

Virchow: The Pope of Medicine



Rudolf Virchow, by Hugo Vogel, 1861. Public Domain

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For if medicine is really to accomplish its great task, it must intervene in political and social life. It must point out the hindrances that impede the normal social functioning of vital processes and effect their removal.

—Rudolf Virchow¹

The impact of some figures on the history of medicine is so expansive and profound it beggars imagination. Case in point: Rudolf Virchow, perhaps the most influential pathologist of all time. Ironically, though Virchow actively sought to reduce the influence of the Catholic church in Prussian society, which he saw as reactionary, his extraordinary clinical excellence, scientific contributions, and public service led some to call him the pope of medicine. His massive body of work and long and rich life offer inspiration to physicians of any age.

Rudolf Ludwig Carl Virchow was born in 1821 in eastern Pomerania, now part of Poland. He was the only child of a municipal treasurer. A child prodigy, he acquired numerous languages and intended to pursue a career in the clergy, publishing a thesis entitled, "A Life of Work is not a Burden but a Benediction," a viewpoint he embodied. Concluding that he did not have the voice for a preaching career, he accepted a scholarship to become a military physician, publishing a thesis on the ocular manifestations of rheumatism.

Introduced to the microscope by one of his teachers, he developed a deep interest in pathology, and began publishing his research. Frustrated that many of his papers were rejected by the editors of the day, he founded the *Archives of Pathological Anatomy, Physiology, and Clinical Medicine*, now simply known as *Virchow's Archive*. Over the course of his career, he published more than 2,000 scientific articles, many of which are now recognized as landmarks in medical history.

Perhaps as a means of removing a formidable critic, the conservative Prussian government sent him away to study a typhus epidemic in Upper Silesia, which resulted in a report that linked the disease to poor living

conditions. Convinced that the government was in part responsible, he returned to Berlin to press for political change. He had become convinced that, if medicine really aimed at improving health, it needed to expand its field of view beyond the individual patient to encompass the living conditions of whole communities.

In his 1848 analysis of the typhus epidemic, Virchow concludes that the health of the people requires the authorities of the day to adopt new policies that would overturn the unjust social order. To prevent future outbreaks of disease, he argues, ordinary people must get out from under the feudal aristocracy and assume responsibility for planning and working to enrich their own lives. He writes:

What can one expect of people who have been fighting for their existence in such abject misery for centuries and have never seen a time when the rewards of their labor were their own, who never knew the joys of possessions, never had the satisfaction of deserved earnings, who had never received wages for the onerous work they did, but who always saw the fruit of their labors falling into the pockets of the landowners?²

Virchow exerted huge influence on medical education in Germany, helping to teach influential figures such as Ernst Haeckel, a physician and biologist who originated such terms as ecology, phylum, and Protista and played an important role in promoting Darwin's theory in Germany. And Virchow worked closely with Edwin Klebs, who help establish the field of bacteriology.

Virchow also taught pathology to two highly influential American physicians who served as founders of the Johns Hopkins School of Medicine, William Welch (AQA, The Johns Hopkins University School of Medicine, 1906), and Sir William Osler.

Virchow married a liberal politician's daughter, Rosalie Mayer, in 1850, and they had six children, three sons and three daughters. He left Berlin and accepted Germany's first chair in anatomic pathology at the University of Wurzburg, where Roentgen would later discover X-rays.

Six years later, Virchow returned to Berlin to become the director of the newly created Institute for Pathology, a post he held for 20 years. In 1902, he suffered a broken leg when he jumped off a streetcar, an injury that contributed to his death later the same year.

Cell biology

The introduction of the term "cell" predated Virchow by two centuries. Most physicians and scientists of young Virchow's day subscribed to the theory of spontaneous generation, which held that single-celled and larger living organisms can arise from non-living matter—for example, that maggots could form in rotting flesh. Virchow rejected this notion, popularizing the dictum, "All cells [come] from cells."³ Simply put, living organisms are made of cells, and the only source of a cell is another living cell.

Instead of confining attention to the whole organism, organs and organ systems, and tissues, Virchow held, it is ultimately necessary to focus on the cell. He writes:

No matter how we twist and turn, we shall eventually come back to the cell. The eternal merit of Schwann does not lie in his cell theory, which has occupied the foreground for so long and which perhaps soon will be given up, but in his description of the development of the various tissues, and in his demonstration that this development (hence all physiological activity) is in the end traceable back to the cell. Now if pathology is nothing but physiology with obstacles, and diseased life nothing but healthy life interfered with by all manner of external and internal influences, then pathology too must be referred back to the cell.³

And yet, Virchow did not believe that any one cell, or any one type of cell, could account for the whole organism or its life. In a mature human being, there is no master cell that gives life to and controls all the other cells. Instead, Virchow regarded cells as bound together in a kind of cooperative society characterized by specialization and the division of labor, such that "every element has its own special action, and even though it derives its stimulus to activity from other parts, yet it alone effects the actual performance of its duties."³

Throughout his career, Virchow emphasized parallels between the cellular economy of the body and the political economy of nations. He liked to refer to the human organism as a cellular democracy or a republic of cells. So long as cells were protected from noxious external forces, the organism would continue in a healthy state, but if cellular organization were sufficiently disrupted, disease would result. And, because cells naturally reproduce themselves, once they become pathologic, diseases tend to spread.

Cancer biology

In view of his contributions to cell biology, it is unsurprising that Virchow believed that cancerous cells arise from normal cells. Specifically, he suspected that cancers arise when cells are chronically irritated, a notion familiar to contemporary physicians in the relationship between chronic inflammation and cancers of the lung, esophagus, and colon. Yet when it comes to the mechanism of metastasis, Virchow seemingly turned his back on his own cell theory and supposed that cancers spread in the form of liquid toxins.

Virchow's rationale for drawing this conclusion is instructive. He observed that metastases are often less common in the lungs than in the liver, even though the capillaries of the lung would be expected to trap any clumps of malignant cells in the blood, making the lungs a more common site of metastatic spread.

In effect, this great proponent of cell theory, opponent of the humoral theory of disease, reverted to a humoral view when it came to cancer metastasis.

Virchow's first great contribution to cancer biology concerned leukemia. While working early in his career as an anatomy demonstrator, he encountered a 50-year-old woman with a history of fatigue, nosebleeds, and abdominal swelling. He identified not only an enlarged liver and spleen but also blood vessels filled with a pus-like substance, attributing it not to an infection but an abnormal imbalance between red and white blood cells, which he labeled white blood, or in Greek, leukemia.

Virchow introduced numerous oncologic terms into the medical lexicon, including hyperplasia and metaplasia, which he recognized as pre-cancerous conditions.⁴ He was the first to demonstrate that clumps of tumor cells could form thrombi and embolize. He also illustrated various types of squamous carcinomas. His observation that red blood cells are reduced in both iron-deficiency anemia and leukemia anticipates the close contemporary linkage of hematology and oncology.

Social medicine

Virchow is often regarded as the founder of social medicine, in part from his view that problems in society provide the necessary conditions for the emergence of diseases (today, social determinants of health), and also because improving social conditions could more rapidly and effectively advance human health and longevity than treating individual patients. A health system that focused solely on the treatment of diseases would be far costlier and less effective than one aiming to prevent disease in the first place.

Although a life-long champion of the microscope, the autopsy, and laboratory medicine in general, Virchow argued that a comprehensive understanding of health and disease requires physicians to look at social conditions and the health of whole populations. He writes:

Medicine is a social science, and politics is nothing else but medicine on a large scale. Medicine, as a social science, as the science of human beings, has the obligation to point out problems and to attempt their theoretical solution: the politician, the practical anthropologist, must find the means for their actual solution.⁵

It is not enough to prescribe medications or perform procedures. The physician must work for changes in food, housing, education, and the economic system that would benefit not just individual patients but vast swathes of society.

Virchow manifested the courage of his convictions. Beginning as a member of Berlin's municipal court, he went on to serve in the Prussian Diet and then from 1880 to 1893 as a member of the Reichstag, the lower house of parliament. He took on German "iron chancellor" Otto von Bismarck, who played a central role in German unification, and advocated on behalf of public health over military funding.

One practical manifestation of Virchow's social medicine was his work on the Berlin sewer system. Reputed to be Europe's foulest-smelling capital, the city was pockmarked by pits of human waste, the gutters of its streets often choked until rains swept it away, and pedestrians had to wear boots throughout the year. Virchow, highly respected as both a scientist and a political reformer, argued that the city would be plagued by epidemics until it cleaned up its act.⁵ The sewer system was completed in the 1890s.

Two mistakes

Virchow's convictions led him to two especially notable mistakes. First, he ardently opposed social Darwinism, the idea that some categories of people were inherently fitter than others and would inevitably win out in the struggle for scarce resources. He doubted that human beings could have emerged from lower species, and he believed that proof for the theory of natural selection was lacking. He suggested that teaching evolution in schools might undermine respect for scientific methods and standards of proof.

Yet Virchow's opposition to Darwin sprang from noble motives. Perhaps anticipating eugenics, he argued that

social Darwinism was racist, anti-democratic, and would tend to foment nationalism and militarism. He fought back with science, attacking the notion of the "Aryan race" through careful analysis of craniometric data and conducting a large study of schoolchildren that showed that, based on such traits as hair and eye color, it is impossible to sustain the notion of distinct German or Jewish races, writing:

It is almost embarrassing that we must admit that in terms of ethnic groupings, Celts, Germans, Slavs, Jews, we are unable to identify any typically identifying features that allows distinguishing one group from another or to which nationality they could belong. In the last analysis, the differences between any two individuals are greater than any differences between the races.⁶

Based in part on these findings, Virchow vigorously opposed anti-Semitism.

Virchow also opposed the germ theory of disease, as developed by Louis Pasteur and Robert Koch. He held that disease results primarily from internal derangements within cells, not external pathogens. He feared that the germ theory would distract from more important social and political programs to prevent disease. Of course, he did not argue that germs were not present in diseased tissue, but he suspected that the germs were not the cause of the disease.

On this point, Virchow was both right and wrong. He was right in that biological imbalances can predispose patients to infectious diseases. Examples include malnutrition and diseases and drugs that impair the immune system. Yet even a healthy organism can be infected by microorganisms. Virchow's mistaken view led him to attack the work of those who believed that handwashing could reduce disease transmission.

Eponymous Virchow

The name Virchow is associated with many medical eponyms. Among the more prominent are:

1. Virchow-Robin space—in the central nervous system, the space between blood vessels and glial cells, which are continuous with the subarachnoid space.
2. Virchow's cell—a macrophage in Hansen's disease.
3. Virchow's law—in craniosynostosis, the principle that skull growth is restricted along a line perpendicular to the affected suture, but accentuated parallel to it.

Virchow: The Pope of medicine

4. Virchow's method of autopsy—an orderly approach to post-mortem examination, in which organs are removed one by one.
5. Virchow's node—a palpable, firm supraclavicular lymph node, usually associated with abdominal or thoracic malignancies.
6. Virchow's theory—*Omnis cellula e cellula* (every cell [comes] from a cell).
7. Virchow's triad—factors associated with thrombosis, including pathology of the vessel wall, altered blood flow, and hypercoagulability.

Many common terms in contemporary medicine are not found in the medical literature prior to Virchow: agenesis, chordoma, embolism, leukemia, neuroglia, parenchyma, spina bifida, and thrombosis. Likewise, the pathophysiology of pulmonary embolism was unknown before Virchow.

A liberating force

Virchow received many recognitions over the course of his life. He was elected to royal societies and received some of the most prestigious scientific awards of his day. He became a top university administrator. He was so widely known and admired that the date of what would have been his 80th birthday was celebrated as a national holiday. Today a research center at Wurzburg bears his name, and the Society for Medical Anthropology presents the Virchow prize.

The “pope of medicine” was no supporter of popery. He believed that no one's statements, not even his, should be accepted simply because someone seemed to be speaking *ex cathedra*. To the contrary, he regarded science as a force liberating humankind from the dogmas of the church, writing:

Every advance a church makes in the building of its dogmas leads to a further taming of the free spirit. Every new dogma narrows the circle of free thought. Science, by contrast, liberates with every step of its development. It opens up new paths to thought and allows the individual to be truly free.⁷

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