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Many discoveries made in the 19th century led to great advances in diagnosis and treatment of disease and in surgical methods. Medicine's single most important diagnostic tool, the stethoscope, an instrument used to detect sounds in the body such as a heart beat, was invented in 1819 by French physician René-Théophile-Hyacinthe Laënnec. A number of brilliant British clinicians studied and described diseases that today bear their names. British physician Thomas Addison discovered the disorder of the adrenal glands now known as Addison's disease; Richard Bright diagnosed the kidney disorder, Bright's disease; British physician Thomas Hodgkin described a cancer of lymphatic tissue now known as Hodgkin's disease; British surgeon and paleontologist James Parkinson described the chronic nervous system disease called Parkinson disease; and the Irish physician Robert James Graves diagnosed the thyroid disorder exophthalmic goiter, sometimes called Graves' disease.

Medicine, like all other sciences, is subject to influences from other fields of study. This was particularly true during the 19th century, renowned for its great scientific innovations. For instance, the evolutionary theory proposed by Charles Darwin in *On the Origin of Species by Means of Natural Selection* (1859) revived interest in the science of comparative anatomy and physiology. And the plant-breeding experiments of the Austrian biologist Gregor Johann Mendel in 1866, although initially overlooked, eventually had a similar effect in stimulating studies in human genetics.

German pathologist Rudolf Virchow pioneered development of pathology, the scientific study of disease. Virchow showed that all diseases result from disorders in cells, the basic units of body tissue. His doctrine that the cell is the seat of disease remains the cornerstone of modern medical science. In France, physiologist Claude Bernard performed important research on the pancreas, liver, and nervous system. His scientific studies, which emphasized that an experiment should be objective and prove or disprove a hypothesis, were the basis for the scientific method used today. Bernard's work on the interaction of the digestive system and the vasomotor system, which controls the size of blood vessels, was developed further by the Russian physiologist Ivan Petrovich Pavlov, who developed the theory of the conditioned reflex, the basis of human behaviorism.

A milestone in medical history occurred in the 1870s when French chemist Louis Pasteur and German physician Robert Koch separately established the germ theory of disease. Important in the development of this theory was the pioneering work of the American physician and author Oliver Wendell Holmes and of the Hungarian obstetrician Ignaz Philipp Semmelweis, who showed that the high rate of mortality in women after childbirth was attributable to infectious agents transmitted by unwashed hands.

Soon after the germ theory was recognized, the causes of such age-old scourges as anthrax, diphtheria, tuberculosis, leprosy, and plague were isolated. Pasteur developed a way to prevent rabies using a vaccine in 1885. In the last decade of the

19th century, German physician Emil von Behring and German bacteriologist Paul Ehrlich developed techniques for immunizing against diphtheria and tetanus.

New understanding of infectious diseases made surgery safer. Until the 1800s, surgeons operated in their street clothes, often without even washing their hands. Operating rooms, like other parts of hospitals, were filthy. About half of all surgery patients who survived the actual surgery typically died of infections that developed after the operation. The era of aseptic surgery, in which physicians used sterilized instruments and techniques to avoid infecting patients, was heralded by British surgeon and biologist Joseph Lister. With his introduction of an effective antiseptic, carbolic acid, Lister was able to successfully reduce mortality from wound infection. Rubber gloves were first worn during surgery in 1890, and gauze masks in 1896.

Another great advance in surgery came with the discovery of anesthesia. Until the 19th century, doctors used alcohol, opium, and other drugs to relieve pain during surgery. These medications could sometimes dull pain but could never completely mask it—patients often suffered from shock and died during surgery. In the United States, physician Crawford Long discovered the anesthetic effects of ether in 1842, and the dentist William Morton used ether in a tooth extraction in 1846. Ether and other anesthetics reduced surgical mortality and enabled surgeons to perform longer, more complicated operations.

A new tool for diagnosing internal diseases became available in 1895 when German scientist Wilhelm Roentgen discovered X rays. The Danish physician Niels Ryberg Finsen developed an ultraviolet-ray lamp, which led to an improved prognosis for some skin diseases. In 1898 in France, Marie and Pierre Curie discovered radium, which was later used to treat cancer.

In 1898 British physician Ronald Ross proved the role of the mosquito as a carrier of the malarial parasite, a disease that has been widespread and sometimes fatal for most of human history. In 1900 United States Army physician Walter Reed and his colleagues, acting on a suggestion made by the Cuban biologist Carlos Juan Finlay, demonstrated that the mosquito is the carrier of yellow fever. This finding led to better sanitation and mosquito control, resulting in the virtual elimination of this disease from Cuba and other areas.