The History of Medicine

The practice of medicine has a rich history that spans several centuries. Since the first use of plants and other items as simple medicines and balms, many men and women have contributed to the advancement of the "healing arts."

Methods to improve techniques and make use of new technologies are developed nearly every day as researchers strive to find additional ways to combat disease. In fact, so much is happening that it is impossible to cover the subject completely here. However, we can establish a good foundation for the understanding of the medical profession by first reviewing a short summary of highlights in the history of medicine.*

Highlights

Date	Event
3000–1400 B.C.	The **first textbooks of medicine and surgery** appear in ancient Egypt, providing evidence of practice in these fields.
400–200 B.C.	The Greek physician **Hippocrates** and his followers lay the groundwork for medical practice for centuries to come, especially in their emphasis on the influence of factors such as diet, weather, and rest on a patient's ability to recover.
Circa A.D. 50	**Discorides** compiles a list of the drugs available at that time, which were derived mostly from plants. Physicians continued to prescribe some of these drugs until the 20th century, but most are used only in the practice of "folk medicine" today.

* Adapted from materials provided by J. Worth Estes, M.D., of the American Association for the History of Medicine, and Thomas R. Welch, M.D.

The Bubonic Plague—Past and Present†

In 1348, three trade ships from Asia docked at Genoa, Italy, bringing with them spices, silks, and an unexpected stowaway—the deadly bubonic plague, an infectious disease carried by rat fleas. In two years, the contagion had spread rapidly across Europe, reaching as far as England and leaving almost a third of Europe's population dead in its wake. The epidemic became known as the Pestilence, the Great Mortality, and—the name we recognize today—the Black Death.

Within a few days of a small flea bite or exposure to an infected person, victims were taken with fever, extreme fatigue, and swollen, painful lymph nodes called *buboes.* Medieval medicine was of little help, and the disease rapidly progressed to the victim's bloodstream and lungs, causing death. It was rumored in some areas there were not enough left living to bury the vast number of dead. Outbreaks of plague continued to occur over the next few centuries, devastating Europe socially, culturally, and economically.

Caused by a bacterium called *Yersinia pestis,* the plague still exists today, though mostly in underdeveloped rural and agricultural parts of the world. The United States reports an average of 10 to 15 cases of plague a year; worldwide, there are 1,000 to 3,000 reports a year, according to the World Health Organization. There are three progressive stages of plague: *bubonic, septicemic* (in which the bloodstream is infected), and *pneumonic* (in which the lungs are infected). As in the Middle Ages, humans are usually infected by the fleas of the domestic rat, once the infected host rat is dead.

Today we have the benefit of effective antibiotics to treat plague, but if left untreated, this disease can still be fatal. Preventive measures worldwide must be enforced to control plague—vaccination, antibiotic drug therapies, public health education, and most importantly, environmental sanitation.

† Some of the information in this section was taken from the "Plague" home page of the Centers for Disease Control Web site, *http://www.cdc.gov/ncidod/dvbid/plague.index.htm.*

Date	Event
131–201	**Galen** writes books on anatomy, physiology, and practical medicine that remain authoritative until the 1500s.
Circa 900	The Arab physician **Rhazes** describes smallpox and measles.
Circa 1270	**Spectacles** (glasses) for correcting vision are introduced in Venice.
Circa 1330	The **invention and introduction of gunpowder** changes the nature of war wounds. This requires adaptation by physicians treating these wounds, which are much more destructive and life-threatening than wounds made by arrows, swords, and clubs.
1348–50	The **"Black Death"** (bubonic plague) kills a third of the population of Europe. It wasn't until 1894–98 that the plague was found to be caused by bacteria that normally infest rats, but which are transferred to humans by fleas that find human hosts after their rat hosts die.
1440–50	**Paracelsus** introduces many chemical drugs to the practice of medicine.
1538–43	**Andreas Vesalius** publishes the first anatomical drawings to challenge the erroneous theories of **Galen.**
1545–75	**Ambroise Paré** develops new methods for treating wounds.
1553	**Servetus** describes the circulation of blood through the lungs.
Early 1600s	Through experimentation, **William Harvey** discovers that blood, propelled by the force of the heart's contractions, circulates throughout the body in a closed system. (Previously, blood was thought to flow only in one direction, as **Galen** had taught.) Although Harvey did not determine how the smallest arteries and veins were connected to each other, he knew a connection must exist.
Circa 1635	**Cinchona,** or Peruvian bark (a tree bark now known to contain the drug quinine), is introduced for the treatment of what is now recognized as malaria.
1658	**Jan Swammerdam** discovers red blood cells.

Date	Event
1660	**Marcello Malpighi** discovers that small vessels (capillaries) connect arteries and veins, thus completing the discoveries of **Harvey.**
1669	**Richard Lower** discovers that veins in the lungs absorb gases from the air.
1670	**Thomas Willis** discovers that diabetes can be diagnosed by excess sugar present in the urine.
1673–90	**Antonie van Leeuwenhoek** creates microscopes that allow observation of bacteria, protozoa, sperm, and the structure of the retina of the eye, among other cells.
1721	**Dr. Zabdiel Boylston** and **Rev. Cotton Mather** begin the first large-scale inoculations to protect against smallpox in Boston. They injected fluid from the sores of a smallpox patient into the skin of the person to be protected, causing a mild, but seldom fatal, case of the disease. After this, the person would not contract smallpox, even in major epidemics.
1726	**Rev. Stephen Hales** first measures blood pressure (in horses).
1740	**Friedrich Hoffman** describes rubella (German measles).
1742	**Anders Celsius** invents the 100-degree thermometer.
1752	The **Pennsylvania Hospital** opens, the first general hospital in North America.
1761	**Giovanni Baptista Morgagni** publishes the first major book on autopsy (postmortem anatomic pathology).
1765	The **first medical school** in this country opens in Philadelphia.
1768	**William Heberden** describes the angina pectoris syndrome (chest pain, usually with exertion).
1771–85	Oxygen is isolated by **Joseph Priestley** and **Willem Scheele** and is defined by **Antoine-Laurent Lavoisier,** who describes its exchange with carbon dioxide in the lungs (respiration) and its role in maintaining life.

Date	Event
1780	**Benjamin Franklin** invents bifocal lenses for glasses.
1785	**William Withering** introduces digitalis for the treatment of "dropsy" (now called heart failure) after the first clinical trial of any drug. (A clinical trial is an experiment that uses actual patients to determine whether a certain drug is effective.)
1786	**John Coakley Lettsom** describes addiction to alcohol and other drugs.
1796	The British navy adopts lemon juice (containing vitamin C) as its standard method of prevention against **scurvy.**
1798	**Edward Jenner** discovers that smallpox can be prevented with fluid from cowpox sores, and that this method, called vaccination (from the Latin word for cow, *vacca*), is safer than inoculation. (Both methods stimulate the body to produce a protective response to the smallpox virus.)
1803	**Thomas Percival** publishes the first major book on medical ethics.
1809	**Ephraim McDowell** performs the first major abdominal surgery (removal of a large tumor of the ovary).
1811	**Charles Bell** discovers the function of the individual spinal nerves, which control different muscles and receive sensations from specific parts of the limbs and skin.
1816	**René-Théophile-Hyacinthe Laennec** develops the stethoscope.
1833	**William Beaumont** publishes his first experiments on gastric digestion after observing how the stomach responds to various foods and emotions through a "window" produced by a musket wound in the stomach of a backwoods hunter.
1839	**Theodor Schwann** publishes his theory of disease at the level of the cell.
1845	**Rudolf Virchow** and **Hughes Bennet** describe leukemia (cancer of the white blood cells).

Date	Event
1846	The first public demonstration of anesthesia using ether by dentist **William T. G. Morton** and surgeon **John Collins Warren** is given at Massachusetts General Hospital in Boston. (**Crawford Long** of Georgia had used this four years earlier but did not publish his work.)
1847	**James Young Simpson** introduces the use of chloroform for obstetrical (during childbirth) anesthesia.
1848–58	**Claude Bernard** discovers that the liver stores food energy, that nerves control blood flow through different tissues by constricting and dilating blood vessels, and that curare relaxes (paralyzes) skeletal muscles.
1849	**Thomas Addison** describes pernicious anemia (now known to be caused by lack of absorption of vitamin B_{12}) and adrenal gland failure (now called Addison's disease).
1850	The organism causing anthrax, a devastating disease of sheep, is the **first disease-producing bacterium** to be discovered.
1853	The **hypodermic syringe** is invented.
1858	**Rudolf Virchow** publishes a major work on disease processes at the level of the cell.
1859	**Florence Nightingale** publishes her pioneering *Notes on Nursing,* establishing the foundation for that profession.
1860–81	**Louis Pasteur** demonstrates the presence of bacteria in air, explaining how disease can be transmitted by an airborne route. He also is credited with classifying various types of bacteria, developing vaccines for anthrax and rabies, and developing the process to sterilize milk by heating it quickly to high temperatures, thus killing any bacteria present (pasteurization).
1861	**Ignaz Semmelweis** demonstrates that "childbed fever" is transmitted by the contaminated hands of health-care personnel, indicating the need for careful handwashing to help prevent the spread of disease.

Date	Event
	Also, **Paul Broca** discovers the area of the brain responsible for speech.
1864	**Julius Cohnheim** discovers the mechanism of inflammation (response of tissue to an irritant or injury).
1865	**Gregor Mendel** publishes the results of his classic experiments with pea plants, revealing the basic laws of inheritance, and leading the way to the discovery of genes and DNA (the molecule that "codes" for genes).
1867	**Joseph Lister** introduces antiseptic surgery by spraying carbolic acid (phenol) over the operative field to reduce the likelihood of infection in the surgical wound. (It would be another 10 years before such infections were found to be caused by bacteria.)
1868	**Ewald Hering** and **Joseph Breuer** describe how the body regulates respiration (breathing).
1869	**Charles-Edouard Brown-Seqard** describes the role of endocrine secretions (hormones) in regulating body functions.
1878–82	**Robert Koch** discovers the bacteria that cause wound infections and tuberculosis. He also establishes a set of rules (still known as "Koch's Postulates") for proving that a specific microorganism causes a specific illness.
1880	**Charles-Louis-Alphonse Laveran** discovers the microorganism that causes malaria.
1883	**Edwin Klebs** discovers the diphtheria bacillus. **Elie Metchnikoff** finds that one of the body's methods of protecting itself against disease depends on phagocytes (cells that "eat" bacteria and debris and destroy them).
1884	**Carl Koller** introduces the use of cocaine for local anesthesia in eye surgery.
1886	**Reginald Fitz** describes the process of appendicitis.
1890	**Emil von Behring** introduces a vaccine for diphtheria.

Date	Event
1895	**Wilhelm Conrad Roentgen** discovers the X ray, which can be used to "see" inside the body, establishing a powerful new tool for diagnosing disease; this is the basis for the field of radiology.
1897–98	**Ronald Russ** discovers that the parasite causing malaria is transmitted by mosquitoes.
1898	**Marie and Pierre Curie** discover radium and perform pioneering work that will eventually lead to treatments for some forms of cancer.
1899	**Aspirin** is introduced to clinical medicine.
1899–1900	**Walter Reed** demonstrates that yellow fever can be transmitted by mosquitoes.
1900	**Sigmund Freud** publishes his pioneering work in the field of psychiatry, *The Interpretation of Dreams.*
1901	**Karl Landsteiner** discovers the A, B, and O blood groups on red blood cells, laying the groundwork for safe blood transfusions.
1903	The modern **blood pressure cuff** (sphygmomanometer) is introduced.
1906	**Clemens von Pirqet** develops his theory of allergic disease.
1906–20	**Gowland Hopkins,** and others, investigate and name the vitamins ("vital amines").
1910–20	The **electrocardiograph** (ECG/EKG) is invented and initially developed.
1914–19	**Edward C. Kendell** discovers thyroxin, the thyroid hormone.
1921–22	**Frederick Banting** and **Charles Best** isolate insulin and use it in the first successful treatment of diabetes (caused by a lack of this hormone).
1929	**Alexander Fleming** discovers, by accident, that a common mold produces a substance called penicillin that can stop the growth of bacteria. First used to cure a serious bacterial infection in 1942, it was the first true antibiotic (a substance made by one microorganism that can inhibit the growth of another one).
1935	**Sulfonamides,** the first synthetic chemicals used to treat infections, are introduced.
1940s	The development of **open-heart surgery** occurs, as does the first use of drugs for **cancer chemotherapy.**
1945–47	The **artificial kidney** is developed.
1950s	The **first drugs for psychiatric illness** are developed.
1953	**James Watson** and **Francis Crick** publish a paper describing the structure of DNA, laying the foundation for an understanding of how genes reproduce and code for genetic information.
1954	The **first kidney transplant** is performed at Boston's Peter Bent Brigham Hospital.
1954 and 1963	**Jonas Salk** develops the killed polio vaccine (1954) and **Albert Sabin** introduces the inactivated oral polio vaccine (1963). One of the major causes of infant death and disability is nearly completely eliminated by vaccines.
1967	**Christian Bernard** performs the first heart transplant surgery at Capetown, South Africa.
1977–80	An intensive worldwide vaccination campaign culminates with the complete **eradication of smallpox.** For the first time in history, medicine totally eliminates a disease.
1981	**Acquired immune deficiency syndrome (AIDS)** first appears in the United States; the responsible virus and modes of transmission are identified.
1983	**Cyclosporine,** the first drug developed specifically to help prevent the rejection of transplanted organs, is introduced. Transplantation of the heart, liver, lung, pancreas, and intestine becomes feasible, marking the start of a new era in the treatment of diseases of these organs.
Late 1980s	**First anti-AIDS drugs** are developed and found effective.

Date	Event
1995	Researchers discover a gene responsible for a rare but aggressive form of Alzheimer's, the degenerative disease that causes memory loss, poor judgment, and increasingly affects an individual's ability to carry on with day-to-day activities. Their finding could lead to a test that can identify people who may be genetically susceptible to the disease.
1996	A breakthrough in anti-AIDS drugs is made with the discovery of protease inhibitors, which significantly reduce the amount of HIV in the blood by attacking the enzyme protease.
1997	Scientists in Scotland are able to clone a mammal for the first time. Dolly, a sheep cloned from cells taken from another sheep's udder, is born in February.
2001	In February the Human Genome Project, a global effort to find the blueprint for the human genetic makeup, announces it has the complete order of the human genome, or layers of tens of thousands of genes in the human body. Scientists are hoping that the mapping of the human genome will eventually lead to the treatment and cure of many of the world's most devastating diseases. In July, President George W. Bush approves limited federal funding for embryonic stem cell research with the use of existing stem cell lines. Simply put, scientists will be able to explore the possibility of developing specialized cells and a renewable source of replacements cells and tissue to treat diseases and disabling conditions such as spinal cord injuries, diabetes, and arthritis. There is great debate about weighing the potential medical benefits against the ethical concerns of this research.

The Oath of Hippocrates

The Hippocratic Oath, although somewhat changed over the years, serves as a general code of ethics for the practice of medicine. Almost universally, those completing medical school stand before their professors and instructors during graduation ceremonies and promise to uphold the values attributed to the teachings of Hippocrates in the third or fourth century B.C. This ancient document, written by an unknown author, is very much alive today.*

Changing With the Times

The shaded text on the following pages presents two versions of the Hippocratic Oath—the original and a more modern one (in bold print, adapted at Ohio State University and currently used at many other schools). Changes in society and what is viewed as accepted medical practice have prompted modifications of this now classic promise. For instance:

- References to Greek gods, more appropriate in the day of Hippocrates, have been replaced by a generalized statement recognizing various beliefs and religions.
- Elaborate promises about perpetuating the healing arts from generation to generation no longer reflect the current methods used and are, for this reason, not included.
- Specific statements about the primary reliance on dietary measures to prevent illness have been generalized to recognize the use of more modern techniques such as medication.
- A reference forbidding surgery ("I will not use the knife") reflected the separation of medicine and surgery at the time. As no such separation exists today, this statement is omitted.

*Portions of this section were adapted from materials provided by Irwin J. Cohen, M.D., M.P.H., of the Department of Community Medicine, Tulane University School of Medicine.

Comparing Oaths

I swear by Apollo Physician and Asclepius and Hygeia and Panaceia . . . that I will fulfill according to my ability and judgment this oath and this covenant:

I do solemnly swear, by whatever I hold most sacred:

To hold him who has taught me this art as equal to my parents and to live my life in partnership with him . . . to give a share of precepts and oral instruction and all the other learning to my sons and to the sons of him who has instructed me and to pupils who have signed the covenant and have taken an oath according to the medical law, but to no one else.

That I will be loyal to the profession of medicine, and just and generous to its members.

I will apply dietetic measures for the benefit of the sick according to my ability and judgment; I will keep them from harm and injustice.

I will neither give a deadly drug to anybody if asked for it, nor will I make a suggestion to this effect. . . . In purity and holiness I will guard my life and my art.

That I will exercise my art solely for the cure of my patients and the prevention of disease, and will give no drug and perform no operation for a criminal purpose . . . I will lead my life and practice my art in uprightness and honor.

I will not use the knife, not even on sufferers from stone, but will withdraw in favor of such men as are engaged in this work.

Whatever houses I may visit, I will come for the benefit of the sick, remaining free of all intentional injustice. . . .

That into whatever home I shall enter, it shall be for the good of the sick and the well to the utmost of my power. . . .

What I may see or hear in the course of the treatment or even outside of the treatment in regard to the life of men, which on no account one must spread abroad, I will keep to myself. . . .

That whatever I shall see or hear of the lives of men and women that is not fit to be spoken, I will keep inviolably secret.

If I fulfill this oath and do not violate it, may it be granted to me to enjoy life and art. . . . If I transgress it and swear falsely, may the opposite of all this be my lot.

(Translation of the original Hippocratic Oath)

These things I do promise, and in proportion as I am faithful to this oath may happiness and good repute be ever mine—the opposite if I shall be forsworn.

(Version of the Hippocratic Oath administered at the Ohio State University)

Other minor changes were made to simplify and clarify the language.

The original version of the oath directs the loyalty of the physician to his or her teachers (i.e., promising to "hold him who has taught me this art as equal to my parents") and to perpetuating the profession, rather than to the patients he or she treats. The modern version of the oath emphasizes patient care and moral behavior.

The Meaning of the Oath

As you can see, comparison of the two oaths reveals several differences, but most of the basic principles of the original have been preserved. The importance of the Hippocratic Oath, either in its original or modern version, must not be underestimated. As one takes the oath, a student actually becomes a physician. This change does not occur when the student receives a diploma from medical school or passes the required examinations to receive a legal license to practice. Such events merely certify that the student has acquired a minimum, necessary amount of special knowledge. It is important to note that the oath is not concerned with technical competence, but rather with *how physicians do what they do.*

In its text (modern version), a taker of the oath promises to "lead my life and practice my art in uprightness and honor." It seems then that the quality of one's work as a physician is dependent not only on how one practices medicine, but also on how one lives. To be a good physician *one must lead a good life.*

This emphasis on the physician's "goodness" rather than on his or her technical competence is prompted by the special relationship that exists between patient and physician. The patient comes to the physician in a somewhat vulnerable state—ill or fearful of illness. To feel better, the patient must place complete trust in the skills of the physician. To do so, the patient must be convinced that the physician's efforts will always be designed to promote the patient's welfare. This concern is frequently more important in establishing trust than is technical ability.

It is appropriate then that a student should become a physician only when he or she takes an oath that emphasizes a virtuous life. Such an oath establishes a solid bond between the physician and that physician's future patients.

The Health-Care Provider–Patient Relationship

Having a physician you trust and can communicate with is as important as having regular checkups.

The relationship a patient has with a health-care professional is important if the patient is to receive the best medical care possible. Frequently, patients need to reveal fairly personal information about themselves that they might not realize could be related to their illness—information they might not feel comfortable discussing with their closest friends, let alone someone they might not feel they can trust completely. If a patient is reluctant to provide this information, and it turns out to be important, it is possible that a diagnosis could be missed.

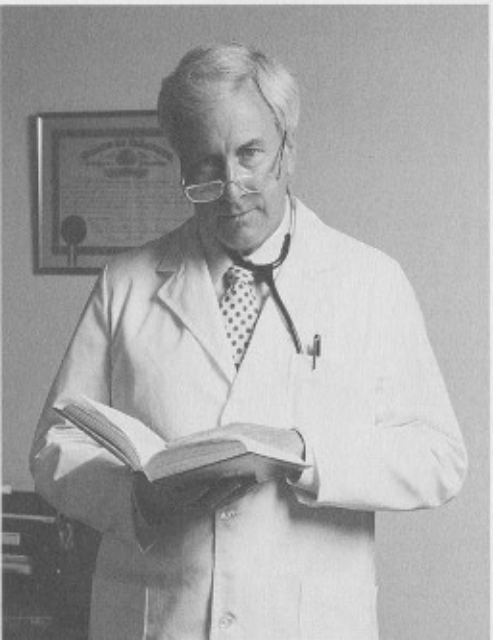
To prevent this from happening, a health-care professional and a patient must *communicate* with each other. The provider must put the patient at ease, but make him or her understand that the information is important in determining what medical problem might be present, and that the information will be used only for that purpose. In other words, the information will be treated as *confidential*, and will be disclosed only to people directly involved in that patient's medical care.

This is frequently easier said than done, and it can take several years to develop a rapport to where the patient can comfortably discuss information of a truly personal nature with the provider. Yet, this rapport is absolutely necessary if the professional is to be able to help the patient in all situations.

Even when a good relationship exists, however, a patient might still be reluctant to disclose certain information fully, and a health-care professional must be willing to consider this possibility if other facts (e.g., those discovered through a physical examination or laboratory testing) indicate that the patient is being less than truthful.

Questions about the use of illegal drugs or alcoholic beverages, as well as sexual activity, are appropriate in a medical setting if the health-care professional feels information about these areas might be related to a patient's problem. It is not difficult to imagine, however, that questions about these subjects could be distressing or embarrassing for the patient to answer, especially if the patient is concerned that revealing information about an illegal activity (such as drug use) might result in that information being given to the police.

With few exceptions, the expectation has always been that discussions between a patient and a health-care professional are **privileged.** The information shared is protected from disclosure to any third parties, including legal authorities. Recently, however, there have been instances of erosion of this expectation of confidentiality.



In some cases (child abuse, for example), physicians are required by law to report suspicions to legal authorities. Insurance companies, in their role as payers for much medical care, are increasingly collecting details of patient medical histories and treatments. With the recent expansion of computerized medical records, unauthorized access to confidential medical information is a growing concern.

If patients do not feel they can trust those treating them, they are unlikely to provide potentially vital information. It is therefore extremely important for a health-care professional to hold in highest regard the trust placed in him or her by the patient, and to maintain the confidential nature of medical conversations.

Health-Care Professions

Although it might not be immediately obvious, many different professionals play a part in the delivery of health care in the United States. Of these, the most visible are usually the physicians and nurses with whom you come in contact when you have a minor illness. However, any other specialists who provide services supporting the various aspects of diagnosis and treatment, as well as those who may be consulted outside the scope of a physician's care, also play very important roles in seeing that patients receive assistance with the various health problems they might have.

Each of these professionals serves a specific function, and what he or she is permitted to do within that field is defined by laws established by state governments, frequently through the granting of licenses. As these laws vary somewhat around the country, information on licensing for each profession cannot be included here. Such information can, however, usually be obtained from your state's department of Consumer Affairs, or the equivalent.

The remainder of this section describes various health professions and the educational requirements (after high school) usually required to practice them. While an attempt has been made to include as many of these as possible, space limitations have necessitated some omissions.*

Physician. A professional trained in the practice of medicine and surgery. *Allopathic* physicians are those who graduate from school's granting a doctor of medicine (M.D.) degree and are qualified to practice all aspects of these areas. *Osteopathic* physicians graduate from schools granting a

*The descriptions of health professions contained in this section were adapted from materials in the *American Medical Association Encyclopedia of Medicine* (Random House, 1989), with permission.

doctor of osteopathy (D.O.) degree and use a system of diagnosis and treatment that emphasizes the role of the musculoskeletal system in the healthy functioning of the body. These physicians are similarly qualified to practice all aspects of medicine and surgery; however, their training emphasizes osteopathic palpation and manipulative therapy. This profession and its educational requirements are further described in the next section.

Educational requirements: Completion of an undergraduate college degree followed by four years of medical school education leading to either a Doctor of Medicine or a Doctor of Osteopathic Medicine. (Further educational requirements for specialties beyond the M.D. or D.O. degree are covered in "Medical Education and Specialties.")

Chiropractor. A specialist in this area practices a theory of healing based on the belief that disease results from a lack of normal nerve function. Chiropractic relies on physical manipulation and adjustment of the spine for therapy, rather than on drugs or surgery. Chiropractors make use of X rays and special techniques to diagnose and treat back disorders and other musculoskeletal problems. In some states they perform physical examinations and do some minor surgery.

Educational requirements: Completion of at least two years of college education followed by four years of training in chiropractic leading to a doctor of chiropractic degree.

Optometrist. Specialists trained to examine, diagnose, treat, and manage diseases and disorders related to the eye and vision. They prescribe glasses, contact lenses, and other vision aids, as well as vision therapy and medicines for the treatment of eye diseases. Optometrists also are trained to identify when it might be necessary to refer a patient to an ophthalmologist (physician specializing in eyes) for medical or surgical treatment. In some states they are permitted to monitor selected patients for chronic conditions.

Educational requirements: Completion of an undergraduate college degree followed by four years of education leading to a doctor of optometry degree.

Podiatrist. A specialist in this field deals with the examination, diagnosis, treatment, and prevention of diseases and malfunctions of the foot and its related structures. Podiatric medicine is concerned with many different types of foot problems, including walking disorders in children, ankle injuries among adolescents, fractures among athletes and joggers, bunions and hammer toes among men and women of all ages, and care of foot ulcers, toenails, and infections among people who have diabetes.

Educational requirements: Completion of an undergraduate college degree followed by four years of education leading to a doctor of podiatric medicine degree.

Pharmacist. A person who is responsible for the preparation and dispensing of drugs. Pharmacists are expert in the uses of such medications for the prevention and treatment of diseases and with their side effects and toxicities. They fill prescriptions, counsel patients on possible interactions that can exist with medications they might be receiving from different health-care professionals, and make decisions concerning the substitution of generic equivalents that might be more affordable for some patients, unless specifically forbidden by the prescriber.

Educational requirements: Completion of an undergraduate college degree followed by four years of training leading to a bachelor or doctor of pharmacy degree.

Psychologist. A specialist in the diagnosis and treatment of behavioral disorders and mental and emotional illness. Those in the field are expert in the internal aspects of the mind, such as memory, feelings, thought, and perception, and external manifestations such as speech and behavior. They administer intelligence and personality tests and analyze the results. Their role with patients also includes counseling or psychotherapy. They refer appropriate patients to psychiatrists when medical treatment (i.e., medication) might be indicated.

Educational requirements: Completion of a master's or doctor of philosophy or doctor of psychology degree.

Physician's Assistant. This professional performs diagnostic, therapeutic, preventive, and health maintenance services under the supervision of a physician, to allow more effective and focused application of the physician's particular knowledge

and skills. Individuals concentrating in surgical fields perform a number of functions formerly done only by surgeons within a variety of appropriate settings such as hospital surgical suites, surgical clinics, emergency rooms, and office practices. Physician assistants are accountable for their own actions and to their supervising physicians.

Educational requirements: Completion of an undergraduate college degree and two years of additional clinical training.

Nurse. A person trained to assist patients in recovery from an illness or injury, or to regain as much independence as possible. Working closely with physicians and other health-care professionals, a nurse exercises continuous surveillance over the patient. This involves measuring and recording bodily functions, monitoring the level of consciousness, performing tasks to avoid injury to unconscious patients, administering medications, and providing emotional support and comfort. Nurses are more concerned with the patient's overall reaction to a disorder than with the disorder itself, and are devoted to the control of physical pain, the relief of mental suffering, and, when possible, the avoidance of complications. In terminal cases, a nurse's responsibilities include helping the patient meet death with as little distress and as much dignity as possible.

> ***Registered nurse.*** A health-care professional licensed by a state to care for the sick and to promote health. Some registered nurses concentrate on a particular field, engaging in the full-time practice of anesthesia, psychiatry, pediatrics, or surgery.
>
> **Educational requirements:** Two to four years of nursing training; might result in a baccalaureate degree in nursing; specialization might require a master's degree in nursing.
>
> ***Licensed vocational/practical nurse.*** These professionals are trained to provide basic care for patients under the supervision of physicians and registered nurses.
>
> **Educational requirements:** One year of nursing training.

In recent years, programs have been developed in which some nursing personnel have received additional training permitting them to provide expanded clinical services.

> ***Nurse practitioner.*** This professional (also called a nurse clinician) is trained to provide health services (such as preventive care, monitoring of chronic conditions, physical examinations, and health counseling) under the supervision of a physician.
>
> **Educational requirements:** Completion of a master's degree in nursing followed by approximately two years of additional clinical training.
>
> ***Nurse-midwife.*** The professional trained in this area assists women in pregnancy and childbirth, providing care and information throughout pregnancy, supervising labor and delivery, and caring for both the mother and the baby during the period immediately following childbirth. The vast majority of nurse-midwives practice in hospitals and birthing centers, usually with physician backup in case of complications and emergencies.
>
> **Educational requirements:** Completion of a master's degree in nursing followed by approximately two years of additional clinical training.

Medical Assistant. A person in this role performs a broad range of administrative and clinical duties under the supervision of a licensed medical professional. Administrative duties include preparing and maintaining medical records, handling medical transcription, and serving as a liaison between the physician and other individuals. Clinical duties include infection control, taking patient histories and vital signs, performing first aid and CPR, preparing patients for procedures, assisting with examinations and treatments, performing selected diagnostic tests, and administering medications as directed by the supervising personnel.

Educational requirements: Completion of a program that is either two years in length, resulting in an associate degree, or one year, resulting in a certificate or diploma.

Emergency Medical Technician. This professional, often referred to as a paramedic, is trained to recognize, assess, and manage medical emergencies of acutely ill or injured patients in pre-hospital settings. This training includes the ability to initiate appropriate invasive and noninvasive treatments for airway and respiratory problems, cardiac arrest, and psychological crises. Emergency medical technicians work principally in advanced life-support units and ambulance services that are under medical supervision and direction (often through radio communication).

Educational requirements: Completion of a program of 600 to 1,000 hours of instruction, including exposure to supervised clinical situations.

Medical Laboratory Technologist. Professionals in this area perform laboratory tests that play an important role in the detection, diagnosis, and treatment of many diseases. They perform these tests in conjunction with pathologists and other physicians, or scientists who specialize in clinical chemistry, microbiology, or other biological sciences. They develop data on the blood, tissues, and fluids in the human body by using a variety of precision instruments and are trained to recognize interdependency of tests. They also have a knowledge of physiological conditions affecting test results in order to confirm these results.

Educational requirements: Approximately two years of college-level work in related sciences and mathematics and one year of clinical education.

Radiologic Technologist. Some professionals in this role provide services using imaging modalities involving X rays, magnetism, or ultrasound, as directed by those qualified to order and/or perform radiologic procedures. Others administer radiation therapy for various cancers and other conditions. They are responsible for quality control programs and are particularly concerned with limiting radiation exposure to patients and others. They exercise independent judgment in the technical performance of medical imaging procedures by adopting variable technical parameters of the procedure to the condition of the patient and by initiating lifesaving first aid and basic life-support procedures as necessary during medical emergencies.

Educational requirements: Two to four years of training, depending on program design, objectives, and the degree or certificate awarded.

Occupational Therapist. These health-care professionals administer treatment aimed at enabling people disabled by physical illness or a serious accident to relearn muscular control and coordination, to cope with everyday tasks (such as dressing), and, when possible, to resume some form of employment. They are trained to apply purposeful, goal-oriented activity in the evaluation, diagnosis, and/or treatment of people whose abilities to cope with the tasks of living are impaired by physical injury, illness, emotional disorder, developmental disability, or the aging process, in order to achieve optimum functioning, prevent disability, or maintain health.

Educational requirements: Completion of an undergraduate degree and at least six months of additional practical experience in occupational therapy.

Physical Therapist. These specialists administer treatment of disorders or injuries with physical methods or agents, such as exercise, massage, heat (including ultrasound and diathermy), cold, water (e.g., whirlpool), light, and electrical current. Exercises may be passive (in which the therapist moves parts of the patient's body) or active (in which the patient is taught to contract and relax certain muscle groups). Physical therapists help the patient prevent or reduce joint stiffness; restore muscle strength in the treatment of arthritis or after a fracture has healed; reduce pain, inflammation, and muscle spasm; and retrain joints and muscles after stroke or nerve injury.

Educational requirements: Completion of an undergraduate degree and at least six months of additional practical experience in physical therapy.

Respiratory Therapist. Professionals in this role apply scientific knowledge and theory to the practical clinical problems of respiratory care. The respiratory therapist is qualified to assume primary responsibility of all respiratory care modalities under the direction of a physician. Respiratory therapists collect and review data (e.g., blood gases), monitor and adjust ventilatory assistance devices, and administer chest percussion (series of controlled blows to the chest to loosen excess secretions) and inhaled treatments of medications to clear a patient's airways. They usually operate in a hospital setting.

Educational requirements: Programs are usually two years in length, leading to an associate's degree; some longer programs lead to a bachelor's degree.

Medical Education and Specialties

Earlier in this century, the large majority of physicians were "general" practitioners; that is, they managed essentially all aspects of medical care for their patients using treatments known at that time. However, since that day, medical knowledge has increased many hundredfold as the result of ongoing research and the introduction of new technology for diagnosis and treatment. Therefore, it has become almost impossible for a single physician to know "everything about everything," let alone be able to apply this knowledge adequately to patient care.

The realization of this fact has resulted in diverse specialization among physicians so that some can concentrate on a given area, usually limited to a single organ system or a small set of related systems, while others remain more general in their approach. To permit this, medical education has adapted to meet the needs of today's specialists and subspecialists.

Educating Physicians

Most medical schools in the United States and Canada require evidence of superior performance in achieving a minimum of an undergraduate (bachelor's or the equivalent) college degree for admission. While many premedical students major in scientific fields such as biology or chemistry, any major can be acceptable if the required courses in biology, chemistry, and physics are included. An acceptable score on the Medical College Admission Test (administered by the Association of American Medical Colleges) and a personal interview are also usually required.

Once in medical school, a student will study primarily courses in basic biomedical sciences over the first two years.

Years three and four focus on clinical sciences training in a hospital setting.

The basic sciences usually include anatomy (gross and microscopic), embryology, biochemistry, physiology, genetics, pathology, pharmacology, microbiology and immunology, and biostatistics. These might be taught individually or on a coordinated basis (by organ; for example, information about each of the above subjects regarding the heart is presented at one time).

The clinical sciences during the third year include broad exposure to certain "core" specialties, which are believed necessary to provide a foundation upon which to build, regardless of which specialty is eventually chosen. These usually include internal medicine and/or family practice, obstetrics and gynecology, pediatrics, psychiatry, and surgery.

The fourth year is usually composed of a series of elective courses or rotations, allowing the soon-to-be-graduated student to explore specialties he or she might be interested in entering. As this final year progresses, more and more clinical responsibility is placed on the student to prepare him or her for the postgraduate training that will follow.

Choosing a Specialty and the "Match"

Having decided on a specialty, a position in a training program for that specialty is obtained by submitting applications, much in the way one applies to college. Frequently, candidates will do elective rotations in the program for which they would most like to be accepted, primarily to show interest and to have their clinical skills better evaluated.

After all applications have been submitted and interviews have been held, the candidate submits to the "Match"—a rank-ordered list of the programs he or she would like to attend. The "Match" is the National Resident Matching Program, a computerized service that pairs students with postgraduate (residency) training programs. Each program submits to the Match a similar rank-ordered list of the people it would like to train. After some calculations, a list of matched candidates and programs is released. The graduating student can then plan to participate in the program where a position is acquired.

Residency and Fellowship

In past years, most physicians completed a year of postgraduate training called an "internship" that provided a broad, general overview of medical practice, attempting to give the new physician a strong background regardless of the more limited specialty that might be pursued. Since 1982, however, this year has been absorbed into the specialty's first year of residency training (called that because physicians used to live at the hospital facility and were actually "resident" there). There are very few first-year positions that resemble the old internships. These usually are filled by physicians who will enter the specialties of dermatology, radiology, ophthalmology, psychiatry, or neurology.

Postgraduate training requires several years of study in the field chosen by the new physician, depending on the requirements of each discipline. As in clinical training in medical school, increasing levels of responsibility are placed on the resident as training progresses until competence is achieved for practice without supervision. Following the completion of training, residency graduates are eligible for certification in the specialty, a process that involves written and, in some cases, oral examinations.

Some areas of certain specialties are considered too complicated to be learned within the confines of a residency and have been further broken down into subspecialties, usually requiring additional residency or fellowship training.

Core and Primary Care Specialties

To give students a strong background in certain core subjects, most medical schools require exposure to specific, general specialties. These tend to include what are commonly referred to as primary care specialties—internal medicine, family practice, obstetrics and gynecology, and pediatrics—so-called because physicians in these areas are frequently the primary contact patients have with the medical profession and are relied upon to manage their overall care.

Primary care physicians often follow a patient on a day-to-day basis as needed and are usually able to handle routine problems. They make decisions regarding if and when patients need referrals to specialists. They also are responsible for being familiar with the care being given by any other specialists involved to avoid problems that could result from interactions

between therapies. In doing this, they serve essentially as "gatekeepers" of their patients' health care.

The remainder of this section describes the various medical specialties and the educational requirements (beyond completion of an undergraduate college degree followed by four years of medical school education leading to either an M.D. or D.O. degree) usually required to practice them.* (While an attempt has been made to include as many of these as possible, space limitations have necessitated some omissions.)

Internal Medicine. Physicians in this specialty, called internists, provide comprehensive medical services for adults (and occasionally adolescents) on a continuing basis. Emphasis is placed on the treatment of problems with medication rather than surgery, and on coordination of care, with referrals to other specialists as needed. Various subspecialties exist (see below).

Educational requirements: Three years of residency training; subspecialty fellowships are available.

Family Practice. Physicians in this specialty provide comprehensive medical services for individuals, regardless of sex or age, on a continuing basis, and often care for all members of a family. Emphasis is placed on the treatment of all problems experienced by the person and on coordination of care, with referrals to other specialists as needed. Care ranges from placing stitches and the treatment of "sniffles" to management of long-term conditions (e.g., terminal cancer or diabetes mellitus).

Educational requirements: Three years of residency training; additional residency training in geriatrics or obstetrics is available.

Obstetrics and Gynecology. Obstetricians are physicians who specialize in the care of a woman during pregnancy, labor, delivery, and the period immediately afterward. Prenatal care may include periodic examinations of the woman and her developing baby with recommendations for changes in activity or diet. These physicians also deliver the baby, performing a cesarean section if necessary. Gynecologists study, diagnose, and treat conditions of the female reproductive system, including infertility and cancer. Frequently, a physician will be both an obstetrician and a gynecologist.

Educational requirements: Four years of residency training; subspecialty fellowships are available.

Pediatrics. These specialists are concerned with the growth and development of patients from infancy to adolescence, and with the diagnosis, treatment, and prevention of childhood diseases. They advise on the care of children, provide vaccinations, and conduct periodic well-baby examinations to assess general health and detect any problems. Special aspects of pediatrics include the care of newborn infants and children with disabilities. All of the subspecialties listed in the next section have pediatric counterparts.

Educational requirements: Three years of residency training; subspecialty fellowships are available.

Psychiatry. Physicians in psychiatry are concerned with the study, prevention, and treatment of mental illness and emotional and behavioral problems, from psychological, social, and physical approaches, including drug therapy. Many subspecialties exist including child and adolescent psychiatry, social psychiatry, community psychiatry (addressing the care of the mentally ill outside psychiatric hospitals), forensic psychiatry (dealing with criminal and legal issues), and neuropsychiatry (relating to brain disorders with mental symptoms).

Educational requirements: Completion of one year of training (like an "internship," in internal medicine) and three years of residency training.

Surgery. Surgeons deal with the study, diagnosis, and management of all disorders treated by operative surgery. This includes incision (cutting) into the skin or other organs, removal or repair of diseased tissues or organs, restoring structures to their normal positions, transplantation of tissues or whole organs, and implantation of mechanical or electronic devices. Many procedures today are performed by subspecialists (see the next section). Those not done by subspecialists are frequently in the realm of the general surgeon, although considerable overlap in responsibilities exists.

*The descriptions of specialties and subspecialties contained in this section were adapted from materials in the *American Medical Association Encyclopedia of Medicine* (Random House, 1989), with permission.

Educational requirements: Five to six years of residency training; subspecialty residencies are available.

Other Specialties and Subspecialties

Allergy/Immunology. Specialists in these fields deal with the diagnosis and treatment of any form of allergy and the functioning of the immune system. They might conduct tests to determine agents to which a person is allergic and recommend ways to avoid exposure or to build up the patient's immunity, as well as place the patient on a regimen of medications to control allergic reactions. They might also devise ways to stimulate the immune system to produce immunity (principally through the use of vaccines).

Educational requirements: Completion of an internal medicine or pediatric residency and two years of fellowship training.

Anesthesiology. Physicians in this field administer the drugs that control pain and consciousness during surgery. Anesthesiologists also assess the condition of a patient's heart, lungs, and circulation before he or she is sent into the operating room. They decide what actions should be taken if an emergency develops and are responsible for monitoring the progress of the waking patient and watching for any developing complications in the recovery room after surgery. Anesthesiologists also specialize in the control of pain after surgery and in patients with conditions—such as cancer—that cause severe pain.

Educational requirements: Four years of residency training.

Cardiovascular Disease. Those in this subspecialty of internal medicine are expert at diagnosing and treating problems related to the heart and peripheral vessels. Guided by symptoms such as shortness of breath, chest pain, irregular heart rhythms, or pain in the legs with walking, a cardiologist examines X rays, echocardiograms (studies using sound waves to view internal structures of the heart), electrocardiograms (studies showing the electrical activity of the heart), and special studies performed by injecting dye into the vessels of the heart to determine the specific cause of a problem. Depending on the results of the tests, the cardiologist might recommend changes in diet or physical activity, prescribe medication, or refer the patient to a cardiothoracic or vascular surgeon.

Educational requirements: Completion of an internal medicine residency and two years of fellowship training.

Colon and Rectal Surgery. Physicians in this surgical subspecialty perform operations to correct disorders in or remove diseased tissue from the small intestines, colon (large intestine), or the rectal area. Procedures can range from the removal of hemorrhoids to removal and reconstruction of part of the intestine (e.g., as in the treatment of colon cancer). Special techniques allow the physician to help patients retain fairly normal function, despite the often extensive removal of tissue required to treat disease in these organs.

Educational requirements: Completion of a surgery residency and one year of additional residency training.

Dermatology. Specialists in this area have been trained to treat conditions related to the skin, hair, and nails. Problems include everything from wrinkles, warts, and hair loss to acne, athlete's foot, and skin cancer. Treatment methods include medication, surgery, or the destruction of unwanted growths by freezing, burning, lasers, and radiation.

Educational requirements: Completion of one year of training (like an "internship," usually in internal medicine) and three years of residency training.

Emergency Medicine. These physicians have been specially trained to deal with the broad range of life-threatening conditions, ranging from acute asthma attacks to bullet wounds. The concern of the emergency care physician is to stabilize the patient as much as possible before transferring the patient to an appropriate hospital unit for further care and, if necessary, long-term treatment.

Educational requirements: Four years of residency training.

Endocrinology and Metabolism. Physicians in this subspecialty of internal medicine study and treat disease produced by abnormal function of the endocrine glands—structures that secrete hormones into the blood which regulate growth and

metabolism. Disease may result if these glands produce too much or not enough of these important molecules (e.g., giantism results from too much growth hormone, dwarfism from too little).

Educational requirements: Completion of an internal medicine residency and two years of fellowship training.

Gastroenterology. A gastroenterologist is a subspecialist in internal medicine who diagnoses and manages disorders of the digestive system. These specialists treat peptic ulcers of the stomach and duodenum and other conditions affecting the gastrointestinal tract, including the liver and gallbladder. The work of physicians in this area has been revolutionized in recent years by the development of fiber-optic endoscopes (long tubelike devices for looking inside and taking tissue samples from the esophagus, stomach, and intestines). Whenever possible, these specialists treat patients by advising them on diet and lifestyle and by prescribing medications. If necessary, they refer patients for surgical treatment.

Educational requirements: Completion of an internal medicine residency and two years of fellowship training.

Geriatric Medicine. Physicians in this specialty are concerned with the care of the elderly. Many diseases that affect this group occur in patients of all ages, but older people tend to respond differently to sickness and treatment. Aging is associated with progressive decline in the functioning of major organs. Consequently, infection in one of these organs that would normally cause only minor illness in a young adult might be life threatening in an older person and might cause confusion in the patient because of the added stress placed on the brain during illness. Furthermore, medications tend to behave differently in these patients because of a decreased ability of the body to process these drugs with age. Geriatricians are taught to recognize and deal with the special needs of this group of patients.

Educational requirements: Completion of an internal medicine or family practice residency and two years of additional residency or fellowship training.

Hematology/Oncology. Hematologists specialize in the study of blood and blood disorders such as anemia, leukemia (cancer of the white blood cells), and bleeding diatheses (clotting problems). They are experts at the measurement of blood constituents, used in the diagnosis of a wide range of disorders, not only those of the blood. Microscopic examination and the counting of blood and bone marrow cells (obtained using a special needle) are essential procedures in diagnosing different types of blood disorders. Oncologists are specialists in the diagnosis and treatment of cancer. Many specialize in a particular type of cancer such as leukemia. They conduct tests to determine the location, type, and extent of disease, and administer or supervise treatment in the form of radiation therapy, chemotherapy, surgery, or a combination of these. Frequently, a physician will be both a hemotologist and an oncologist.

Educational requirements: Completion of an internal medicine residency and one to two years of fellowship training for each subspecialty.

Infectious Disease. Physicians in this subspecialty of internal medicine receive concentrated training in the diagnosis and treatment of disease caused by the wide variety of disease-causing microorganisms (i.e., bacteria, viruses, protozoa, etc.) known to the medical profession. They are frequently called upon to solve the mystery of which disease process may be causing a patient to have a fever or other symptoms for which no cause can seemingly be found, or to propose the most effective and efficient set of antibiotics or other medications to treat a patient infected with several organisms. They are also experts in the prevention of illness through the use of vaccines and medications taken in anticipation of possible exposure to disease (e.g., from travel to a foreign country).

Educational requirements: Completion of an internal medicine residency and two years of fellowship training.

Nephrology. Specialists in this subspecialty area of internal medicine are concerned with the normal functioning of the kidneys, and with the causes, diagnosis, and treatment of kidney disease. Methods of investigating the kidneys include kidney biopsy (removal of a small piece of tissue for study), kidney function tests (measurement of substances in the blood produced or

Polio: A Dying Disease

An infectious disease that causes paralysis, mainly in children, polio reached pandemic levels in the 1940s and 1950s. While there still is no curative drug, this destructive disease could soon disappear. Polio has become more controllable thanks to vaccines created in the late 1950s and early 1960s.

In 1988, the World Health Organization (WHO) began its Global Polio Eradication Initiative—an international effort to eliminate the disease. WHO is working to eradicate the disease through systematic immunizations and close surveillance. The poliovirus cannot survive outside of a human host, so it is entirely possible to destroy the virus by ensuring that all potential cases are treated by immunization. Smallpox was eradicated in a similar fashion in 1977.

With the help of the United Nations Children's Fund, Rotary International, the U.S. Centers for Disease Control and Prevention, and countless volunteers around the world, the Global Polio Eradication Initiative decreased the number of polio cases from 350,000 in 1988 to 2,881 in 2000. As of 2001, countries still at-risk for polio include Afghanistan, Angola, the Democratic Republic of the Congo, Somalia, and Sudan, where immunization efforts are challenged by political conflict. But with continued international cooperation, WHO hopes to declare the world free of polio by the year 2005.

Source: World Health Organization, Division for Vaccines and Other Biologicals, Expanded Programme on Immunization; "Global Polio Eradication Initiative," 2001; *http://www.polioeradication.org*

processed by the kidneys), and special X-ray studies. Once a diagnosis is reached, these physicians propose the most effective drug or surgical therapy and make referrals as appropriate. They are experts in dialysis (methods of purifying the blood artificially—a function of the normal kidney) and the medical aspects of kidney transplantation.

Educational requirements: Completion of an internal residency and two years of fellowship training.

Neurological Surgery. Physicians in this surgical subspecialty are concerned with the surgical treatment of disorders of the nervous system—those in which a localized structural change interferes with nerve function. These include tumors of the brain, spinal cord, and associated structures; certain abnormalities of blood vessels that supply these structures (which may compress nervous tissues or cause bleeding into these tissues); localized infections of these structures; damage caused by accidents; and birth defects resulting in abnormal structures (e.g., failure of the bones covering the spinal cord to close properly). They also are concerned with the surgical relief of otherwise untreatable pain.

Educational requirements: Six to seven years of residency training; may include one year of research.

Neurology. The study of the nervous system and its disorders, particularly their diagnosis and treatment, is the concentration of the neurologist. In addition to a detailed knowledge of the structure and function of the brain, spinal cord, and nerves, these physicians must understand the many conditions that can affect those areas. To aid in the diagnosis of such conditions, extensive use is made of modern techniques to visualize these structures and their blood supplies. In the past, relatively few disorders of the nervous system could be treated effectively, but recent advances have expanded treatment options. Thus, by using new drugs and working closely with neurological surgeons, they are capable of helping a significant number of patients with such conditions.

Educational requirements: Completion of one year of training (like an internship, usually in internal medicine) and three years of residency training.

Nuclear Medicine. Physicians in this specialty use radioactive substances to detect and treat disease. The most important application of this field is in diagnosis. Radioactive materials (which are injected or swallowed) are taken up by body tissues or organs in different concentrations, and an instrument is used to detect the location or distribution of radiation within the body. The amount of radiation required is small and can produce images that reflect bodily functions as well as changes in the structure of organs and tissues. When such techniques are used for treatment, higher doses of radiation are usually required. Diseased tissues are destroyed by exposing them to an external radioactive source or by inserting a small piece of radioactive substance directly into a body tissue or cavity. Special emphasis in the training of these specialists is placed on aspects of safety since exposure to radiation can injure both healthy and diseased tissues.

Educational requirements: Completion of two years of residency in an approved clinical specialty and two years of additional residency training.

Ophthalmology. Those in this surgical subspecialty study the diagnosis and treatment of disorders that affect the eye, such as glaucoma (visual loss associated with increased pressure in the eye), retinal detachment, and cataracts (cloudiness of the natural lens of the eye). They assess vision and prescribe glasses or contact lenses to correct defects and perform surgery required to treat eye disease. Ophthalmologists frequently work closely with other physicians because many disorders of the retina at the back of the eye are signs of nonoptical disorders such as high blood pressure and diabetes mellitus. Careful analysis of a person's field of vision can reveal defects that indicate neurological damage, such as that caused by a brain tumor.

Educational requirements: Completion of one year of training (like an "internship," usually in internal medicine or surgery) and three to four years of residency training; subspecialty fellowships are available.

Orthopedic Surgery. Physicians in this surgical subspecialty are concerned with disorders of the bones and joints and the muscles, tendons, and ligaments associated with them. Orthopedists perform many tasks, including setting broken bones and putting on casts; treating joint conditions such as dislocations, slipped disks, arthritis, and back problems; treating bone tumors and birth defects of the skeleton; and surgically repairing or replacing hip, knee, or finger joints. They work closely with physical therapists and direct treatment plans to restore patients to as high a level of functionality as possible after surgery is performed.

Educational requirements: Five to six years of residency training.

Otolaryngology/Head and Neck Surgery. These specialists are experts in the medical and surgical treatment of disorders of the head and neck, excluding the brain, eyes, spinal cord, and spinal column. The term "head and neck surgery" refers to surgical procedures on certain tumors of the sinuses, throat, and neck, and to facial plastic surgery. Much of an otolaryngologist's time is spent treating common conditions, such as sinus infections, acute otitis media (middle-ear infection), persistent middle-ear effusion (fluid in the ear), tonsillitis, and minor hearing loss. But these physicians also are faced with complex problems such as otosclerosis (changes in the bones of the middle ear resulting in progressive deafness), dizziness, airway problems, uncontrollable bleeding from the nose, and cancers of the larynx and sinuses.

Educational requirements: Five to six years of residency training; subspecialty fellowships are available.

Pathology. Physicians in this specialty conduct laboratory studies of tissues and cells that help other physicians reach accurate diagnoses, and supervise other laboratory personnel in the testing and microscopic examination of blood and other body fluids. They also perform autopsies (examination of corpses to determine the underlying causes of death) and study the various factors that can cause changes and abnormalities in tissues and cells. Subspecialists in pathology may concentrate on blood banking (the science of providing safe blood products for transfusion), cytopathology (analyzing cells to identify disease), and surgical pathology (analyzing tissue removed during surgery, frequently to determine whether or not cancer is present).

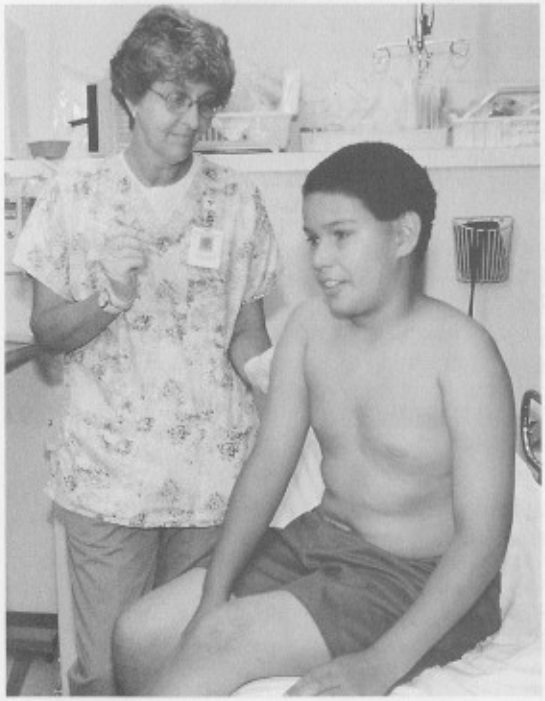
Educational requirements: Four years of residency training; subspecialty fellowships are available.

Physical Medicine and Rehabilitation. This specialty concentrates on diagnosing, evaluating, and treating patients recovering from or overcoming disabilities or impairments caused by injury (especially of the joints and muscles), illness, or neurological conditions such as paralytic strokes. Physicians specializing in rehabilitation examine and test the patient, establish a rehabilitation program, and supervise a team of therapists who help the patient carry out the program.

Educational requirements: Four years of residency training.

Plastic, Reconstructive, and Maxillofacial Surgery. Those who practice this subspecialty of surgery use special techniques to repair visible defects of skin and underlying tissue present from birth or caused by burns, injuries, certain types of operations, aging, or disease. Maxillofacial surgeons concentrate on restoring or reconstructing structures of the face. Every attempt is made to maintain or restore function of the affected structures and to create as natural an appearance as possible. They also perform procedures to improve the appearance of previously uninjured or malformed tissues (so-called "cosmetic" surgery).

Educational requirements: Completion of a surgical residency and two years of additional residency training.



From age 14 to 16 and beyond, it's good practice to be immunized against diphtheria and tetanus every 10 years.

Preventive Medicine. Physicians in this specialty deal with prevention of disease by the use of public health measures, such as the provision of pure water supplies; by health education aimed at discouraging smoking and the overuse of alcohol, promoting exercise, and giving advice about a prudent diet; by specific preventive treatments, such as immunization against infectious diseases; and by screening programs to detect diseases such as glaucoma, tuberculosis, and cancer of the cervix and colon before they cause symptoms. In this country the primary objective is to persuade the adult population to adopt healthier lifestyles, as most premature deaths are preventable, being the result of accidents and/or linked to factors such as an unhealthy diet, smoking, and excessive drinking.

Educational requirements: Two years of residency training.

Pulmonary Disease. Physicians in this subspecialty of internal medicine are concerned with problems and medical treatment of the lungs and airways, including pneumonia, cancer, bronchitis, and various problems resulting from exposure of the lungs to damaging substances (e.g., asbestos). They might use special tests to assess breathing (pulmonary function), and use special tubelike scopes to examine and take tissue samples from the lungs and airways. They also are experts in the use of artificial ventilation.

Educational requirements: Completion of an internal medicine residency and two years of fellowship training; further subspecialty fellowships are available.

Radiology. Physicians in this specialty use special diagnostic techniques including X rays, ultrasound (use of sound waves to form images of internal structures), magnetic resonance imaging (MRI, use of the magnetic characteristics of tissues to form images), and occasionally radionuclide scanning (monitoring the distribution of small doses of radioactive materials introduced into the body). Such testing can usually provide a "view" of almost any organ, system, or part of the body in a fairly noninvasive way so that diagnosis can be made and treatment planned, frequently without the need for exploratory surgery (i.e., surgery to look directly at the specific problem). These techniques also enable instruments to be accurately guided into different parts of

the body for both diagnosis and treatment (e.g., a needle to drain a collection of fluid deep in a body cavity). A separate discipline, called therapeutic radiology or radiation oncology, uses radiation to treat disease (primarily cancer).

Educational requirements: Completion of one year of training (like an internship, usually in internal medicine) and three to four years of residency training.

Rheumatology. This subspecialty of internal medicine is concerned with the causes, development, diagnosis, and treatment of joint, muscle, and connective tissue diseases such as arthritis (many types) and systemic lupus erythematosus ("lupus"). Rheumatologists use a wide variety of investigative techniques, ranging from X rays of joints to tests of muscle function and blood analysis. Treatment is often quite variable but includes antiinflammatory medication and pain medication, as well as physical therapy.

Educational requirements: Completion of an internal medicine residency and two years of fellowship training.

Thoracic/Cardiothoracic Surgery. Thoracic surgeons specialize in operations on organs within the chest cavity, including the lungs, esophagus, and trachea (windpipe). Such surgery is frequently needed to repair traumatic injuries, as well as to treat cancers of these organs. If they are also skilled in treating disease of the heart, they are called cardiothoracic surgeons, and may perform coronary artery (supplying the heart) bypasses to restore adequate blood flow to the heart because of narrowed arteries or repair injured or malformed structures of the heart.

Educational requirements: Completion of a surgical residency and two years of additional residency training.

Urology. Specialists in this field are concerned with the investigation and treatment of disorders of the urinary tract—the kidneys, ureters, bladder, and urethra in patients of both sexes—and of the prostrate gland, epididymis, seminal vesicles, testes, and penis in men. The urologist might use special investigative techniques including pyelography (X-ray study of the urinary tract using intravenous dye), cystoscopy (looking at the inside of the bladder or urethra with a special thin tubelike device), and ultrasonography (using sound waves to make images of internal structures). Treatment might range from medication, to surgery, to special techniques such as lithotripsy (using sound waves to pulverize renal calculi, or *kidney stones*).

Educational requirements: One year of surgical internship and four years of residency training.

Vascular Surgery. This subspecialty of surgery deals with the diagnosis and treatment of disease of blood vessels exclusive of those associated with the heart, lungs, and brain. They perform procedures to bypass obstructed vessels in the legs (usually secondary to atherosclerosis), permitting improved blood flow and therefore increased function; to repair traumatic injuries involving severed major vessels; and to treat aneurysms of the aorta.

Educational requirements: Completion of a surgical residency and one year of additional residency training.

The Practice of Medicine

Although medical professionals on television and in the movies are frequently shown surrounded by complex electronic gadgets and mechanical devices, in real life they usually can be found in their offices or in a hospital seeing patients with specific problems.

Determining what those problems are, and what specific diseases might be causing them, is the true "practice" of medicine. However, this doesn't usually begin by whisking the patient off to a CT scanner to find out whether or not there might be a brain tumor—that comes later once that test has been determined to be *necessary and appropriate* to that patient's problem. While there are emergency situations where one must "act first and ask questions later," physicians normally begin by gathering information.

There are three major steps in this process: taking a *history*, performing a *physical examination*, and ordering any *laboratory or diagnostic tests* that might be helpful. Each of these phases provides different information, and all of this information can be important.

With each step, most physicians will begin to develop in their minds a list of possible diagnoses (possible diseases or problems), a list that usually gets shorter with each step, as more information becomes available.

You are probably beginning to see that the job of a physician is sort of like the job of a detective. Every cough, sneeze, ache, pain, bump, swelling, redness, or other abnormality that a patient has, as well as how long each symptom has been present or how long it took to develop, is a "clue" in the "mystery" of diagnosing the patient's illness. It is therefore important not to miss anything.

Over the years, a fairly standard way of writing down medical information has been developed, helping those who use it to be successful in organizing their thoughts and to avoid overlooking details.

Taking a Medical History

The first step when a patient comes to you with a problem is to take a thorough history. A standard medical history usually includes the following:

Chief complaint. This is usually written in the patient's own words and states the specific problem for which the patient is seeking medical care, as well as the length of time it has been present (duration).

History of present illness. The events and circumstances, including relevant past medical problems, leading to the patient's current problem.

Past medical history. A list of medical and surgical problems, as well as treatments, the patient has had in the past.

Family medical history. Known diseases in immediate family members. This is important because some disease processes are known to be inherited (that is, they "run in families").

Social medical history. Information about the patient's occupation, income, sexual activity, and use of alcohol, tobacco, or illegal drugs, etc. This information is important because certain factors might make it more likely for a patient to have specific problems (e.g., smoking might increase a patient's risk to develop lung cancer).

Medications and allergies. Knowing about all the medicines the patient is taking, including those purchased without a prescription ("over the counter"), is extremely important since any drug, in addition to the effects it is supposed to have, might actually cause disease in the form of unexpected (and unwanted) side effects. Knowing any allergies to medications that a patient has also might influence the choice of treatments.

Review of systems. This is a series of specific questions about possible symptoms the patient might have but might not realize are related to his or her problem. These questions are usually organized by body system (e.g., cardiovascular, respiratory) and are asked to avoid missing important details.

The importance of taking a careful medical history cannot be emphasized enough, since this information tends to determine where the physician concentrates his or her attention when performing a physical examination and ordering tests. A famous physician of the 19th century, Sir William Osler, said, "Listen to the patient—he [or she] is telling you the diagnosis." This advice is still true today. It is fair to say that around 80 to 90 percent of diagnoses are usually made from the history alone.

The Physical Examination

Once a history has been gathered, the *physical examination* gives a physician further information to help explain what might be causing the patient's problems. Four basic techniques are used in this process: inspection, palpation, percussion, and auscultation.

Inspection involves simply looking at the patient and describing any abnormalities that may be present. Changes in skin coloration or a "bump" in the skin might be detected by inspection.

Palpation involves touching the patient and noting changes in the normal "feel" or size of structures, or locating structures that are not normally present. Enlargement of the liver, spleen, or a lymph node might be detected by palpation.

Percussion involves using sound waves generated by light but firm tapping on the surface of the body to detect changes inside. One finger is used to apply pressure to the desired area while the index finger of the other hand taps on the first finger. This technique relies on the fact that different tissues have different densities. For example, tapping over the liver (a fairly solid tissue) produces a much duller noise than the hollow sound produced by tapping over the lung or the intestines (frequently filled with air). Pneumonia (indicated by a dull sound over a specific area of the lungs) might be detected by percussion.

Auscultation involves using a stethoscope to listen to body organs that have characteristic sounds. The most common use of this technique is to detect changes in heart function, as new or different noises often give clues as to the location within the heart of any problem that might be present. Changes in the character of sounds of the lungs or intestines might also be detected by auscultation.

Physical findings are usually recorded by location or body system. Commonly used headings include the following:

- Vital signs: temperature, pulse, respiratory rate, and blood pressure
- HEENT (head, ears, eyes, nose, and throat)
- Neck
- Chest and lungs
- Heart
- Abdomen
- Extremities (arms and legs)
- Genitalia
- Rectum
- Neurologic (strength or weakness, reflexes)
- Skin and integument
- Mental status

Tools of the Trade

Special tools frequently are needed to examine some parts of the body that could otherwise not easily be studied, and to obtain certain useful responses or measurements.

Ophthalmoscope. Used to examine the inside of the eye. Special mirrors and lenses allow light to enter the eye through the small pupil and be reflected back to the eye of the observer, so that the retina can be seen. This allows inspection of the arteries, veins, and the optic nerve head of the eye.

Otoscope. Used to examine the ear. It includes a magnifying lens, a light, and a speculum (a funnel-shaped tip that is inserted into the ear canal). The instrument allows easy inspection of the outer ear canal and the eardrum, as well as some structures or the presence of fluid behind the semitransparent drum.

Reflex hammer. Used to apply a "pulse" of force (short quick blow) to a stretched tendon (e.g., in the knee). This stimulates the central nervous system and frequently causes a response (e.g., the knee jerk). It is used to examine the nervous system, as abnormal reflexes may indicate disease.

Sphygmomanometer. An instrument for measuring blood pressure. It consists of a cuff with an inflatable bladder, a rubber bulb for inflating the bladder, and a gauge for indicating the pressure. Repeated measurements allow monitoring of changes that might require beginning or modifying therapy.

Stethoscope. An instrument used to concentrate and amplify sounds from various parts of the body so that they can more easily heard by the listener. It is most frequently used to listen to the heart, lungs, and abdomen. Abnormal sounds can be clues to various problems.

Diagnostic Tests and Their Usefulness

Once a physician has completed a physical examination, he or she has likely reached a tentative diagnosis as to the patient's problem. It is then common to make use of various tests to confirm—and possibly refine—that diagnosis.

The vast number of tests available today is quite impressive. Various substances in blood, urine, and other bodily secretions can be measured in very small amounts using sophisticated techniques. Special scans involving X rays, ultrasound, magnetism, or radioactivity can detect tumors or other abnormalities in early stages when they are the most treatable. Still other tests involving detection of electrical impulses (such as electrocardiogram) generated by tissues of the body are part of the arsenal used to combat disease.

And while all these tests are available, the physicians who use them must select the ones they feel will help their patients the most. Testing is not always risk-free, some tests can even cause pain or discomfort, and the patient cannot supply enough blood (and remain living) to perform all the blood tests currently available to the medical profession—nor would the patient or the insurer likely be willing to pay for all these tests, some of which can be very expensive.

Even if it were possible for every test to be done, unless the patient were extremely ill, nearly all of the test results would be completely normal and would therefore not provide much useful information about the patient's condition. Worse yet, some test results might actually be abnormal by random chance, and have nothing to do with the disease process, sending the person taking care of that patient on a wild goose chase trying to figure out what the abnormal test results mean.

Therefore, the general idea is to do enough diagnostic testing so that a disease process is not overlooked, keeping in mind that tests are not perfect (or free).

Why Aren't Tests Perfect?

Many medical tests are actually measurements of the contents of a particular body fluid, such as urine or blood. The normal values for these measurements are established by performing the test in a large number of healthy people. Just like people vary considerably in their height and weight, there also is variation in the actual values of many of these tests from person to person. This is why physicians never look at a laboratory test by itself; instead, they view tests in light of what they know about the patient from that patient's medical history and physical examination.

For example, an elevation in the number of white cells in the blood (white blood cell count) is found in many infections. However, some apparently healthy individuals also may have a slightly elevated white blood cell count. If a patient had a high fever, a cough, and abnormal sounds in the chest when examined with a stethoscope, an elevated white blood cell count would be a good indication of pneumonia. On the other hand, if the person were perfectly healthy, with no complaints or physical findings, a slight elevation of the white blood cell count would not be meaningful.

Sometimes, the result of a laboratory test can be interpreted only with the results of additional testing. For example, the finding of sugar (glucose) in the urine could suggest a diagnosis of diabetes. On the other hand, certain types of kidney disease, as well as the administration of intravenous fluids, also can cause glucose to appear in the urine. In diabetes, however, the concentration of glucose in the blood also is elevated. So, before a physician makes a diagnosis of diabetes on the basis of an abnormal urine test, the blood glucose level also will be measured.

While laboratory tests are a critical part of the modern evaluation of a patient, they cannot be relied upon in isolation. Knowing how to order the appropriate tests, and to interpret the results of these tests, is an important part of the science and "art" of medical practice.

Screening Tests

Some tests are very good at detecting treatable diseases and are therefore used to screen people for disease rather than confirm a suspected diagnosis. Such tests are valuable because they permit early detection of a problem when a treatment will be the most helpful.

Virtually every person who enters a health-care setting has a blood pressure check. Why? High blood pressure (unless it is *very* high) initially has no symptoms. Yet if it is allowed to persist, damage to many body organs can occur over an extended period of time. Much of this damage can be prevented with appropriate treatment. Therefore, it is in the interest of the patient for the condition to be detected, and treatment offered, as early as possible. Since it is relatively *easy* and *inexpensive*

to do, and since high blood pressure is fairly *common*, it has been deemed useful to check for this in everyone. Therefore routine blood pressure measurement is a useful screening test for high blood pressure.

It is also in the interest of a patient with a brain tumor to have the tumor detected as early as possible so that treatment can be initiated. A CT (computerized tomography) scan of the head (special X-ray study) is very good at detecting such tumors when they are small and most treatable. Why then doesn't everyone who is seen in a health-care setting have this test done? The reason is that very few tumors would be found this way compared to the huge number of tests that would be done. Unlike high blood pressure, brain tumors are very rare. Therefore, the effort required to perform this (very expensive) test to detect tumors has not been felt to be appropriate by most health-care professionals.

Thus, it would appear that a good test to screen for disease must have certain characteristics:

1. The test must help identify a condition that is fairly common (to make it useful to look for in a large group of people), or one that is sufficiently devastating to the well-being of an affected patient.

2. The test must help identify people with a condition that is treatable. (Otherwise, why look for it?)

3. The test must be relatively good at identifying people with the condition the test is used for detecting. It can also be used to determine untreatable conditions, to avoid unnecessary treatment.

4. The cost of doing the test and the early treatment must be low when compared to the cost of treating the disease if it is not found early (i.e., it must be cost-effective).

Checking for high blood pressure meets all of these criteria, while performing a CT scan to detect brain tumors meets only numbers 2 and 3.

It should be pointed out that the first characteristic allows screening for less common diseases. For example, newborn babies are routinely screened for conditions that, if untreated, may result in permanent mental retardation, even though these conditions are fairly rare. This is because the treatment is simple and the cost of caring for a mentally retarded individual throughout a lifetime is very high when compared with the cost of the test, especially when the condition is preventable.

Useful Measurements

Taking a blood pressure reading. Place both thumbs firmly against the inside of the elbow and feel where the pulse from the brachial (meaning "arm") artery is the strongest. Remember where this is.

Fit the blood pressure cuff on the upper arm snugly. If there is an arrow on the cuff, align it with the artery you found before. The cuff should be positioned so that it is at the level of the heart with respect

to the ground. Apply the diaphragm (flat part) of a stethoscope over the place where the pulse was the strongest.

Close the valve, and pump the bulb of the cuff until the pressure reading is higher than you expect the pressure to be (200 should be sufficient in young people). This stops all blood flow in the artery.

Slowly release the valve until the pressure is dropping about 5 units (mmHg, or millimeters of mercury) per second.

Listen with the stethoscope for blood flow to begin again in the artery. This will be a "spurting" sound since the blood is being forced through the portion of the artery that was closed off. The reading at this point corresponds to the highest pressure the heart can generate (high enough to open the collapsed artery) and is called the *systolic* pressure.

Continue to carefully listen as the pressure in the cuff falls. When the spurting stops, note the reading. This is the *diastolic* pressure and corresponds to the resting pressure of the artery (the pressure that the stretchable walls of the artery exert on the blood when the heart is at rest/between beats).

The pressure is reported as systolic "over" diastolic. A normal blood pressure reading is less than 130 over 85, or 130/85 mm Hg. A systolic level higher than 130 means that the pressure within the arteries during each heartbeat is great enough to eventually damage vessel walls. A diastolic pressure higher than 85 means that your heart and blood vessels don't relax well between heartbeats.

High blood pressure, or *hypertension*, puts a person at greater risk of heart and kidney disease and stroke.

Source: Some of the information in this section was taken from the Mayo Clinic Web site, *http://www.mayoclinic.com*

Taking a pulse reading. Press the second (index) and third fingers of one hand against the wrist of the patient, just below the thumb on the palm side, and feel for the pulse of the radial (near the "radius" bone) artery. Do not use your thumb, as it has a fairly strong pulse of its own and will likely confuse you.

Count the number of pulses you feel while you observe a watch or timer for 60 seconds. The number of pulses felt is the value you record (in pulses per minute). Many people count the number of pulses in 15 seconds and multiply by 4, or the number in 30 seconds and multiply by 2. It should be noted that this becomes very inaccurate if the pulse is irregular.

Sensitivity vs. Specificity

Sensitivity and specificity are important factors that affect the usefulness of diagnostic tests. *Sensitivity* relates to the ability of a test to accurately detect a disease when it is present—correctly reporting a positive result. *Specificity* relates to the ability of a test to accurately rule out a disease when it is absent—correctly reporting a negative result. In general, a test that has a high level of sensitivity will have a low rate of specificity, while a test that has a high rate of specificity will have a low level of sensitivity.

Final Diagnosis and Treatment

Once a physician has collected all the information he or she feels is necessary for a diagnosis, the course of action must be determined. Frequently there are several options available to treat a given illness, some more effective than others, and the option that will best serve the needs of the patient must be selected.

It is important to keep in mind, however, that a physician can never have enough information, and that it is possible the diagnosis might not be correct. All the treatment in the world will do the patient no good at all if the physician is treating a disease the patient does not have, especially if the disease missed is very serious. The physician must therefore be willing to reassess the available evidence, including the patient's lack of response to a treatment expected to work.

And since some treatments have significant unwanted side effects, the wrong therapy might actually be worse than the disease that is present. As the Hippocratic Oath counsels the physician to essentially "do no harm," and since the trust the patient places in the physician is great, it is very important to avoid hasty decisions that might lead to undesired results.

"Pacemaker" for the Brain

Cardiac pacemakers work to keep the heart beating at a steady, regular rhythm. This same technology has recently helped neurologists develop a breakthrough technique that helps alleviate the symptoms of Parkinson's disease. The technique, pioneered by Dr. William C. Kohler of the University of Miami–National Parkinson Foundation, is called deep brain stimulation.

Parkinson's is a progressive disease that affects one out of every 100 people over the age of 60; its symptoms include stiffness, muscle weakness, and tremors, sometimes violent. The symptoms result from a decrease in the production of a chemical in the brain called dopamine, which is caused by the degeneration of certain brain cells. The reason for this degeneration remains a mystery, but deep brain stimulation is a promising alternative to current drug therapies that often have undesirable side effects.

The treatment calls for a thin metal electrode to be surgically implanted in the brain and connected to a device—much like a pacemaker—inserted under the skin. The device can be turned on and off, depending on the intensity of the symptoms. The surgery is complicated and is not suitable for every patient, but for some deep brain stimulation can mean the freedom to participate once again in activities like cycling and golf that they have had to refrain from for years.

Source: "On the Brink of Beating Parkinson's," by Christine Morris. *The Miami Herald*, January 18, 2001.

A Sample "Simple" Patient

The shaded box contains a sample medical record for a patient who appears to have a relatively simple problem—likely the "common cold." It is presented to give you a feeling for what has been described above and how a medical professional might organize his or her findings in such a patient. Obviously, a complicated problem might warrant more elaborate description, extensive examination, and sophisticated testing, but the key is to understand how the components fit together, permitting the health professional to arrive at a logical diagnosis and treatment.

A Sample "Simple" Patient

Chief Complaint
"Stuffy nose and fever for three days"

History of Present Illness
The patient is a 26-year-old white male with a three-day history of nasal congestion and a nonproductive cough (i.e., no mucus comes out of the lungs despite the coughing). He has taken some over-the-counter decongestants and cough syrups, without significant relief. He also notes a fever (confirmed at home by thermometer) of 101° F, which responds to acetaminophen (Tylenol, Panedol, etc.). He states that several people at work have had similar symptoms during the past two weeks.

Past Medical, Family, and Social History
No relevant findings

Medications
Pseudoephedrine (Sudafed, a decongestant) and cough syrup

Allergies
Allergic to penicillin

Physical Examination (Relevant Findings)

Vital signs:	Temperature 100.5° F (37.6° C); pulse: 100; respirations: 24; blood pressure: 140/80
HEENT:	Ears: tympanic membranes (ear drums) intact, no noted fluid; nose: mucosa pink and moist; throat: mild erythema (redness), no exudate (pus) on the tonsils
Neck:	No palpable lymph nodes
Heart:	Regular rate and rhythm, tachycardia (fast beat)
Lungs:	Normal breath sounds; no areas of consolidation (i.e., no evidence of pneumonia)
Abdomen:	Normal bowel sounds, soft, non-tender, no masses
Extremities:	Warm, normal pulses, poor turgor (texture of skin is "doughy," indicating loss of water)

Laboratory and Diagnostic Tests
Complete blood count: Within normal limits
Blood chemistry: Consistent with mild dehydration

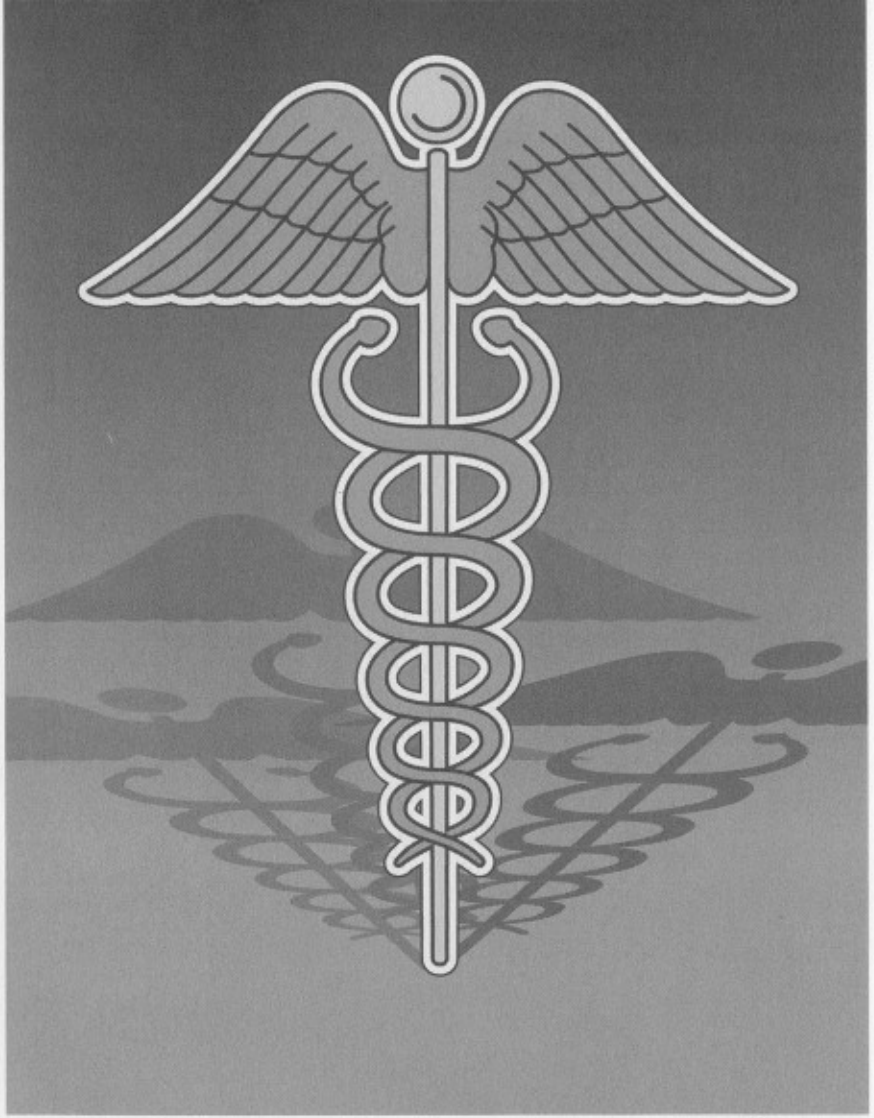
Diagnosis
Upper respiratory tract infection, probably viral

Treatment/Therapy
Encourage intake of fluids (four to six glasses of water per day)

Acetaminophen every four hours as needed for fever

Over-the-counter cough syrup (during the daytime)
Codeine cough syrup at night to promote the ability to rest (prescription required as it is habit-forming; can cause drowsiness, so dangerous activities should be avoided while taking)

Follow-up
Return to be seen if symptoms do not resolve or if cough becomes productive of yellow or green mucus (indicating bacterial infection possibly requiring antibiotics).



Influencing Medical Practice

When most people think of the practice of medicine, they probably picture a health-care professional sitting down with a patient to address a specific problem. While this might have been true in the past, things are no longer quite that simple.

Various groups play a part in shaping the practice of medicine. This section describes the roles played by three interested parties—the government, insurance companies, and professional societies—in influencing health care in the United States.*

The Role of Government

At both the national and the state levels, government has a major influence on the practice of medicine. This influence stems from the government's inherent responsibility to protect the public interest and its increasing involvement in funding several aspects of health care.

Federal Government. All three branches of the federal government play a part in this process, with the executive and legislative branches having the greatest roles. The executive branch became heavily involved in the 1960s when the Medicare and Medicaid programs were created by Congress. Medicare funds health care for senior citizens; Medicaid funds health care for the poor and certain disabled people. Since the creation of these programs, an extensive bureaucracy has been constructed to administer them.

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*Portions of this section were adapted from materials provided by Jonathan L. Burkhart, program administrator, Department of Resident Physician Services, American Medical Association.

The Department of Health and Human Services (DHHS) is the main governmental agency responsible, led by a secretary who reports directly to the president. It has the second-largest budget of any department within the federal government. Through several subagencies, the DHHS administers these and other government programs and oversees various aspects of the training and education of physicians. Also under the DHHS are the Public Health Service; Centers for Disease Control and Prevention; National Institute for Occupational Safety and Health; Alcohol, Drug Abuse, and Mental Health Administration; National Institutes of Health; Food and Drug Administration; and Health Resources and Service Administration.

The Department of Veterans Affairs also plays a significant role through its administration of Veterans Affairs hospitals and health centers that care for the nation's veterans. It also trains a significant number of medical students, resident physicians, and other health-care professionals.

Within the legislative branch, congressional committees in both the House of Representatives and the Senate control the allocation of funds and thus decide which aspects of health-care programs to create or eliminate as the president's proposed governmental budget makes its way through Congress. The amount physicians and other health-care professionals are paid for treating Medicare patients often is decided during these budget deliberations.

While frequently indirect, the judicial branch influences health-care issues with social implications, such as abortion and the right to refuse medical treatment, through court decisions that shape the way society addresses concerns in these and other important areas.

State Government. Through their various Practice Acts (sets of laws), state governments determine the parameters for the practice of health care within their respective borders and thus have a great deal of influence over what health-care professionals can and cannot do.

For example, a fairly simple issue involves who is permitted to treat patients. Just having the desire to practice health care is obviously not enough to begin doing so. Each professional is expected to possess a certain level of education and competence. Therefore, the Practice Acts set forth minimum requirements for education and training that must be fulfilled before a license to practice is granted and empower various boards (e.g., medical, nursing, etc.) to handle the day-to-day details involved in certifying qualified individuals. These boards also receive complaints from the public and investigate the validity of such claims, suspending or revoking licenses when necessary. In this way, states monitor the quality of care rendered by practitioners.

State governments are also called upon to bear the responsibility for providing necessary health care for the poor (e.g., those without adequate insurance) and administering the Medicaid program previously mentioned, supplementing federal funds with state funds where necessary and appropriate. Since each state is free to establish its own standards for eligibility and benefits, these programs can be quite variable, both in their cost to the taxpayer and in their effectiveness.

The Role of Insurance Companies

Earlier in this century, patients paid for their health care directly. More recently, however, it has become more economical to participate in some form of health insurance plan. In this way, the cost of health care is spread over a large group of people, each member of which pays a relatively small amount. Since not everyone in the group is likely to get sick in a given period of time, money paid by those who are healthy is used to subsidize the medical bills of those who become ill.

An obvious benefit of such a system is that each person receives (almost) all the health care he or she will require for a fixed, predictable fee. Unfortunately, having insurance makes some patients lose sight of the true cost of health care and may encourage them to try to get more than they actually need from the program. Such patients demand various procedures simply because they feel paying insurance premiums entitles them to "anything they can get." On the other side of the coin, some health-care professionals may opt to do certain procedures simply because an insurance plan will pay for them, rather than because they are medically necessary.

Partly for these reasons and more important ones, including the rapid introduction of new technologies for improved diagnosis and treatment, health-care costs have risen significantly over the past three decades. Insurance companies (and the government in its role as an "insurance company" for the poor and the elderly) are interested in seeing that those covered by policies receive the health care required in a cost-effective

manner. They have therefore become increasingly involved in establishing rules and regulations defining how much will be paid for specific examinations and procedures in an effort to minimize any unscrupulous practices.

Some health insurers are taking an even more active role in patient care decisions, both as a way of controlling costs and in an effort to improve upon the quality of care provided to their customers. Some companies have designed "centers of excellence" for certain complicated procedures (open-heart surgery and organ transplants, for example), and direct their customers to these centers. Others have recognized that there is a great variability in the care provided to patients with such chronic diseases as asthma or diabetes. The companies have defined what is considered to be the "best practices" in the care of such patients and monitor physicians to insure that they are practicing within these guidelines. While such practices do not carry the force of law, physicians who do not comply often risk a loss of patients.

Insurance companies also have become more active in "negotiating" the cost of procedures with physicians. In the early days of health insurance, physicians would simply bill insurance companies what was considered reasonable for that procedure. Today, many companies negotiate with physicians and hospitals for discounts on such procedures. In return for agreeing to accept such discounted rates, physicians receive the assurance that the insurance companies will direct large numbers of patients to them for care.

The Role of Professional Societies

Because the potential impact of decisions related to health-care issues might not be fully understood by their makers (simply because they might not deal with patient care on a day-to-day basis), health-care professionals have established mechanisms to guide the making of sound choices. These mechanisms usually take the form of professional societies that work to see that the views of their memberships are presented in an organized fashion.

The American Medical Association (AMA), founded in 1847, is an example of such a professional society, and is the largest association of physicians in the country. The AMA is run by a house of delegates composed of physicians elected by each state and many medical specialty societies. The AMA's goal is "to promote the science and art of medicine and the betterment of public health." Thus, improving public health and allowing all citizens access to high-quality medical care are major concerns of the association. Through its house of delegates, board of trustees, various councils, and staff, the AMA establishes and attempts to implement policy on various topics related to health care.

The AMA's influence stems from its lobbying efforts and its ability to serve as a "unified voice" of physicians. It is frequently called upon to give advice to governmental, regulatory, and judicial bodies seeking to make changes in medical practice, medical education, and health-care funding.

Similar medical societies exist at the state level and exert influence in many ways. First, through their delegates, states contribute to the making of policy regarding medicine throughout the country. Second, because of the increasing authority of state governments with regard to health-care issues, state societies lobby for changes in laws and regulations at that level. State societies also often have representatives on licensing agencies and other statewide policy-making bodies.

Specialty societies (those that represent members of a particular medical specialty) have become increasingly important with the rapid development of the science of medicine over the past half century. Because they exist for physicians with a specific area of expertise, they can provide educational programs and disseminate information most applicable to the needs of their members. In addition, specialty societies occasionally can be more responsive to their constituencies because they understand and work directly for the specific goals of the specialty.

The system described permits the physicians of this country to be heard on issues affecting them. Almost all of the other health-care professions have similar mechanisms in place to accomplish the same result on issues related to their specific occupations.

It should be clear from this short section that many challenges face the field of medicine today, and many people play a part in facing these challenges. Many of the issues discussed, and others that were not touched upon, are beyond the scope of this pamphlet, as are their "solutions." And while it is not specifically required for you to be familiar with such issues, you might wish to discuss some of them with your counselor as you work toward earning the Medicine merit badge.

Medicine—Here and Abroad

The health-care system used in this country is not the only one available. Countries deliver and help pay for care to their residents using different methods from those in the United States. Each of these methods takes into account the resources available and the differing health-care needs and expectations of the people it serves.

Factors Influencing Health-Care Delivery

Resources

"Developed" countries* with highly industrialized economies can afford to devote significant resources to health-care services for their citizens. "Developing" countries, on the other hand, must devote a larger percentage of their resources to providing basic necessities such as food and shelter for their people, and, therefore, funds available for health care are much scarcer.

Developing countries may often find that their limited resources are best used in public health efforts rather than in direct care to patients. For example, investments in clean water technology will help to control diseases such as cholera, and insect control efforts are crucial to the control of malaria. Money targeted to such programs, in the long run, will do much more to improve the overall health of a developing country than using a similar amount of money to treat the diseases once they have occurred.

The result of varying abilities to devote resources to health-related needs is that different types of diseases tend

*Although for simplicity in this discussion countries are referred to as "possessing resources" or "making decisions," etc., such powers usually are held by individual citizens and/or the government of the countries involved.

to prevail in different populations. For example, infectious diseases tend to be the primary concern of patients in developing countries and tend to lead to the greatest morbidity and mortality rates. In developed countries, however, infectious diseases have largely been controlled, allowing greater concentration on more "sophisticated" disease processes such as cancer and atherosclerosis, which tend to be promoted by the diet and lifestyles of those in industrialized nations.

Specialization

In turn, the types of diseases requiring treatment tend to influence the need for specialization. In countries where infectious diseases predominate and large rural populations exist, there is a much greater need for those delivering primary care. More developed countries with largely urban populations also use primary care health-care professionals, but they tend to require a significantly higher percentage of various specialists to handle the health-care needs of their peoples.

Values

Because countries have limited resources, they must decide what health-care services they can provide without sacrificing things that are felt to be more important. Such decisions are affected, among other things, by the values of the people in the specific country.

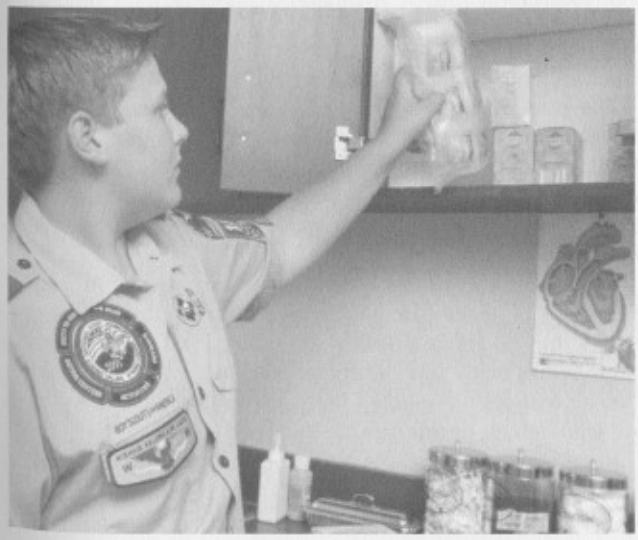
Life-Sustaining Care. Most societies regard providing care that is "necessary to preserve life" to be a high priority, and receiving this type of health care has become almost a "right" in many places. However, the extent of this care can vary greatly and might range from appropriate antibiotics (medications to fight infection) to complicated life-support equipment (e.g., ventilators and monitors). The better able a country is to devote its resources to health care, the more likely patients are to receive more complex and costly levels of life-sustaining care.

Essential Care. Similarly, countries make value judgments as to whether they will provide care that, while not essential to life, is essential to permit normal functioning in the society. Again, provision of such care varies with the country, but it could include surgical repair of birth defects, or rehabilitation after an injury to permit a patient to return to work.

Elective Care. Treatments and services that improve the quality of life of a patient, but that do not fall into the other two general categories are considered elective health care. An example of this includes some cosmetic plastic surgical procedures. Since such care usually benefits only the patient, it is usually thought of as an expense the patient must bear. Thus, elective care is more frequently available in developed nations (where more resources can be devoted to health care) rather than in developing ones.

Expectations

A fourth factor influencing the level of health care offered is the expectations of the patients receiving such care. In countries where people have known little health care (other than that minimally necessary to sustain life), the amount of care they expect to obtain is limited. Patients in industrialized nations, however, tend to have greater expectations. Since they frequently have larger incomes and can more readily pay for health care themselves if it is not provided by the government, they expect to be able to obtain a higher level of care and services, especially if historically these have been provided in the past. Thus, attempts to restrict services offered (e.g., in the interest of cutting costs) usually are more readily accepted in developing, as opposed to developed, nations.



Volunteering at a local hospital or nursing home can be rewarding for you—and those you help.

Health Care in Developed Nations

United States

An example of a developed, industrialized nation is the United States. Here, health care, like other services, is provided on a fee-for-service basis in a market economy. Until recently, this has meant that patients or their insurance companies paid a specific amount for each examination, test, or procedure. Uninsured individuals—those who did not have insurance to cover their health-care costs—either paid these costs themselves ("out of pocket") or were covered by one of the government programs (Medicaid for underprivileged people or Medicare for people who are elderly or disabled).

Lately, the rising cost of health care in the United States has resulted in major changes to this system. Insurance companies now play a much more active role in medical practice. For example, rather than paying any specialist their customer might select for treatment, many companies are developing "panels" of physicians for each specialty. The customer must then obtain care from a member of the panel. In turn, insurance companies negotiate with the physicians on the panel for significantly reduced rates in the cost of these procedures. While this process has helped control the costs somewhat, it may limit the individual's choice of physician.

In this system, the total amount of money spent on health care is determined by *what the people* (through their insurance companies, employers, and the government) *are willing to pay*.

The great majority of professionals who practice independent health care are private practitioners, and thus their incomes are determined by the number and type of patients they see. Health-care professionals in support roles (or in businesses such as hospitals) are paid competitive salaries based on their abilities and talents.

The advantages of this type of system are several. Because the earnings of health-care personnel depend on the quality of the work they do (since a health-care professional who mistreats patients or has many poor treatment outcomes will find himself or herself without a clientele), there are built-in incentives for those who deliver health care to do a good job.

In addition, since people here tend to expect (and are willing to pay for) the best and most advanced treatments, strong incentives exist to develop new methods for addressing health-related problems.

On the negative side, receiving health care is dependent on whether a person can pay for it, usually through some form of employer-offered insurance plan. Individuals who are unemployed or, more commonly, are employed in jobs where health insurance is not a benefit, are in a very difficult position. While they can purchase health insurance on their own, this tends to be too costly for many families. Thus, they frequently go without health insurance entirely, risking even greater hospital and physician bills if they were to become ill or injured. The government provides a "safety net" in the form of the Medicaid program for families whose income approaches the poverty level, but millions of families find themselves in the unfortunate "middle ground" of having too much income to qualify for Medicaid but still not being able to afford health insurance.

Because total costs spent on health care are determined by the total amount of health care given, and because the incomes of health-care professionals and those who provide related products and services also tend to depend on this, it is somewhat difficult to control the overall amount spent on health care in this country.

This system is ill-suited to promoting preventive health. Programs such as smoking cessation, obesity prevention, and aerobic exercise have proven value in improving health. There is, however, little incentive in the American health insurance industry to offer such services.

Sweden

Although Sweden is tiny compared to the United States, the quality of life there is very similar. Education, availability of goods and services, housing, and transportation, for example, are alike in the two countries.

Sweden has taken a very different approach to delivering health care to its people. Health care there is considered a right of citizenship—it is "nationalized," and Swedes are entitled to care regardless of their economic situation, age, or employment status. The system is paid for mainly by taxes (tax rates there are quite high compared to rates in the United States); patients frequently are required to pay for a small "copayment" at the time they receive services.

Citizens of countries with nationalized health-care systems generally receive all of their care through the system. Those with a greater means of income, however, may choose to receive some or all of their care from private practitioners who work outside the government system. They also may leave the country for care elsewhere.

Although the central government has ultimate responsibility for the system, the management is spread out, with much of the decision making made at the regional or city government level. Physicians generally receive a salary.

The advantage to this system is that all citizens receive a standard level of care. Costs are predictable and directly controlled by the amount of money the country budgets for health care. Since society directly bears the burden of health-care costs, there is a greater incentive to promote preventive medicine and public health efforts such as immunization.

On the other hand, such a system is fairly rigid and bureaucratic, requiring lots of paperwork, and is occasionally criticized as insensitive to the needs of the individual patient. New technologies and procedures may take longer to be introduced into the system because of concerns about their impact on overall health-care costs.

Canada

Another example of a developed nation is Canada. While some private methods of health care are available, Canada relegates much of the responsibility for providing health services to governmental agencies, and the vast majority of its citizens elect to participate.

Within this type of system, health-care personnel are employed by such agencies, administered within each province (like a state). They are paid fixed salaries, and patients "pay" for their care in the form of taxes to the government, somewhat like health insurance premiums in this country.

While such a system provides health care for virtually everyone, much like in Sweden, and allows better prediction of health-care costs (helping to control the total amount spent), it, too, is fairly rigid and limits the services offered. Therefore, many new or promising treatments might not be available within this form of "nationalized" or "socialized" medicine.

Also missing are incentives to maintain the quality of one's work (since health-care personnel will be paid roughly the same amount regardless of their performance, and since patients usually are unable to choose the specific professional they would like to see) or to develop new treatments (since these, if developed, would likely add to current cost levels).

Health Care in a Developing Nation

China

China is a huge nation, with a large portion of its population living in rural or remote areas and in conditions of relative poverty. Although the country has made some great strides in the past decade, it is still very much a developing nation.

China's economy is strictly controlled by the government, and virtually everything related to its health-care system is tightly regulated. As a developing country with limited resources, its budget for health care also is quite limited. Emphasis is placed on preventive services like immunization and family planning.

There is a great range of sophistication in the medical services available in China. In many areas, the first source of care comes from village doctors who work out of local health stations. These individuals have received about three to six months of medical training. Township health centers have small hospitals staffed by physicians with considerably more training. Larger county hospitals have more highly trained physicians and facilities comparable to many in the United States.

Until recently, the government assumed the cost of nearly all health care in China. Recent changes in the Chinese economy have resulted in the adoption of some features more common in western economies, and patients are now sometimes required to pay for an increasing amount of their care.

The health-care picture in China is changing constantly. As the nation's economy has improved, more sophisticated technology and medications have become available for some citizens. Ironically, one of the strengths of the old system, universal free access, is now threatened.

Mexico

Mexico's method of health-care delivery contains components of both the private and nationalized systems described above. However, since most of the population is fairly poor, nationalized health care tends to dominate, especially in more rural areas where incomes are relatively lower than in large cities. Thus, Mexico's approach is fairly similar to that of Canada.

Care is provided to all Mexican citizens, regardless of their employment status. The primary difference between the Mexican and Canadian systems is that Mexico, being a developing country, is less able to devote the taxes it collects to health care, and thus the types of services offered are much more limited in Mexico than in Canada.

While the advantages and disadvantages (in the form of incentives, etc.) inherent in the Mexican system are similar to those of Canada, Mexicans are used to receiving more limited care, and so their expectations tend to be lower. Thus, they tend to be less sensitive to the quality of the work performed by health-care professionals, being content simply to have the opportunity to receive care. In part, this explains why Mexico has a much higher demand for primary care providers than for specialists. In order to promote primary care, the number of residencies—positions in training programs to become a specialist—is severely limited. Therefore, the lack of such incentives in the Mexican system has less impact than the same lack in the Canadian system.

Drawing Conclusions

The descriptions above should give you a very brief idea of the way in which these countries provide health care for their citizens. Obviously, each of these situations is much more complicated than the simple outlines suggest. What is more, some of these countries are in the midst of major changes in their health-care systems, and all are likely to change over the next few years.

Which of these systems is the "best"? The answer to this question, of course, depends upon what is measured. For example, when considering the availability of extremely sophisticated medical and surgical technology, the United States is clearly the world's leader. In fact, the "rich and famous" from all over the globe frequently come to the United States when confronted with a life-threatening medical diagnosis.

Technology, however, is not the only measure of a nation's health. Infant mortality (deaths of infants under the age of 1 month) is much higher in the United States than in a host of other developed nations, including Sweden. In fact, there are areas of some American cities with infant mortality rates similar to those in developing nations such as China. Deaths from violence (such as that caused by guns), and from the complications of such "lifestyle" factors as obesity and smoking, are also quite high in the United States.

Increasingly, doctors around the world are recognizing that major improvements in the health of nations do not simply come from direct physician-patient contacts. Preventing violence, spreading the word against smoking, improved nutrition, and the prevention of teenage pregnancies, for example, can have enormous positive effects on a nation's overall health. Rather than leave such matters in government hands, many physicians now take a much more active role.