



CONTAGION HISTORICAL VIEWS OF DISEASES AND EPIDEMICS

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Robert Koch, 1843-1910

Robert Koch was one of the most important and influential bacteriologists in history. He is credited with developing many innovative and fundamental laboratory techniques—some of which are still used today—and proving that microorganisms caused anthrax, cholera, and tuberculosis. His work was essential in proving the **germ theory of disease** and that such diseases were **contagious**. Koch was also instrumental in applying the germ theory to **public health** and hygiene practices in order to prevent disease in his native Germany and elsewhere. He won the Nobel Prize for Physiology or Medicine in 1905, and received many other medals and honors during his lifetime and after his death.

Koch's Teachers and Students

Koch was part of an impressive scientific lineage. One of his teachers was **Jacob Henle**, who had proposed that diseases were caused by microorganisms in the 1840s, during a period when miasma theories and the **humoral theory** were still dominant. While studying in Berlin in 1866, Koch was also influenced by the important pathologist and hygienist **Rudolf Virchow**.

Koch's students included Paul Ehrlich, who would later discover the first effective chemotherapy for syphilis, **Salvarsan**, in 1909; August von Wasserman, who developed the famous seriological text for **syphilis** in 1906; and Emil von Behring, who won a Nobel Prize four years before Koch in 1901 for his development of the **diphtheria antitoxin**.

Techniques and Postulates

Koch developed many fundamental laboratory techniques that are still used today. One of his most important innovations was the use of solid media instead of liquid to prepare pure cultures of bacteria. Liquid media was easily contaminated by other germs, and colonies of bacteria became mixed up with each other. With solid media, colonies could be kept isolated. Koch first used ordinary sliced potatoes to grow his germs on, but later developed techniques using agar gelatin in Petri dishes. Koch also introduced microphotography of bacteria, made important strides in the techniques of bacterial staining—a method made possible by the the enormous 19th century growth of the German chemical and artificial dye industry—and developed methods of animal experimentation and experimental pathology.

Koch's "postulates" have been basic for bacteriology. They are used to prove that specific microorganisms cause specific diseases which can reproduce and spread from animal to animal—a very different concept from the concepts of contagion, health and disease that had been dominant in Europe for centuries before.

The postulates are also important because they require the use of laboratory research; clinical work plays only a subsidiary role, or no role at all. Unlike the physicians associated with the **Paris Clinical School** in the early decades of the 19th century, Koch, despite his training as a physician, was known for his almost complete disinterest in clinical medicine and the use of clinical appearances as a way to identify disease.

Koch's postulates were first discussed in his 1877 publication on the **etiology of wound infections**. The four postulates state that 1. infected tissue must show the presence of a particular microorganism not found in healthy animals; 2. the microorganism must be isolated and grown in a pure culture; 3. when injected into a healthy animal, the microorganism must cause the disease associated with it; and 4. this "second generation" microorganism should then be isolated and shown to be identical with the microorganism found in 1.

Koch himself recognized that these postulates did not always work well and required flexibility, for instance in cases where diseases that affected people did not affect animals. The problem of the "healthy carrier"—an animal that carries a germ and transmits disease without being sick itself—could also throw a wrench into the works.

Anthrax, Tuberculosis and Cholera

Koch is famous for his description of the life cycle of the anthrax bacillus and its relationship to anthrax disease, published in 1876 to great acclaim; his painstaking identification of the **tuberculosis bacillus** in 1882; and his identification of the cholera bacillus in 1884, which for many people proved its **contagiousness**.

Koch's string of heroic accomplishments were transformed into disgrace, however, when in 1890 he prematurely announced a cure for tuberculosis—his secret formula, tuberculin. For about three months there was an **international celebration**, but it turned out that tuberculin was useless as a treatment. It also came to light that Koch had a substantial financial interest in the manufacture and use of the product.

Rivalries and Politics

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Koch was known for his sometimes vicious professional rivalry with French chemist Louis Pasteur. National rivalries between Germany and France contributed to this conflict. Germany and Britain also played out international rivalries in the laboratory; for instance, Britain assembled a committee of physicians and scientists, including **Edward Klein**, who did not accept the germ theory, to investigate Koch's identification of the cholera bacillus and his assertion that cholera was contagious. Britain controlled much of the world's maritime shipping and was often opposed to quarantines; the committee published an "official refutation" of Koch's cholera germ theory in 1886.

Koch is also known as the man who unseated the influential hygienist **Max von Pettenkofer** from his important German government post and contributed to Pettenkofer's professional demise, due to fundamental differences in their understandings of the contagiousness of cholera and the means by which it became **epidemic** in the 19th century.

Legacy

After the tuberculin setback, Koch was unable to repeat the revolutionary accomplishments of his early career. However, he has retained his position as one of the most important scientists in history, and has been inspirational for generations of scientists.

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Selected *Contagion* Resources

This is a partial list of digitized materials available in *Contagion: Historical Views of Diseases and Epidemics*. Additional materials may be found by browsing the topic "**Robert Koch, 1843-1910**" and by **searching** the collection's Catalog and Full Text databases.

Web Pages

Cholera Epidemics in the 19th Century
Concepts of Contagion and Epidemics
Germ Theory
International Sanitary Conferences
P. C. A. Louis 1787-1872
Public Health
Syphilis 1494-1923
Tuberculosis in Europe and the US, 1800-1922
Rudolf Virchow 1821-1902
Max von Pettenkofer, 1818-1901

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