscape recedes to icy mountains. Winding paths and a distant bridge give only the slightest indications of human presence. The landscape reflects Leonardo's studies of geology. He was one of the first people to grasp that geological time is revealed in rock layers and to understand such processes as erosion.

Leonardo's importance

Leonardo had one of the greatest scientific minds of the Italian Renaissance. He wanted to know the workings of what he saw in nature. Many of his inventions and scientific ideas were centuries ahead of his time. For example, he was the first person to study the flight of birds scientifically. Leonardo's importance to art was even greater than his importance to science. He had a strong influence on many leading artists, including Raphael and Michelangelo. Leonardo's balanced compositions and idealized figures became standard features of later Renaissance art. Painters also tried to imitate Leonardo's knowledge of perspective and anatomy, and his accurate observations of nature.

What most impresses people today is the wide range of Leonardo's talent and achievements. He turned his attention to many subjects and mastered nearly all. His inventiveness, versatility, and wide-ranging intellectual curiosity have made Leonardo a symbol of the Renaissance spirit.

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DIVING

Diving, Underwater, is the way people reach the strange and beautiful world beneath the surface of oceans, lakes, and rivers. Ancient peoples dived underwater in search of fish, other water animals, and plants for food. With improved skills and equipment, many activities began to be performed underwater.

Today, divers repair ships, recover valuable objects, build and repair various types of structures, and conduct research. Work can be performed at great depths in specially equipped diving vehicles. In the armed services, divers and submarines carry out military missions. Many people enjoy underwater diving as a sport. They dive to study underwater life, to take photographs, to hunt water animals, or simply to explore.

Kinds of underwater diving

There are two basic kinds of diving: (1) ambient diving, in which the diver's body is exposed to the pressure of the ambient (surrounding) water; and (2) diving in vehicles that protect divers from the water pressure.

Ambient diving. Water pressure on the body increases with water depth. At great depths, this pressure can have dangerous effects on an ambient diver. The three types of ambient diving are (1) breath-hold diving, (2) scuba diving, and (3) surface-supplied diving.

Breath-hold diving is the oldest and simplest form of underwater diving. It is also called free diving, skin diving, and snorkel diving. Breath-hold divers may use no equipment at all, but most of them use a face mask, foot fins, and a short breathing tube called a snorkel. The snorkel allows the diver to swim at the surface and observe underwater before diving.

Most breath-hold divers can go only 30 to 40 feet (9 to 12 meters) deep. They must surface to breathe after less than a minute. Some skilled divers can go as deep as 100 feet (30 meters) and stay submerged for as long as two minutes.

Scuba diving gives divers greater mobility and range than breath-hold or surface-supplied diving. The word scuba stands for self-contained underwater breathing apparatus. A scuba diver wears metal tanks that hold compressed air or a special mixture of breathing gases. The diver breathes from the tanks through a hose. A device called a demand regulator supplies the amount of air required. Scuba divers also use a mask and fins.

The most common type of scuba equipment, called open circuit scuba, uses air. The diver breathes air from the tank, and the exhaled air is released into the water. Closed circuit equipment, also called a rebreather, uses oxygen or a mixture of oxygen and other gases. It filters out the carbon dioxide and other harmful gases from the exhaled gas. More oxygen is added automatically. This action enables the diver to breathe the same air again and again.

Surface-supplied diving involves wearing a waterproof suit and a helmet. A diver gets air or breathing gas through a hose connected to air pumps on a boat. Most deep diving is surface supplied. Divers wear many kinds of helmets and suits. Some wear heavy helmets and canvas suits. Lightweight fiberglass helmets and special diving masks are replacing older helmets made of copper. In addition to hoses that supply breathing gas, other hoses and wires may supply hot water to warm the diving suit, electricity or high-pressure air to operate power tools, and gases used for welding torches.

Diving in vehicles. There are several kinds of diving vehicles. These vehicles keep divers dry, warm, and at surface pressure.

Some divers wear metal suits called articulated armor. These suits cover the entire body. Like diving vehicles, articulated armor provides protection against pressure, but it enables the diver to move
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about more freely. Some types of articulated armor permit the diver to descend and ascend without the aid of cables.

Submarines are the largest diving vehicles. Most submarines are warships that carry powerful weapons. For more information about these ships.

Submersibles have extremely strong hulls and can descend much deeper than submarines can.

Unmanned submersibles, which are operated using a cable, can descend to about 20,000 feet (6,100 meters). Manned submersibles can descend to about 21,000 feet (6,500 meters). Submersibles are used for research and other purposes.

The first submersibles, including the bathysphere and the benthoscope, were ball-shaped chambers with viewing ports (windows). They were lowered on cables from ships. Modern submersibles have motors and propellers and can maneuver independently. Some receive electric power through cables

from the surface, but each carries its own supply of air. Some of these vehicles have external mechanical arms called manipulators, which can pick up objects from the ocean floor. Submersibles also have cameras and floodlights that enable scientists to photograph objects and organisms at depths where sunlight never penetrates.

Some types of submersibles carry tanks of gasoline, oil, or a foam composed of tiny glass bubbles. Such light substances help make the craft buoyant (able to float). Tanks filled with air, such as those used in submarines, would be crushed by the pressure at great depths. To descend, some of the buoyancy substance is released and replaced by water, which gives the craft additional weight. To ascend, the craft is lightened by dropping pieces of iron carried for this purpose. Some types of submersibles also use propellers when descending or ascending. A submersible called a bathyscaph consisted of a steel sphere attached to the bottom of a cigar-shaped hull filled with gasoline. Gasoline is lighter than water and so it gave the craft buoyancy. In 1960, the bathyscaph Trieste made the deepest dive ever recorded. It descended 35,800 feet (10,910 meters) into the Pacific Ocean.

Dangers of underwater diving

There is greater pressure underwater than on land. The pressure increases by almost half a pound per square inch (0.04 kilogram per square centimeter) for each foot (30 centimeters) of depth. For example, the pressure on a diver 33 feet (10 meters) beneath the surface is twice as great as the air pressure at the surface. An ambient diver may be injured if the pressure in the lungs and other air spaces in the body does not equal the water pressure. Such an injury is called barotrauma or squeeze.

During ascent, the pressure in the lungs must be kept equal to the decreasing water pressure. Otherwise, a serious condition called air embolism may result. An ambient diver breathes more molecules of air underwater than on land because the air breathed underwater is compressed. When the diver rises to the surface, the air in the lungs expands because of the lesser pressure. If the air cannot be exhaled, it will tear the lungs and force air bubbles into the blood. These bubbles can block the flow of blood and cripple or even kill the diver. Air embolism can be prevented by breathing naturally and ascending slowly.

A condition known as the bends or decompression sickness occurs when nitrogen bubbles form in the blood. Nitrogen gas makes up more than three-fourths of the air breathed by human beings. An ambient diver who breathes compressed air absorbs large amounts of nitrogen into the blood. As the diver ascends, this excess nitrogen is exhaled. But if the diver ascends too quickly, bubbles of nitrogen gas form in the blood. The nitrogen bubbles can block the flow of blood and cripple or kill the diver. A diver can avoid the bends by rising slowly enough to allow the excess nitrogen to be eliminated through breathing.

A chart called a decompression table tells a diver how long he or she can stay at a certain depth without absorbing a dangerous amount of nitrogen. It also tells how slowly the diver must ascend to

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avoid the bends. A person who has air embolism or the bends should be put into a recompression chamber immediately. In this chamber, the diver is returned to a pressure which compresses the bubbles so that the gas dissolves back into the blood. The pressure is then reduced in stages.

Divers breathing air at extreme depths may also suffer a kind of drugged effect called nitrogen narcosis. This condition causes a loss of the ability to reason. Nitrogen narcosis occurs most frequently at extreme depths. To avoid it, divers may breathe a gas mixture that contains helium instead of nitrogen.

A diver who breathes 100 percent oxygen at great depths may suffer oxygen poisoning. The victim becomes dizzy and vomits and may have convulsions. Gas mixtures with a high oxygen content can also cause oxygen poisoning.

History

Breath-hold divers dived for shells in the Mediterranean Sea as early as 4500 B.C. Ancient Greek and Roman divers sought pearls, sponges, and shells.

Divers in the Persian Gulf used goggles made of polished clear tortoise shell to see clearly underwater as early as A.D. 1300. In the early 1930's, Guy Gilpatric, an American diver, became one of the first to use rubber goggles with glass lenses. By the mid-1930's, face masks, fins, and snorkels had come into use.

The first devices that enabled people to breathe underwater were called diving bells. These bellshaped hulls have been used since ancient times. Diving bells are open to the water at the bottom

and get air from the surface through a hose. The air pressure that exists within the bell keeps water out of the device.

In 1715, an English diver named John Lethbridge designed a wooden and leather diving suit that was used in salvage work. The suits used for helmet diving today are based on a diving suit that was introduced in 1837 by Augustus Siebe, a German engineer who was living in England.

Independent breathing devices for diving appeared during the late 1800's and early 1900's. The first safe and simple device, the aqualung, was invented in 1943 by two Frenchmen, Jacques-Yves Cousteau, a naval officer, and Emile Gagnan, an engineer.

The development of enclosed diving vehicles expanded the range of underwater activity. Otis Barton of the United States designed the bathysphere. In 1930, he and William Beebe, an American naturalist, made the first dive in it. The Swiss physicist Auguste Piccard designed the first bathyscaph in 1948.

Experimental underwater saturation habitats were developed in the 1960's. These stations consist of one or more buildings erected on the ocean floor. They have been tested at depths ranging from 30 to more than 600 feet (9 to 180 meters). Compartments inside the buildings are filled with compressed breathing gas. Divers may live there for weeks. They leave the station daily to explore or work. By staying underwater, the divers avoid the need to undergo decompression every day.

The first saturation habitat was built off the coast of France in 1962 by Cousteau. During the 1960's and 1970's, many such structures were built in various locations.

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USA

United States of America is the third largest country in the world in population, and it is the fourth largest country in area. China and India are the only countries with more people. Only Russia, Canada, and China have larger areas. The United States covers the entire midsection of North America, stretching from the Atlantic Ocean in the east to the Pacific Ocean in the west. It also includes Alaska, in the northwest corner of North America; and Hawaii, far out in the Pacific. The United States is often called the U.S., U.S.A., or America.

The land of the United States is as varied as it is vast. It ranges from the warm beaches of Florida and Hawaii to the frozen northlands of Alaska, and from the level Midwestern prairies to the snowcapped Rocky Mountains. This huge and beautiful country is rich in natural resources. It has great stretches of some of the most fertile soil on earth, a plentiful water supply and excellent water routes, and large stretches of forests. Huge deposits of valuable minerals, including coal, natural gas, and petroleum, lie underground.

Economically, the United States is one of the world's most highly developed and productive nations. No other country equals the United States in the production of goods and services. Its people enjoy one of the world's highest standards of living.

Until the 1500's, most of what is now the United States was thinly populated forests and prairies. Small groups of Indians lived scattered over the land between the Atlantic and Pacific. Inuit (also called Eskimos) inhabited what is now Alaska, and Polynesians lived in Hawaii. People in Europe saw in this vast "new world" a chance to build new and better lives. Small groups of Spaniards settled in what is now the southeastern and western United States in the 1500's. People from England and some other European countries began settling along and near the East Coast during the 1600's. In 1776, colonists in the East established an independent nation based on freedom and economic opportunity. Through the years, large numbers of Europeans continued to settle in the United States. People from almost every other part of the world also settled in the country. Except for black Africans brought in as slaves, these immigrants came seeking the rights and the opportunities that had become part of the American way of life. As a result of this immigration, the United States today has one of the world's most varied populations. It has been called "a nation of immigrants."

The vast space and resources of the land, the ideals of freedom and economic opportunity, and hard work by the people all helped build the United States into the economic giant it is today. The Americans--as the people are commonly called--also made major contributions in such fields as technology, science, and medicine. Americans developed the mass production system of manufacturing, the electric light bulb, the telephone, polio vaccine, and the transistor. They also created the skyscraper and such new art forms as jazz and musical comedy.

At times, the U.S. economy has run into difficulty. Even so, it remains one of the most productive systems ever developed. In some cases, groups of Americans have suffered socially and economically from discrimination. But the country's laws have helped many people overcome

discrimination and achieve better lives.

This article discusses the nation's regions, people, way of life, land, climate, and economy. For government and history information.

UNITED STATES/People

Population. The U.S. Census Bureau reported that in 1990 the country had a population of 249,632,692. Figures from the 1980 census had put the population of the United States at 226,545,805.

Whites make up about 80 percent of the country's population. Blacks form the largest minority group. They account for about 12 percent of the population. About 3 percent of the population is of Asian descent.

American Indians make up about 1 percent of the population. Other groups combine to make up the remaining 4 percent.

The U.S. population includes many Hispanic people, such as people of Mexican, Puerto Rican, or Cuban descent. Hispanics consist mainly of whites, but they also include some blacks and American Indians. Hispanics make up 9 percent of the U.S. population.

About 51 percent of the people in the United States are females. The United States has one of the highest life expectancies of any country--74.9 years old. Since 1945, the part of the U.S. population that is over 65 years old has increased from 8 percent to 12 percent. Improvements in medical care have been the main reason for the increase. The over-65 population of the United States will continue to grow at a rapid rate as advances in medicine continue and as the large numbers of people born during the "baby boom" grow older. The baby boom was a period of high birth rate that occurred in the United States from 1946 to 1964.

Approximately 92 percent of the total population was born in the United States. The largest foreignborn groups are, in order of size, Mexicans, Germans, Canadians, Italians, Cubans, and Filipinos. The population density in the United States varies widely from place to place. See the map in this section of the article for the density throughout the country.

Ancestry. The United States has one of the world's most varied populations in terms of ancestry.

The population includes descendants of people from almost every part of the world.

The first people to live in what is now the United States were American Indians, Inuit (also called Eskimos), and Hawaiians. The Indians and Inuit are descended from peoples who migrated to North America from Asia thousands of years ago. The ancestors of the Hawaiians were Polynesians who sailed to what is now Hawaii from other Pacific islands about 2,000 years ago.

Most white Americans trace their ancestry to Europe. Some Spaniards settled in what is now the United States during the 1500's. European settlement increased sharply during the 1600's. At first, most of the settlers came from England. But America soon attracted many immigrants from other nations of northern and western Europe including France, Germany, Ireland, the Netherlands, and Scotland; and the Scandinavian lands of Denmark, Norway, and Sweden. Until the late 1800's, northern and western Europe provided most of the immigrants. Then, large waves of people began arriving from southern and eastern European nations, including Austria-Hungary, Greece, Italy, Poland, and Russia.

Most Hispanic Americans are people who immigrated--or whose ancestors immigrated--to the United States from Latin America. A small percentage of them trace their ancestry directly back to Spain.

Some have mainly Spanish ancestry. Others have mixed Spanish and Indian or black ancestry.

Most African Americans are descendants of Africans who were brought to the United States as slaves during the 1600's, 1700's, and 1800's and forced to work on plantations.

Since the 1800's, the United States has attracted immigrants from Asia. Most Asian Americans trace their ancestry to China, India, Indochina, Japan, Korea, or the Philippines. For more details on the flow of people into the United States through the years.

The United States has often been called a melting pot. This term refers to the idea that the country is a place where people from many lands have come together and formed a unified culture.

Americans have many things in common. For example, the vast majority of them speak English, and people throughout the country dress similarly and eat many of the same kinds of foods. Public education, mass communication, and other influences have helped shape a common identity.

But in other ways, U.S. society is an example of cultural pluralism. That is, large numbers of its people have retained features of the cultures of their ancestors. Many Americans take special pride in their origins. They preserve traditions--and in some cases the languages--of their ancestors. In

many cities, people of different national or ethnic origins live in separate neighborhoods, and shops and restaurants reflect their cultural heritages. Ethnic festivals, parades, and other events emphasize the nation's cultural pluralism.

Language. The United States has never had an official language, but English has always been the chief language spoken there. Immigrants from the England, Scotland, and Ireland--who included the nation's founders--spoke English. Many immigrants from other lands who spoke little or no English also came to the United States. They learned at least enough English to be able to communicate with other Americans. Their children learned English in school. The immigrants' children generally spoke both English and their ethnic language, and in many families the immigrants' grandchildren spoke only English.

Today, Spanish is the second most common language in the United States. The region that is now the Southwestern United States was colonized by Spain in the 1500's. As a result, many people from that region speak Spanish. Since the 1950's, many Spanish-speaking people have immigrated to the United States from Mexico, Cuba, and other places. Many of these people learned English. But others speak only Spanish. This is especially true in Spanish-speaking neighborhoods that developed in cities. Some people feel that special efforts should be made to provide education and other services in Spanish for people who speak only Spanish.

Many people believe every American should know English. They point out that it is difficult to get a job outside Spanish-speaking neighborhoods without a knowledge of English. They also argue that a language shared by everyone is an important unifying force for a country. In the 1980's and 1990's, a number of states passed laws declaring English to be their only official language. These laws provide that the government must offer its services in English, and need not do so in any other language. But in some places, public documents and signs are written in both English and Spanish.

UNITED STATES/Way of life

For census purposes, the United States is divided into urban areas and rural areas. An urban area, as defined by the U.S. Census Bureau, is a community with 2,500 or more people. A rural area is a community with fewer than 2,500 people.

In 1790, the year of the first census, about 95 percent of the nation's people lived in rural areas, and only about 5 percent were urban dwellers. Through the years, these percentages changed steadily and dramatically. Today, about 75 percent of all the people live in urban areas. Only about 25 percent live in rural areas.

Several factors contributed to the dramatic population shift from the countryside to urban areas. Through the years, Americans greatly improved agricultural methods and equipment. From the 1800's onward, farm work has become more and more efficient, farm production has soared, and fewer and fewer people have been needed to work on the nation's farms. At the same time, an industrial boom has created large numbers of new jobs in the nation's urban areas. As a result of these economic changes, a steady flow of people from rural to urban areas has taken place. Also, large numbers of immigrants--many of whom had been farmers in their homelands--found jobs in cities and settled there when they reached the United States. In addition, the variety of job choices and recreational, educational, and cultural opportunities in cities attracted many rural people, especially the young. Large numbers of rural people left home to seek employment and excitement in cities.

Urban life. Urban areas, which range from giant cities surrounded by suburbs to small towns, dot the U.S. landscape. Although the urban areas cover about 2 1/2 percent of the land, they are the home of about three-fourths of the people. New York City, with about 7 million people, is the largest U.S. city by far. Los Angeles has about 3 1/2 million people. Chicago has a population of about 2 3/4 million. Five other U.S. cities--Houston, Philadelphia, San Diego, Detroit, and Dallas--each have more than 1 million people.

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Networks of suburbs surround many U.S. cities. The central cities and their suburbs form units called metropolitan areas. There are about 268 metropolitan areas in the United States. The three largest are, in order of size, the New York-Newark, Los Angeles-Long Beach, and Chicago areas. The New York-Newark metropolitan area has about 17 million people, the Los Angeles-Long Beach area has more than 8 3/4 million people, and the Chicago area has about 7 1/2 million people.

For many years, the vast majority of the country's urban population lived in the central cities. But during the mid-1900's, suburban population soared throughout the United States, while central city growth slowed down or decreased. In 1970, for the first time, more Americans lived in suburbs than

in central cities.

The Northeast and Midwest have long had most of the nation's largest urban areas. But during the 1900's, other parts of the country experienced dramatic urban growth. Since the early 1900's, many California urban communities--especially Los Angeles--have grown tremendously. Since the mid-1900's, the populations of many more urban areas in the West, and in the South and Southwest, have soared. Such metropolitan areas as Atlanta, Dallas, Denver, Houston, and Phoenix grew rapidly. Large numbers of people were attracted to the West, South, and Southwest by jobs created by new industries. Also, many of the fastest-growing communities have warm, sunny climates, which helped attract many of the newcomers. Parts of the South, Southwest, and West are sometimes called the Sun Belt because they have such climates.

Urban economies provide jobs for a great variety of workers, including office and factory workers, bankers, doctors, fire fighters, medical personnel, police officers, teachers, trash collectors, and construction and transportation workers. Urban life also has many other positive features. Because urban areas have large populations, they generally offer a wide variety of specialized services and shops. Urban dwellers can take advantage of an assortment of restaurants, recreation facilities, and places of entertainment. Because of such facilities as art galleries, museums, libraries, theaters, and concert halls, many cities are important cultural centers. These and other features make urban areas exciting and interesting places to live for many people.

The people of most U.S. urban areas represent a variety of ethnic backgrounds. Most cities include neighborhoods in which almost all the people belong to the same ethnic or nationality group. The people of large urban areas are also divided economically. Urban society includes extremely wealthy and extremely poor people, and a huge middle class. The wealthy live in luxurious apartments or condominiums, or in large, comfortable single-family houses. Middle-class housing also includes apartments, condominiums, and single-family houses. In general, the housing of the middle class is comfortable, though not as luxurious as that of the wealthy. In contrast, large numbers of urban poor people live in substandard housing. They rent crowded, small apartments or rundown singlefamily houses.

In addition to substandard housing, urban areas have a number of other unpleasant features. Such features include high crime rates, racial and ethnic friction, noisy surroundings, pollution, and traffic jams.

Rural life. More than 97 percent of all the land of the United States is classified as rural. But much of the rural land is uninhabited or only thinly inhabited. About 25 percent of all Americans live in rural areas.

Farms provide the economic basis of the nation's rural areas. But only about 9 percent of the country's rural people work on farms. Many other rural people own or work in businesses related to agriculture, such as grain and feed stores and warehouses. Mining and related activities and light industries also employ many rural people. Still other rural Americans work as teachers, police officers, salesclerks, or in other occupations. Many farmers hold other jobs for part of the year to add to their incomes.

American farmers of today lead vastly different lives from those of their grandparents. Machines have eliminated much backbreaking farm work. Farmers use machines to help them plow, plant

seeds, harvest crops, and deliver their products to market. Many farms have conveyor systems so that the farmer no longer has to shovel feed to farm animals. Milking machines make morning and evening chores easier. In the home, farm families may have all the comforts and conveniences of city people. In the 1900's, the automobile, telephone, radio, television, and computer brought U.S. farm families into close contact with the rest of the world.

The steady decline in the percentage of the country's rural population has slowed since 1970. Although many people continued to move away from rural areas, others chose to move into rural towns and farm communities. Many of the newcomers wanted to escape the overcrowding, pollution, crime, and other problems that are part of life in urban areas and to take advantage of benefits of country living. Rural areas have lower crime rates and less pollution than urban areas. They are also far less noisy and crowded.

Because of their small populations, rural communities collect less tax revenues than urban communities do, and they generally cannot provide the variety of services that urban areas can. For example, rural communities have cultural and recreational facilities that are more limited than those available in urban areas. For many rural Americans, social life centers around family gatherings,

church and school activities, special interest clubs, and such events as state and county fairs. Rural areas generally have less diversified economies than urban areas. Because there are fewer jobs and a smaller variety of jobs to choose from, rural communities may experience more widespread economic hardships than urban communities. A single economic downturn--a drop in farm prices, for example, or the closing of a mine--can cause economic hardship for an entire rural area.

The nation's rural areas, like its urban areas, have wealthy, middle class, and poor people. For the most part, however, the gaps between economic classes are not as large in rural areas as in urban areas. Most rural Americans live in single-family houses. The majority of the houses are comfortable and in good condition. But some people, including many who live in parts of Appalachia--in the eastern United States--and other pockets of rural poverty, have rundown houses and enjoy few luxuries.

Education has been an important factor in the economic development of the United States and in the achievement of a high standard of living for most Americans. It has also contributed to the enjoyment of life for many people. Americans are among the best-educated people in the world. Schools, libraries, museums, and other educational institutions in the country provide learning opportunities for people of all ages.

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MARRIAGE

Marriage is the relationship between a man and a woman who have made a legal agreement to live together. When a man and woman marry, they become husband and wife. Marriage is also an important religious ceremony in many of the world's religions.

Most couples decide to marry because they love each other and want to spend the rest of their lives together. A man and woman who marry usually hope to share a special sexual relationship and a permanent romantic attraction. But each hopes the other will always be a close friend as well. Each also expects the other to help with many problems and to share certain responsibilities. These responsibilities include earning a living, budgeting money, paying bills, preparing meals, and taking care of a home.

Most couples who marry plan to have children and to raise them together. A husband and wife are required by law to protect and care for their children. Marriage thus serves as the basis of family life. In the United States, about 21/2 million couples marry each year. However, many people choose never to marry. Some people who remain single may not find a mate with whom they want to share their life. Others may not want the many responsibilities required of a successful marriage. Still others prefer to stay unmarried because they enjoy their independence.

Many married couples find they are not happy as husband and wife. Some marriages fail because the man and woman married when they were young and inexperienced in many ways. People who marry before they are 18 years old are much more likely to have unsuccessful marriages than if they had waited until they were older. A man and woman also have less of a chance of achieving a happy marriage if they marry primarily because the woman is pregnant. In addition, if a man and woman are of a different age, nationality, religion, or background, their chances of a successful marriage drop significantly.

In the United States, divorce has become common. Each year, more than a million American couples divorce. Most couples who divorce do so in the first 10 years of marriage. A majority of divorced people remarry, and many have a successful marriage with another partner.

Dating and courtship. In India and many other countries, most marriages are arranged by parents' deciding whom their children will marry. But in Western countries, including the United States and Canada, nearly everyone makes his or her own decision about whom and when to marry.

Before people marry, they date members of the opposite sex. A man and woman who date each other spend a great deal of time together learning to know the other person. After they have dated over time, they may find that they love each other and decide to become engaged.

In many cases, the man gives the woman an engagement ring as a token of their agreement to marry. The use of a ring as an engagement token comes from the ancient custom of using a ring to seal an important agreement.

The age at which people start to date varies widely. But generally, the younger that a man and a woman are when they begin to date, the younger they are when they marry.

Most men and women date and marry people they live near, or with whom they work or go to school. Most people also date and marry those whom they consider attractive and who, in turn, regard them

as attractive. In addition, people tend to date and marry individuals who are like themselves in certain ways. For example, people of the same nationality, ethnic group, and religion tend to marry each other. A man and woman are more likely to marry if they have similar social and educational backgrounds. They are also more likely to marry if they are about the same age.

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Laws concerning marriage. A man and woman must follow certain laws when they marry. The United States and Canada have basically the same marriage laws. Neither nation has federal marriage laws, but each state and province has its own regulations.

In all except four states, both the man and woman must be at least 18 years old to marry without parental consent. Nebraska and Wyoming require a couple to be at least 19. Mississippi and Rhode Island have a minimum age of 21. Most states allow people to marry as young as 16 with parental consent. In some states, a person under age 16 needs a judge's permission to marry.

According to law, both the man and woman must freely consent to marry. If a person is forced or tricked into marrying against his or her will, a judge will annul (cancel) the marriage.

State laws prohibit close relatives from marrying each other. Laws also forbid a person to marry if he or she is married to someone else. A person who marries a second time while a first marriage is still in effect commits the crime of bigamy.

Some states permit a couple to marry even if the bride or groom cannot be present at the wedding ceremony. However, another person must serve as a proxy (substitute) for the absent bride or groom. This type of marriage is called marriage by proxy.

In nearly all states, a couple must have a marriage license to marry. Some states require both the man and the woman to have a blood test before they can obtain a marriage license. Several states test to determine if a person has syphilis, a sexually transmitted disease. Other states test the blood for immunity to rubella. A few states require both tests. In some states, both the man and the woman must also have a medical examination before they can get a marriage license.

Most states require a waiting period of three to five days between the day a couple apply for a license and the day they marry. This period gives both people time to make sure they want to marry. The waiting period developed from a Roman Catholic custom that required a couple to announce their engagement publicly on each of the three Sundays before the wedding day. Between the first announcement and the wedding, anyone who believed that the couple should not marry was expected to say so. Today, some couples announce their engagement at church services or through church bulletins. Such announcements are called banns.

If an unmarried couple live together as husband and wife, a court may declare them married after a certain period of time. The time period varies among the states that permit such common-law marriages. It is usually several years. A couple do not have to have a license or wedding ceremony for a common-law marriage.

Most states have laws forbidding people of the same sex to marry. However, many homosexual couples establish long-term relationships that are similar to marriage and consider themselves married.

Wedding ceremonies and customs. Most wedding ceremonies involve two requirements. First, the man and woman must say that they want to become husband and wife. Second, the ceremony must have witnesses, including the official who marries the couple. If the couple have a religious ceremony, it is conducted by a member of the clergy, such as a minister, priest, or rabbi. If a couple are married in a civil (nonreligious) ceremony, a judge or some other authorized official performs it. During the days of long sea voyages, the captain of a ship was authorized to conduct a marriage ceremony while the ship was at sea.

Many couples prefer a traditional religious ceremony, though some people depart from custom. Some even write their own wedding service. A traditional marriage ceremony begins with the bridesmaids and ushers walking slowly down a center aisle to the altar. They stand on each side of the altar throughout the ceremony. The groom enters and waits for the bride at the altar. The bride then walks down the aisle with her father, another male relative, or a family friend. She wears a white dress and veil and carries a bouquet. At the altar, the bride and groom exchange marriage

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vows and accept each other as husband and wife. The groom puts a wedding ring on the ring finger of the bride's left hand, and the bride may also give the groom a ring. After the ceremony, the bride and groom kiss and then leave down the main aisle.

People of many backgrounds follow the traditional wedding ceremony, but certain religious groups

add their own features to it. For example, different Protestant groups have their own versions of the ceremony. Many Roman Catholic weddings take place during a Mass, and the bride and groom receive Holy Communion. Marriage is a sacrament (important religious ceremony) in the Roman Catholic and Eastern Orthodox churches.

Most Jewish weddings are held under a special canopy that represents the couple's future home. At the end of the ceremony, an empty glass or other breakable object is placed on the floor and the groom breaks it with his foot. This act symbolizes the destruction of the ancient Jewish Temple in Jerusalem and reminds the couple that a marriage can also break if it is not protected.

Mormon weddings are held privately in Mormon temples. Only church members in good standing can attend these ceremonies. Mormons believe that marriage and family life continue after death.

A Quaker man and woman marry at a public gathering where they declare their commitment to each other. Quakers believe that God makes a couple husband and wife, and so a minister or other official is not required.

Many wedding customs have been popular since ancient times. For example, Roman brides probably wore veils more than 2,000 years ago. Bridal veils became popular in the United Kingdom and the New World during the late 1700's. The custom of giving a wedding ring dates back to the ancient Romans. The roundness of the ring probably represents eternity, and the presentation of wedding rings symbolizes that the man and woman are united forever. Wearing the wedding ring on the ring finger of the left hand is another old custom. People once thought that a vein or nerve ran directly from this finger to the heart. An old superstition says that a bride can ensure good luck by wearing "something old, something new, something borrowed, and something blue." Another superstition is that it is bad luck for a bride and groom to see each other before the ceremony on their wedding day.

After many weddings, the guests throw rice at the bride and groom as a wish for children and good fortune. Rice was once a symbol of fertility, happiness, and long life. The bride may toss her bouquet to the unmarried female guests. The woman who catches the flowers will supposedly be the next to marry. This custom probably started in France in the 1300's. The bride may also throw her garter to the unmarried men. The man who catches it will supposedly be the next male to marry.

Marriage problems. A man and woman expect certain things of each other even before they marry. After marriage, some husbands and wives cannot satisfy their partner's expectations. They may become disappointed and unhappy with each other and have problems with their marriage.

A couple may argue about almost anything, such as how to spend their money or how to treat their children. If they do not work out their differences, they may find it difficult to be friends, romantic partners, or good parents.

Couples with marriage problems should seek help from a trained marriage counselor. Only a few states require marriage counselors to be licensed. A couple can obtain the names of qualified counselors in their area from the American Association for Marriage and Family Therapy, which has headquarters in Washington, D.C .

Changing attitudes about marriage. Almost every society has certain traditional ideas about marriage. For example, most societies expect men and women to marry. In addition, most cultures have traditions about the role and the main duties of a husband and a wife. Traditionally, the husband is expected to earn a living, and the wife is expected to manage the household and raise children.

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Many Americans disregard traditional marriage patterns. For example, a large number of married couples share responsibilities that have been traditionally handled by either the husband or the wife. An increasing number of married women have paying jobs and help support their families financially. In 1940, about 15 percent of all married women earned money. In the early 1990's, about 60 percent held a full- or part-time job. More and more husbands share responsibilities traditionally handled by women, such as cooking, doing housework, and caring for the children.

On the average, men and women stay single longer than they once did. In 1950, men married at an average age of 23, and women married at an average age of 20. By the mid-1990's, the average marriage age was about 26 1/2 for men and about 24 1/2 for women.

An increasing number of people choose not to marry. If a man and woman wish to avoid marriage, they may decide to live together with no formal obligations to each other. This arrangement is more common among young adults, but some couples of all ages live together without marrying.

Marriage in other cultures. In most countries, one man marries one woman, and they stay married

unless one of them dies or they are divorced. This system of marriage is called monogamy. Some societies permit polygamy, in which a man has more than one wife, or a woman has more than one husband. The marriage of a man to more than one woman is called polygyny and is practiced by many African and Middle Eastern peoples. Islamic law permits a man to have as many as four wives. Some societies practice polyandry, the marriage of a woman to more than one man.

In certain cultures, marriage involves a gift from the family of the bride or groom to the other's family. In many societies, for example, the bride's family gives money or property to the groom or his family. Such a gift is called a dowry. In some cases, the dowry is given to the bride so that she and her husband may benefit from it. In other cultures, the groom and his family present gifts to the family of the bride. This offering is called a bride price.

Some societies require a person to marry someone who belongs to his or her own tribe or group. This custom is called endogamy. In other places, an individual must follow the rules of exogamy and marry a person from another tribe or village. The most common rule of exogamy requires a man or woman to marry someone outside his or her own family.

Each culture has its own rules about which family members a person is forbidden to marry.

However, most societies forbid incest, which is marriage or sexual relations between certain close relatives. In nearly all cultures, such relatives include a parent and child or a brother and sister.