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THE BRITISH SCIENTIFIC LANDSCAPE AND THE APOTHECARIES ACT (1815)

El panorama científico británico y la Ley de Boticarios (1815)

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ABSTRACT

This article explores the British scientific context leading up to the Apothecaries Act of 1815, which marked the rise of the general practitioner. It examines key developments in chemistry and medicine during the early 19th century, highlighting the influence of the Industrial Revolution, urbanization, and scientific centers like the Royal Institution. Pioneers such as Humphry Davy, John Dalton, and Edward Jenner revolutionized chemistry and medicine through discoveries like atomic theory, electrolysis, and vaccination. The article also discusses the challenges of pre-anesthetic surgery, infectious disease control, and the slow integration of chemistry into medical practice. Technological advancements like the stethoscope and blood transfusion are noted, alongside public health reforms driven by figures like Edwin Chadwick. Ultimately, the period laid the foundation for modern medicine and professionalized science.

KEYWORDS: *History, 19th Century, History of Medicine, general practitioners, Chemistry, United Kingdom, pharmaceutical legislation, Primary Health Care.*

RESUMEN

Este artículo explora el contexto científico británico previo a la Ley de Boticarios de 1815, la cual marcó el surgimiento del médico general. Examina avances clave en química y medicina durante principios del siglo XIX, destacando la influencia de la Revolución Industrial, la urbanización y centros científicos como la Royal Institution. Pioneros como Humphry Davy, John Dalton y Edward Jenner revolucionaron la química y la medicina mediante descubrimientos como la teoría atómica, la electrólisis y la vacunación. El artículo también aborda los desafíos de la cirugía preanestésica, el control de enfermedades infecciosas y la lenta integración de la química en la práctica médica. Se señalan avances tecnológicos como el estetoscopio y la transfusión sanguínea, así como reformas de salud pública impulsadas por figuras como Edwin Chadwick. En última instancia, este periodo sentó las bases de la medicina moderna y de la profesionalización de la ciencia.

PALABRAS CLAVE: *Historia, siglo XIX, Historia de la Medicina, médicos generales, Química, Reino Unido, Legislación farmacéutica, atención primaria de salud.*

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1. INTRODUCCIÓN

It appears that the figure of the general practitioner was born from the promulgation of the Apothecaries Act by the British Parliament in 1815 [i ii], although some researchers consider the possibility of a previous milestone [iii]. Our goal in this assay has been to try to build a scientific scenario of the time in order to understand these events, analyzing the development of two fields basically, chemistry and medicine. This report will explore the key developments in chemistry and medicine during this pivotal period, examining the interplay between scientific discovery, technological innovation, and the social and economic forces that drove this remarkable era of change.

The Dawn of a New Era in Science and Health

The early 19th century in England was a period of profound transformation, marked by rapid industrialization, significant social upheaval, and remarkable advancements in the fields of chemistry and medicine. This era, often referred to as the Industrial Revolution, served as a powerful catalyst for scientific innovation, fundamentally altering the landscape of public health and medical practice [iv v]. This period witnessed the transition from traditional, often superstitious, medical practices to a more empirical and evidence-based approach, laying the groundwork for the modern scientific disciplines we recognize today.

The Industrial Revolution as a Catalyst for Change

The Industrial Revolution, which gained momentum in England from the 1780s onwards, was a period of unprecedented technological and economic growth that had a profound impact on all aspects of society, including science and medicine. The development of new machinery, such as the spinning jenny and the power loom, transformed the textile industry, while innovations in iron and coal production fueled the growth of factories and urban centers. The economic prosperity generated by the Industrial Revolution also provided the financial resources to support scientific research and the establishment of new institutions, such as the Royal Institution of Great Britain, which played a crucial role in advancing scientific knowledge.

The emphasis on practical application and technological innovation led to a greater appreciation for the value of scientific research. Scientists were no longer seen as mere theorists but as individuals who could contribute to the economic and social progress of the nation. This change in attitude was reflected in the growing number of scientific societies and institutions that were established during this period, which provided a platform for scientists to share their ideas and collaborate on research projects. The Industrial Revolution also had a significant impact on the education and training of scientists and medical practitioners.

Urbanization and Its Impact on Public Health

The Industrial Revolution brought about a massive wave of urbanization, as people moved from the countryside to the newly industrialized cities in search of work. This rapid influx of people led to a dramatic increase in the population of cities like London, Manchester, and Birmingham, which often struggled to cope with the demands of their growing populations [vi]. The streets of these cities were often filled with waste, and there was a lack of clean water and proper sewage systems, which created a breeding ground for disease. The first cholera epidemic in Britain in 1831-32 claimed over 50,000 lives, and subsequent outbreaks in 1848-49 and 1854 caused further devastation. The high mortality rates from cholera and other infectious diseases, such as typhoid and tuberculosis, highlighted the urgent need for public health reform.

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The appalling living conditions in the industrial cities also had a significant impact on the health of the population in other ways. The air in the industrial cities was often thick with smoke and other pollutants, which led to a rise in respiratory diseases. The social and economic consequences of this public health crisis were severe. The high mortality rates from disease had a significant impact on the workforce, while the cost of caring for the sick placed a heavy burden on the poor and the state. The work of public health reformers like Edwin Chadwick [vii] and John Snow [viii] was instrumental in raising awareness of the link between poor sanitation and disease.

The Rise of Scientific Institutions and Societies

The early 19th century witnessed a significant growth in the number and influence of scientific institutions and societies in England. These organizations played a crucial role in promoting scientific research, disseminating new knowledge, and fostering a sense of community among scientists. One of the most important of these institutions was the Royal Institution of Great Britain [ix] [x] , which was founded in 1799 by a group of leading scientists with the aim of *"diffusing science for the common purposes of life"*. The founder of the Institution was Benjamin Thompson, Count Rumford, that soldier of fortune who took service with the Elector Palatine of Bavaria, and it was in the course of his duties in Munich that his interest in the practical problems of philanthropy was aroused.

In London, in the concluding years of the eighteenth century, he was drawn into the group of philanthropists and reformers among whom William Wilberforce was the leading figure, and Sir Thomas Bernard, Treasurer of the Foundling Hospital, one of the most active members. The focus of their activities was the *society for Bettering the Condition and Increasing the Comforts of the Poor*, and to this Society Rumford submitted his proposals for a new scientific institution in London, designed to improve the lot of the poor and the working classes by the application of science to useful purposes.

The Royal Institution was instrumental in the advancement of science in the 19th century, providing a platform for scientists like Humphry Davy [xi] and Michael Faraday [xii] to conduct their ground breaking research. The Institution's public lectures, which were often spectacular and entertaining, helped to popularize science and to raise its profile in society. The Royal Institution also played a key role in the education and training of young scientists, and its laboratory was a center of innovation and discovery.

In addition to the Royal Institution, a number of other scientific societies and organizations were established during this period, including the British Association for the Advancement of Science [xiii] [xiv], which was founded in 1831. These societies provided a forum for scientists to present their research, to debate new ideas, and to collaborate on projects.

The State of Chemistry: From Alchemy to Atomic Theory

The early 19th century marked a pivotal moment in the history of chemistry, as the discipline began to shed its alchemical past and embrace a more systematic and scientific approach. This period was characterized by a series of ground breaking discoveries and theoretical advancements that laid the foundation for modern chemistry.

Humphry Davy was one of the most influential chemists of the early 19th century, and his work at the Royal Institution of Great Britain played a crucial role in the advancement of the field. Davy was a brilliant and charismatic scientist who was known for his spectacular public lectures and his ground breaking research. He was appointed as an assistant at the Royal Institution in 1801, and he quickly rose to prominence, becoming the director of the laboratory in 1802 and a

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professor of chemistry in 1803 [xv]. Davy's work at the Royal Institution, therefore, was a key factor in the development of chemistry in the early 19th century, and it had a lasting impact on the field.

Figure Nº 1: *Sir Humphry Davy, 1er Baronet*. (1778 – 1829).

Davy's Discoveries of New Elements via Electrolysis

One of Humphry Davy's most significant contributions to chemistry was his use of electrolysis to isolate a number of new elements. Electrolysis is a process that uses an electric current to drive a non-spontaneous chemical reaction. Davy was one of the first chemists to use this technique to decompose chemical compounds and to isolate their constituent elements [xvi]. In 1807, he used electrolysis to isolate potassium and sodium from their hydroxides, and in 1808, he used the same technique to isolate barium, strontium, calcium, and magnesium. Davy's work on electrolysis also led to a new understanding of the nature of chemical bonding, as he proposed that chemical bonds were formed by the attraction between oppositely charged ions. This idea, which is now known as the ionic theory of chemical bonding, was a major step forward in the development of modern chemistry.

John Dalton's Revolutionary Atomic Theory

John Dalton[xvii] [xviii] was another key figure in the development of chemistry in the early 19th century. He is best known for his atomic theory, which he first proposed in 1803. Dalton's atomic theory was a major departure from the prevailing views of the time, which held that matter was continuous and infinitely divisible. Dalton's atomic theory was a major breakthrough in the field of chemistry, as it provided a simple and elegant explanation for a wide range of chemical phenomena. It also provided a theoretical framework for the development of modern chemistry, and it laid the foundation for the work of later chemists, such as Dmitri Mendeleev, who developed the periodic table of the elements.

The Concept of Atomic Weights and Proportions

One of the key features of John Dalton's atomic theory was his concept of atomic weights and proportions. Dalton proposed that the atoms of different elements have different masses, and he developed a system of relative atomic weights based on the lightest element, hydrogen. He also proposed that chemical compounds are formed by the combination of atoms of different elements in simple, whole-number ratios. Dalton's work on atomic weights and proportions was not only important for its theoretical content but also for its practical applications [xix]. It provided a way to determine the composition of chemical compounds and to predict the products of chemical reactions. It also laid the foundation for the development of stoichiometry, which is the branch of chemistry that deals with the quantitative relationships between reactants and products in chemical reactions.

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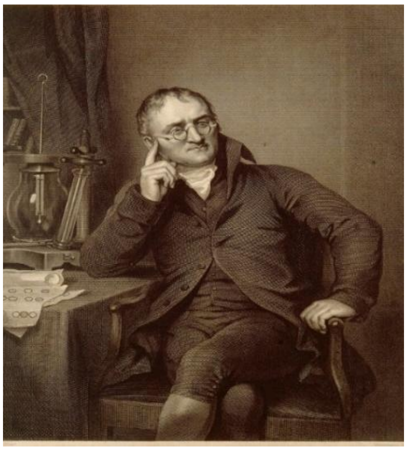

Figure Nº 2: John Dalton Greenup (1766-1844).

The Law of Multiple Proportions

The law of multiple proportions, which was first proposed by John Dalton, states that when two elements combine to form more than one compound, the masses of one element that combine with a fixed mass of the other element are in a ratio of small, whole numbers. This law was a key piece of evidence in support of Dalton's atomic theory, as it could be easily explained by the idea that chemical compounds are formed by the combination of atoms in simple, whole-number ratios.

The Emergence of Organic Chemistry

The early 19th century also saw the emergence of organic chemistry as a distinct branch of the field. Organic chemistry is the study of carbon-based compounds, which are the building blocks of all living organisms [xx] . The development of organic chemistry was driven by a growing interest in the chemical processes that occur in living organisms, as well as by the discovery of a large number of new carbon-based compounds. The work of chemists like Jöns Jakob Berzelius (1779-1848) and Justus von Liebig (1803-1873) was instrumental in the development of organic chemistry. They proposed a new theory of chemical bonding, which was based on the idea of radicals, which are groups of atoms that behave as a single unit in chemical reactions. The development of organic chemistry was a major step forward in the understanding of the nature of life, and it had a profound impact on the fields of medicine and biology.

The Study of Carbon-Based Compounds

The study of carbon-based compounds was a key focus of organic chemistry in the early 19th century. Chemists were particularly interested in understanding the structure and properties of these compounds, as well as the reactions that they undergo. The work of chemists like Friedrich Wöhler (1800-1882) and August Kekulé (1829-1896) was instrumental in the development of the field. Wöhler's synthesis of urea from inorganic compounds in 1828 was a major breakthrough, as it showed that organic compounds could be synthesized from non-living materials. This discovery challenged the prevailing view that organic compounds could only be produced by living organisms, and it opened up a new era of research in organic chemistry. Kekulé's work [xxi] [xxii] on the structure of benzene was another major breakthrough, as it provided a new understanding of the nature of aromatic compounds.

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The Role of Chemistry in Understanding Life Processes

The development of organic chemistry in the early 19th century also had a profound impact on the understanding of life processes. Chemists began to apply their knowledge of chemical reactions to the study of biological systems, and they made a number of important discoveries about the chemical basis of life. For example, they discovered that the process of fermentation is a chemical reaction that is catalyzed by enzymes, and they also made important contributions to the understanding of the chemical nature of proteins and nucleic acids. The work of chemists like Louis Pasteur [xxiii] [xxiv] and Robert Koch [xxv] was instrumental in the development of the germ theory of disease, which revolutionized the field of medicine.

Medicine on the move: Challenges and Innovations

The early 19th century was a period of significant challenges and innovations in the field of medicine. The medical profession was also facing a number of challenges, as traditional medical practices were often ineffective and even harmful. However, the period was also marked by a number of important innovations, as a new generation of medical practitioners began to embrace a more scientific and evidence-based approach to medicine. The development of new diagnostic tools, such as the stethoscope, and the introduction of new treatments, such as anesthesia and vaccination, transformed the practice of medicine and laid the foundation for the modern medical profession. The early 19th century, therefore, was a period of profound transformation for medicine, as it evolved from a largely empirical and often ineffective art into a more rigorous and scientific discipline.

The Agony of Surgical Procedures

The agony of surgical procedures in the pre-anesthetic era [xxvi] is difficult to imagine today. Patients were often held down by a team of assistants while the surgeon performed the operation as quickly as possible. The most common operations were amputations, which were often necessary to treat injuries or infections. The surgeon would use a large, sharp knife to cut through the skin and muscle, and then a saw to cut through the bone. The patient would often scream and struggle, and many would lose consciousness from the pain and shock. The agony of surgical procedures was not limited to amputations. The lack of effective pain relief was a major barrier to the development of surgery, and it was not until the introduction of anesthesia that surgeons were able to perform more complex and delicate operations.

The Battle Against Infectious Diseases

The early 19th century was a period of intense battle against infectious diseases. The rapid urbanization and poor sanitation of the time created a fertile ground for the spread of diseases like cholera, typhoid, and tuberculosis. These diseases were a major cause of death, and they had a devastating impact on the population. The medical profession was largely powerless to prevent or treat these diseases, as the causes of infection were not understood. The prevailing theory of disease at the time was the miasma theory, which held that diseases were caused by "bad air" or noxious fumes. This theory was based on the observation that diseases were often more common in areas with poor sanitation and foul smells. However, the miasma theory was incorrect, and it led to a number of ineffective and even harmful public health measures.

The “Miasma Theory” versus Germ Theory.

The miasma theory and the germ theory were two competing theories of disease in the 19th century. The miasma theory, which was the prevailing theory for most of the century, held that diseases were caused by "bad air" or "miasmas" that were released from decaying organic

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matter. The miasma theory led to a number of public health measures, such as the cleaning of streets and the removal of sewage, which did have a positive impact on public health. The germ theory, which was first proposed in the 16th century but was not widely accepted until the late 19th century, holds that diseases are caused by microorganisms, such as bacteria and viruses. The germ theory provided a scientific basis for public health measures, such as vaccination, antiseptic surgery [xxvii], and the pasteurization of milk. It also led to the development of new drugs, such as antibiotics, which have saved countless lives. The acceptance of the germ theory was a major turning point in the history of medicine, and it laid the foundations for modern medicine.

The Rise of Preventive Medicine

The early 19th century also saw the rise of preventive medicine, a new approach to medicine that focused on preventing disease rather than just treating it. This was a major shift in thinking, as the traditional approach to medicine had been to wait for people to get sick and then try to cure them.

Edward Jenner's Smallpox Vaccine

Edward Jenner (1749-1823) was an English country doctor who made one of the most important discoveries in the history of medicine: the smallpox vaccine. Smallpox was a highly contagious and often fatal disease that had plagued humanity for centuries. It caused a severe rash and fever, and it left survivors with disfiguring scars. Before Jenner's discovery, the only way to prevent smallpox was through a process called variolation, which involved deliberately infecting a person with a mild form of the disease.

Jenner's discovery was based on the observation that milkmaids who had contracted cowpox, a mild disease that affected cows, were immune to smallpox. He hypothesized that cowpox could be used to protect people from smallpox, and he set out to test his theory. In 1796, he took pus from a cowpox sore on a milkmaid's hand and inoculated an eight-year-old boy named James Phipps [xxviii]. He called his new procedure "vaccination," from the Latin word for cow, "vacca". Jenner's discovery was a major breakthrough, as it provided a safe and effective way to prevent smallpox. His work laid the foundations for the science of immunology, and it has saved countless lives.

Figure Nº 3: Edward Jenner (1749-1823)

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Inoculation and Herd Immunity

Edward Jenner's smallpox vaccine was a much safer and more effective form of inoculation, as it used a harmless virus (cowpox) to protect against a deadly one (smallpox). The concept of herd immunity is a related idea. Herd immunity occurs when a large enough percentage of a population is immune to a disease, either through vaccination or previous infection [xxix] . When herd immunity is achieved, the disease can no longer spread easily through the population, and it will eventually die out. Herd immunity is an important concept in public health, as it can be used to protect people who are not able to be vaccinated, such as infants and people with weakened immune systems. The development of vaccines and the concept of herd immunity have been two of the most important advances in the history of medicine, and they have saved countless lives.

Key Figures of Chemistry and Medicine

The early 19th century in England was a period of profound transformation in the fields of chemistry and medicine, driven by the groundbreaking work of a few key individuals. These pioneers, often working at the intersection of multiple disciplines, laid the foundation for modern scientific understanding and practice. Figures like Humphry Davy, William Prout, and John Dalton exemplify the spirit of this era, a time when the boundaries between different scientific fields were fluid, and a single individual could make significant contributions to both theoretical science and practical medicine. .

Humphry Davy: The Chemist Who Bridged Science and Medicine

Sir Humphry Davy (1778–1829) stands as a towering figure in the history of science, a man whose brilliant career exemplified the potential for chemistry to impact medicine and industry. He was largely self-taught, having left school at the age of 15 to be apprenticed to an apothecary-surgeon, an experience that provided him with a foundational understanding of both chemistry and medicine. This early exposure to the practical applications of science would prove to be a defining influence on his later work. Davy was not only a brilliant researcher but also a charismatic and popular lecturer, capable of inspiring a new generation of scientists and capturing the public's imagination. His contributions to the fields of chemistry and medicine were numerous and varied, but it is perhaps his early work on the properties of nitrous oxide that best illustrates his ability to bridge the gap between these two disciplines.

Davy's Experiments with Nitrous Oxide ("Laughing Gas")

In 1798, at the age of 20, Davy took up a position at the Pneumatic Institution in Clifton, Bristol, an organization dedicated to investigating the potential therapeutic uses of newly discovered gases. It was here that he began his groundbreaking research on nitrous oxide, a gas that had been discovered by Joseph Priestley a few years earlier. Davy's experiments were both rigorous and daring; he not only studied the chemical properties of the gas but also inhaled it himself to experience its effects firsthand. His findings, published in 1800 in a book titled "Researches, Chemical and Philosophical, Chiefly Concerning Nitrous Oxide", were a sensation. Davy described the gas's intoxicating effects, which included feelings of euphoria, dizziness, and a propensity to laughter, leading him to coin the popular term "laughing gas" [xxx]. Davy's work was not merely a collection of anecdotal accounts; it was a systematic and scientific investigation into the properties of a new substance, and it laid the groundwork for future research into the use of anesthetics in medicine.

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His Early Suggestions for Anesthetic Use in Surgery

Perhaps the most remarkable aspect of Davy's research on nitrous oxide was his prescient suggestion that it could be used as an anesthetic in surgical procedures. This was a revolutionary idea at a time when surgery was a brutal and agonizing experience, performed on fully conscious patients who had to be physically restrained. However, despite the clarity of his recommendation, his suggestion was largely ignored by the medical establishment for nearly half a century. Davy's work on nitrous oxide is a powerful example of the potential for scientific discovery to be ahead of its time. His research not only demonstrated the analgesic properties of a new substance but also provided a clear and compelling argument for its use in medicine, even if that argument was not immediately heeded.

William Prout: The Physician-Chemist

William Prout (1785–1850) was a quintessential figure of the early 19th century, a man who seamlessly blended the roles of physician and chemist to make significant contributions to both fields [xxxi] . Born in Gloucestershire, Prout received his medical degree from the University of Edinburgh in 1811 and established a successful practice in London. Prout's work was characterized by a meticulous attention to detail and a commitment to rigorous experimentation, which allowed him to make a series of important discoveries about the chemical basis of life. His research on the composition of bodily fluids and secretions, particularly urine and gastric juice, provided new insights into the diagnosis and treatment of disease.

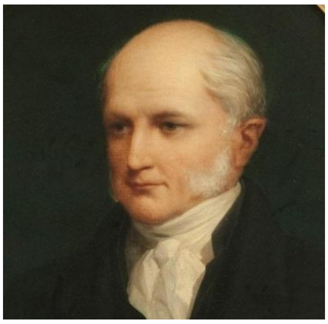

Figure Nº 4: William Prout (1785-1850).

Prout's Research on Gastric Acid and Digestion

One of Prout's most significant contributions to medicine was his discovery that the acid of the gastric juice is hydrochloric acid [xxxii] . In 1824, he published a paper in which he described how he had isolated the acid from gastric juice through distillation, a finding that had important implications for the understanding of digestion. He proposed that the various secretions of the body were produced by the breakdown of bodily tissues, a theory that was later confirmed by other researchers. Prout's work on digestion was not limited to the stomach; he also conducted extensive research on the chemical composition of urine, which he believed could provide valuable clues to the state of a person's health. His 1821 book, "An Inquiry into the Nature and Treatment of Gravel, Calculus and other diseases of the Urinary Organs", was a landmark publication that established his reputation as a leading expert in the field.

His Work on Urinary Chemistry and Disease Diagnosis

Prout's research on urinary chemistry was a cornerstone of his work as a physician-chemist. He was one of the first to recognize the potential of chemical analysis of urine as a diagnostic tool, a practice that is now a routine part of modern medicine. His detailed studies of

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the chemical composition of urine and urinary calculi (kidney stones) provided new insights into the causes of these conditions and led to the development of more effective treatments. Prout's contributions to the field were so significant that he was elected a Fellow of the Royal Society in 1819 and was invited to deliver the prestigious Goulstonian Lectures to the Royal College of Physicians in 1831, on the topic of the application of chemistry to medicine [xxxiii] .

John Dalton: The Father of Modern Chemistry

John Dalton (1766–1844) was a Quaker schoolteacher from the north of England who would go on to become one of the most influential figures in the history of chemistry. His development of the atomic theory, first published in 1808, was a revolutionary concept that provided a new and powerful framework for understanding the nature of matter. Dalton's theory, which proposed that all matter is composed of tiny, indivisible particles called atoms, was a radical departure from the prevailing chemical theories of the time. It was a simple yet elegant idea that had profound implications for all of science, and it laid the foundation for the development of modern chemistry. Dalton's work was not limited to atomic theory; he was also a dedicated meteorologist who kept detailed weather records for over 57 years, and he made important contributions to the study of color blindness, a condition from which he himself suffered [xxxiv] .

Dalton's Background in Meteorology and Color Blindness

Dalton's interest in science was broad and varied, and his work in meteorology and the study of color blindness provides a fascinating glimpse into the mind of this remarkable man. He was a passionate weather watcher, and he kept a daily weather diary for over 57 years, producing a detailed record of local weather conditions that is still of value to meteorologists today. His observations of the aurora borealis, or northern lights, led him to develop a theory about their causes, and he was one of the first to suggest that they were related to magnetic activity in the Earth's atmosphere. Dalton's work on color blindness was also groundbreaking [xxxv] . After his death, an autopsy of his eyes revealed that the vitreous humor was perfectly colorless, but DNA analysis conducted in 1995 showed that he lacked the gene for the receptor sensitive to medium-wavelength (green) light, confirming that he had a form of red-green color blindness that is still referred to as "Daltonism".

The Development and Impact of His Atomic Theory

Dalton's atomic theory, first published in his 1808 treatise “A New System of Chemical Philosophy” [xxxvi] , was a landmark achievement in the history of science. The theory was based on a few simple postulates: that all matter is composed of tiny, indivisible particles called atoms; that all atoms of a given element are identical in mass and other properties; that atoms of different elements have different masses; and those atoms combine in simple whole-number ratios to form compounds. This theory provided a powerful explanation for a wide range of chemical phenomena, including the law of definite proportions and the law of multiple proportions. It also provided a new and more accurate way of calculating the relative masses of atoms, which Dalton referred to as "atomic weights."

The Interplay of Chemistry and Medicine: A Symbiotic Relationship

The early 19th century witnessed a growing recognition of the potential for chemistry to revolutionize the practice of medicine. This period saw the emergence of a new field of study, physiological chemistry, which sought to explain the vital functions of the body in chemical terms.

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This was a radical departure from the traditional medical theories of the time, which were often based on vague and unscientific concepts like "vital forces" and "humors." The new approach, which was grounded in empirical observation and rigorous experimentation, promised to bring a new level of precision and objectivity to the practice of medicine.

The Application of Chemical Principles to Medical Research

The application of chemical principles to medical research was a key feature of the scientific revolution of the early 19th century. The work of William Prout, in particular, exemplified this new approach [xxxvii]. Prout was a strong advocate for the use of chemistry in medicine, and he believed that a better understanding of the chemical processes of the body was essential for the advancement of medical science. His work on urinary calculi, for example, led to a better understanding of the chemical composition of these stones and the development of more effective treatments.

The Development of Early Pharmacology

The early 19th century also saw the beginnings of modern pharmacology, the science of drugs and their effects on the body. The work of Humphry Davy on nitrous oxide was a key event in this development. Davy's discovery that the gas had analgesic properties was a major breakthrough, and it opened up the possibility of using chemical substances to relieve pain. His research on the chemical composition of food and the process of digestion led him to propose a new classification of nutrients, which he divided into carbohydrates, fats, and proteins. This was a major step forward in the understanding of nutrition, and it had important implications for the development of new dietary therapies [xxxviii]. Prout was also a strong advocate for the use of chemical remedies, although he was cautious about their potential side effects. He suggested, for example, that iodine could be used to treat goiter, a condition that was common at the time.

The Chemical Basis of Metabolism and Nutrition

The chemical basis of metabolism and nutrition was a key area of research in the early 19th century. Prout's studies of the chemical composition of food and the process of digestion led him to propose a new classification of nutrients, which he divided into carbohydrates, fats, and proteins [xxxix]. This was a major step forward in the understanding of nutrition, and it had important implications for the development of new dietary therapies. Prout's research on the chemical composition of urine also provided new insights into the process of metabolism. He was one of the first to recognize that the chemical composition of urine could provide valuable clues to the state of a person's metabolism, and he developed a series of tests that could be used to detect the presence of abnormal substances in the urine.

The Resistance to Integrating Chemistry into Medicine

Despite the clear potential for chemistry to revolutionize the practice of medicine, the integration of these two fields was not a smooth or straightforward process. It was met with resistance from many traditional physicians, who were skeptical of the new science and reluctant to abandon their long-held beliefs. This resistance was rooted in a number of factors, including a lack of understanding of chemistry, a fear of the unknown, and a desire to protect the established hierarchy of the medical profession. The traditional medical theories of the time, which were often based on vague and unscientific concepts like "vital forces" and "humors," had been in place for centuries, and they were deeply ingrained in the minds of many physicians [xl].

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The Skepticism of Traditional Physicians

The skepticism of traditional physicians was a major obstacle to the integration of chemistry into medicine in the early 19th century. Many physicians were trained in the classical tradition, which emphasized the importance of theory and philosophy over empirical observation and experimentation. This skepticism was often reinforced by the fact that many of the early pioneers of physiological chemistry, like William Prout, were not trained as physicians. They were seen as outsiders, and their work was often dismissed as being irrelevant to the practice of medicine.

The Invention of the Stethoscope

The invention of the stethoscope in the early 19th century was a major breakthrough in the diagnosis of chest diseases. The stethoscope allowed physicians to listen to the sounds of the heart and lungs with unprecedented clarity, providing them with a new and powerful diagnostic tool. The invention of the stethoscope is credited to René Laënnec (1781-1826), a French physician who first described the instrument in 1816 [xli] [xlii] . Laënnec's original stethoscope was a simple wooden tube, but it was soon improved upon by other physicians, who developed more sophisticated instruments with flexible tubing and multiple earpieces.

The Development of Auscultation as a Diagnostic Tool

The development of auscultation, the act of listening to the sounds of the body, as a diagnostic tool was a major advance in the practice of medicine. Before the invention of the stethoscope, physicians would often place their ear directly on the patient's chest to listen to their heart and lungs. This method, known as immediate auscultation, was often ineffective, as the sounds were muffled and difficult to interpret. The stethoscope allowed for mediate auscultation, which involved listening to the sounds of the body through an instrument [xliii]. The development of auscultation as a diagnostic tool was a major step forward in the understanding of chest diseases.

James Blundell's Pioneering Work in London

James Blundell (1790-1878) was a British obstetrician who is credited with performing the first successful human-to-human blood transfusion. Blundell's work was motivated by the high mortality rate from postpartum hemorrhage, and he believed that blood transfusion could be a life-saving treatment for this condition [xliv] . In 1818, he performed his first transfusion, using a syringe to transfer blood from a donor to a patient. Blundell's work was a major breakthrough, as it demonstrated that blood transfusion was a feasible and effective treatment for severe blood loss. Blundell's work was a major step forward in the field of transfusion medicine, and it laid the foundation for the many advances that would follow in the years to come.

The Development of Anesthesia

The development of anesthesia in the mid-19th century was a major breakthrough in the history of medicine. The introduction of ether and chloroform as anesthetics transformed surgery from a brutal and agonizing ordeal into a safe and humane practice. The discovery of anesthesia is credited to a number of individuals, including the American dentist William Morton [xlv] , who first demonstrated the use of ether as an anesthetic in 1846. The development of anesthesia was a major step forward in the history of medicine, and it has saved countless lives.

The Discovery of Ether and Chloroform

Ether was first used as an anesthetic by the American dentist William Morton in 1846. Morton's demonstration of the use of ether in a public surgery was a sensation, and it quickly led

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to the widespread adoption of the new technique. Chloroform was first used as an anesthetic by the Scottish obstetrician James Young Simpson in 1847 [xlvi]. The discovery of ether and chloroform as anesthetics was a major step forward in the history of medicine, and it had a profound impact on the practice of surgery.

The Rise of Occupational Diseases

The Industrial Revolution led to a rise in occupational diseases, as workers were exposed to a variety of new and dangerous substances and working conditions. The most common occupational diseases were lung diseases, such as pneumoconiosis and silicosis, which were caused by the inhalation of dust and other particles in the workplace. The use of new chemicals and dyes in the textile industry also led to a rise in skin diseases and other health problems [xlvii] . The rise of occupational diseases was a major public health problem, and it led to a number of important reforms, including the Factory Acts, which were designed to improve working conditions and protect the health of workers.

The Impact of Factory Work on Public Health

The long hours and low wages of factory work meant that many workers were unable to afford a healthy diet, and they were often malnourished. The poor working conditions in factories also led to a rise in accidents and injuries [xlviii] .

The Work of Edwin Chadwick and the Sanitary Movement

Edwin Chadwick (1800-1890) was a British social reformer who is best known for his work on public health [xlix] . Chadwick's work was based on the idea that many diseases were caused by environmental factors. Chadwick's most important contribution to the sanitary movement was his 1842 report, “The Sanitary Condition of the Labouring Population”.

Figure Nº 5: Edwin Chadwick (1800-1890)

The Public Health Act of 1848

The Public Health Act of 1848 was a landmark piece of legislation that established a Board of Health with the power to clean streets, build sewers, and regulate the water supply [l]. The act was a major victory for the public health movement, and it marked a significant step towards the creation of a modern public health system. The act was not without its critics, however, and it was

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not fully implemented in all
parts of the country. Nevertheless, the act was a major step forward in the improvement of public health, and it had a lasting impact on the health of the population.

The Rise of the "Scientist" as a Professional

The early 19th century saw the rise of the "scientist" as a professional. Before this period, science was often seen as a hobby for wealthy amateurs. However, the Industrial Revolution created a demand for skilled scientists and engineers, and it led to the establishment of new schools and universities that offered courses in science and engineering. The rise of the "scientist" as a professional was a key factor in the development of science and medicine.

The Foundation for Modern Chemistry and Medicine

The early 19th century was a period of foundational discovery in the fields of chemistry and medicine [li] . Dalton's atomic theory provided a new and powerful framework for understanding the nature of matter, while Davy's work on electrochemistry and the properties of gases opened up new avenues for medical application.

The Importance of Observation and Experimentation

The importance of observation and experimentation in medicine was a key theme of the scientific revolution of the early 19th century. The work of pioneers like Edward Jenner, who developed the smallpox vaccine, and James Blundell (1790-1878), who pioneered blood transfusion, was based on careful observation and rigorous experimentation. The emphasis on observation and experimentation was a major departure from the traditional, often speculative, approach to medicine, and it laid the foundation for the modern scientific approach to medicine.

The Role of Statistics in Medical Research

The use of statistics in medical research became more common in the early 19th century. Physicians began to use quantitative methods to evaluate the effectiveness of new treatments, and to identify the causes of disease. The work of pioneers like John Snow (1813-1858) [lii] , who used statistical methods to demonstrate the link between contaminated water and cholera, was a major step forward in the use of statistics in medical research. The use of statistics in medical research was a major step forward in the history of medicine [liii], and it laid the foundation for the modern scientific approach to medicine.

The Establishment of Scientific Journals and Societies

The establishment of scientific journals and societies was a key factor in the dissemination of new scientific knowledge in the early 19th century. The Royal Society, founded in 1660, was the premier scientific society in Britain, and its journal, the “Philosophical Transactions” [liv] , was one of the most important scientific journals in the world. The British Association for the Advancement of Science, founded in 1831, was another important scientific society that played a crucial role in the dissemination of new scientific knowledge. The establishment of scientific journals and societies was a key factor in the development of science and medicine in the early 19th century, and it had a lasting impact on the way that science is practiced today.

Corollary: The Apothecaries Law (1815)

In this scientific and social context, the British Parliament enacted the Apothecaries Act in 1815 [lv] .These healthcare professionals possessed extensive knowledge of chemistry and were very accessible to the population, especially in rural areas. We must not forget that, for example, Sir *Humphry Davy* apprenticed to an apothecary-surgeon. In the other hand, Edward Jenner was a

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rural physician who lived and worked in Gloucestershire. It is quite possible that this legal gesture gave rise to the figure of the general practitioner, which has been key to the development of modern family medicine and primary care [lvi] [lvii] [lviii]. Accessibility is still a key issue for family physicians in the 21st century.

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https://doi.org/10.62701/revmedica.v14.5517

REFERENCES

[1]Bloor DU: The rise of the general practitioner in the nineteenth century. J R Coll Gen Pract. 1978; 28 (190): 288-91. https://bjgp.org/content/28/190/288.long

[2] Hunting P: The worshipful Society of Apothecaries of London. Postgrad Med J. 2004; 80(939): 41-4. https://academic.oup.com/pmj/article-abstract/80/939/41/ 7033820?redirectedFrom=fulltext&login=false

[3] Farthing MJ: Nicholas Culpeper (1616-1654): London's first general practitioner? J Med Biogr. 2015; 23(3): 152-8. https://journals.sagepub.com/doi/10.1177/0967772013506687?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed

[4] Carlyle, T: Signs of the Times. Cambridge University Press: 2012. https://www.cambridge.org/core/books/abs/works-of-thomas-carlyle/signs-of-the-times/B45EFA8D5EB1638DBA49DE0FE18069BF

[5] Crane-Kramer G, Buckberry J: Changes in health with the rise of industry. Int J Paleopathol. 2023; 40: 99-102. https://www.sciencedirect.com/science/article/pii/S1879981722000705?via%3Dihub

[6] Davenport RJ: Mortality, migration and epidemiological change in English cities, 1600-1870. Int J Paleopathol. 2021; 34: 37-49. https://www.sciencedirect.com/science/article/pii/S1879981721000371?via%3Dihub

[7] Small H: Edwin Chadwick: A biographical update. J Med Biogr. 2022; 30(2): 118-124. https://journals.sagepub.com/doi/10.1177/0967772020951083?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed

[8] Buechner JS, Constantine H, Gjelsvik A: John Snow and the Broad Street pump: 150 years of epidemiology. Med Health R I. 2004; 87(10): 314-5.

[9] Caton R: Two lectures on the temples and ritual of asklepios at Epidaurus and Athens: Delivered at the Royal Institution of Great Britain. Br Med J. 1898; 1(1955): 1572-5. https://pmc.ncbi.nlm.nih.gov/articles/PMC2411783/

[10] Martin T: Origins of the Royal Institution. The British Journal for the History of Science. 1962; 1(1): 49-63. https://www.cambridge.org/core/journals/british-journal-for-the-history-of-science/article/abs/origins-of-the-royal-institution/F47446D84CEB3FE00A17662D74FAE388

[11] Thomas KB: Sir Humphry Davy, PRS (1778--1829). Anaesthesia.1978; 33(10): 903-5. https://associationofanaesthetistspublications.onlinelibrary.wiley.com/doi/abs/10.1111/j.1365-2044.1978.tb08321.x?sid=nlm%3Apubmed

[12] Moshenska G: Michael Faraday's Contributions to Archaeological Chemistry. Ambix. 2015; 62(3): 266-86. https://www.tandfonline.com/doi/10.1179/1745823415Y.

ISSN 2660-6801 Vol. 14, No. 1, 2026 | pp. 60-79
https://doi.org/10.62701/revmedica.v14.5517

0000000004?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed

[13] Rodriguez-Caso JM: The institutionalisation of biology in the British Association for the Advancement of Science, 1866-1894. Hist Cienc Saude Manguinhos. 2022; 29(4): 993-1011. https://www.scielo.br/j/hcsm/a/cJWtk4J5LGS3ZcWZVLBPBWy/?lang=en

[14] Vargesson N: Lewis Wolpert (1929-2021). Cells Dev. 2021; 166: 203673. https://www.sciencedirect.com/science/article/pii/S2667290121000206?via%3Dihub

[15] Unwin PR, Unwin RW: Humphry Davy and the Royal Institution of Great Britain. Notes Rec R Soc Lond. 2009; 63(1): 7-33. https://royalsocietypublishing.org/doi/full/10.1098/rsnr.2008.0010

[16] James FAJL, Ruston S: New Studies on Humphry Davy: Introduction. Ambix. 2019; 66(2-3): 95-102. https://www.tandfonline.com/doi/10.1080/00026980.2019.1625238?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed

[17] Grossman MI: John Dalton's "Aha" Moment: the Origin of the Chemical Atomic Theory. Ambix. 2021; 68(1): 49-71. https://www.tandfonline.com/doi/10.1080/00026980.2020.1868861?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed

[18] Usselman MC, Brown TA: Atomic Theory and Multiple Combining Proportions: The Search for Whole Number Ratios. Ann Sci. 2015; 72(2): 153-69. https://www.tandfonline.com/doi/10.1080/00033790.2015.1007522?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed

[19] Wentrup C: The Transition from Alchemical to Modern Chemical Symbolism: from Bergman and Guiton de Morveau to Hassenfratz and Adet, Higgins, Richter, Dalton, and Berzelius. Chempluschem. 2024; 89(7): e202400033. https://chemistry-europe.onlinelibrary.wiley.com/doi/10.1002/cplu.202400033

[20] Wentrup, C: Origins of Organic Chemistry and Organic Synthesis. Eur. J. Org. Chem. 2022, e202101492. https://chemistry-europe.onlinelibrary.wiley.com/doi/full/10.1002/ejoc.202101492

[21] Rocke AJ: It began with a daydream: the 150th anniversary of the Kekulé benzene structure. Angew Chem Int Ed Engl. 2015; 54(1): 46-50. https://onlinelibrary.wiley.com/doi/10.1002/anie.201408034

[22] Merino G, Solà M: Celebrating the 150th anniversary of the Kekulé benzene structure. Phys Chem Chem Phys. 2016; 18(17): 11587-8. https://pubs.rsc.org/en/content/articlelanding/2016/cp/c6cp90088g

[23] Théodoridès J: Pasteur and rabies: the British connection. J R Soc Med. 1989; 82(8): 488-90. https://journals.sagepub.com/doi/10.1177/014107688908200813?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed

ISSN 2660-6801 Vol. 14, No. 1, 2026 | pp. 60-79
https://doi.org/10.62701/revmedica.v14.5517

[24] Martínez-Palomo A: The science of Louis Pasteur: a reconsideration. Q Rev Biol. 2001; 76(1): 37-45.

[25] Cambau E, Drancourt M: Steps towards the discovery of Mycobacterium tuberculosis by Robert Koch, 1882. Clin Microbiol Infect. 2014; 20(3): 196-201. https://www.clinicalmicrobiologyandinfection.org/article/S1198-743X(14)60856-9/fulltext

[26] Robinson DH, Toledo AH: Historical development of modern anesthesia. J Invest Surg. 2012; 25 (3): 141-9. https://www.tandfonline.com/doi/10.3109/08941939.2012.690328?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed

[27] Dash NR, Singh G, Mohapatra A, Keshetty SS: Dr. Ignaz Phillip Semmelweis: The Unrecognized Pioneer of Aseptic Practices. Cureus. 2024; 16(8): e68350. https://pmc.ncbi.nlm.nih.gov/articles/PMC11442886/

[28] Ellis H: James Phipps, first to be vaccinated against smallpox by Edward Jenner. J Perioper Pract. 2021; 31(1-2): 51-52. https://journals.sagepub.com/doi/10.1177/1750458920950165?url_ver=Z39.88-2003&rfr_id=ori%3Arid%3Acrossref.org&rfr_dat=cr_pub++0pubmed

[29] Ahamed Vp A, Choudhari SG, Mudey A, Joshi A: Jenner's Legacy: How Edward Jenner's Smallpox Vaccine Changed Public Health. Cureus. 2024 Sep 3;16(9): e68594. https://pmc.ncbi.nlm.nih.gov/articles/PMC11450354/

[30] West JB: Humphry Davy, nitrous oxide, the Pneumatic Institution, and the Royal Institution. Am J Physiol Lung Cell Mol Physiol. 2014; 307(9): L661-7. https://journals.physiology.org/doi/full/10.1152/ajplung.00206.2014?rfr_dat=cr_pub++0pubmed&url_ver=Z39.88-2003&rfr_id=ori%3Arid%3Acrossref.org

[31] Rosenfeld L: William Prout: early 19th century physician-chemist. Clin Chem. 2003; 49(4): 699-705. https://pubmed.ncbi.nlm.nih.gov/12651838/

[32] Modlin IM: From Prout to the proton pump--a history of the science of gastric acid secretion and the surgery of peptic ulcer. *Surg Gynecol Obstet. 1990; 170*(1): 81-96. https://europepmc.org/article/med/2152987

[33] Ahrens R: William Prout (1785-1850). A biographical sketch. J Nutr. 1977;107(1): 17-23. https://www.sciencedirect.com/science/article/abs/pii/S0022316623270170

[34] Emery AE: John Dalton (1766-1844). J Med Genet. 1988; 25(6): 422-6. https://jmg.bmj.com/content/25/6/422.long

[35] Hunt DM, Dulai KS, Bowmaker JK, Mollon JD: The chemistry of John Dalton's color blindness. Science. 1995; 267(5200): 984-8. https://www.science.org/doi/10.1126/science.7863342

ISSN 2660-6801 Vol. 14, No. 1, 2026 | pp. 60-79
https://doi.org/10.62701/revmedica.v14.5517

36 Ball P: In retrospect: A New System of Chemical Philosophy. Nature. 2016; 537(7618): 32-3. https://www.nature.com/articles/537032a

37 Coley NG: Medical chemists and the origins of clinical chemistry in Britain (circa 1750-1850). Clin Chem. 2004; 50(5): 961-72. https://academic.oup.com/clinchem/article-abstract/50/5/961/5639991?redirectedFrom =fulltext&login=false

38 Bickel MH: Die Entwicklung zur experimentellen Pharmakologie 1790-1850. Gesnerus Suppl. 2000; 46: 7-158.

39 Orland, B : The invention of nutrients – William Prout , Digestion and Alimentary substances in the 1820s. Food & History. 2010; 8 (1): 149-168.
https://www.brepolsonline.net/doi/epdf/10.1484/J.FOOD.1.100977?role=tab

40 Płonka-Syroka, B: Medical doctrines at the turn of the 18th and 19th c. and their philosophical foundations. Polish Journal of Public Health. 2018; 128(1): 36-43. https://czasopisma.umlub.pl/pjph/article/view/1097

41 Donoso F A, Arriagada S D: René Théophile Hyacinthe Laënnec (1781-1826). Two hundred years of the stethoscope. A brief overview. Arch Argent Pediatr. 2020 Oct; 118(5): e444-e448.

42 Atalić B: 200th Anniversary of the Beginning of Clinical Application of the Laennec's Stethoscope in 1819. Acta Med Hist Adriat. 2019; 17(1): 9-18.

43 Silverman ME. Charles J. B. Williams: English pioneer in auscultation. Clin Cardiol. 2007; 30(10): 532-4. https://onlinelibrary.wiley.com/doi/10.1002/clc.20148

44 Carmichael SP 2nd, Lin N, Evangelista ME, Holcomb JB: The Story of Blood for Shock Resuscitation: How the Pendulum Swings. J Am Coll Surg. 2021; 233(5): 644-653. https://journals.lww.com/journalacs/pages/articleviewer.aspx?year =2021&issue=11000&article=00008&type=Fulltext

45 Haridas RP, Mather LE, Bause GS: William T. G. Morton's English Patent for Etherization: Patently Pointless? Anesth Analg. 2022; 134(6): 1326-1336. https://journals.lww.com/anesthesia-analgesia/fulltext/2022/06000/william _t_g_morton_s_english_patent_for.26.aspx

46 Haridas RP: James Young Simpson's Notice of a New Anaesthetic Agent: The first pamphlet on chloroform. Anaesth Intensive Care. 2025; 53(4_suppl): 17-26. https://journals.sagepub.com/doi/10.1177/0310057X241285167?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed

47 Gochfeld M: Chronologic history of occupational medicine. J Occup Environ Med. 2005; 47(2): 96-114.
https://journals.lww.com/joem/fulltext/2005/02000/chronologic_history_of_occupation al_medicine.2.aspx

ISSN 2660-6801 Vol. 14, No. 1, 2026 | pp. 60-79
https://doi.org/10.62701/revmedica.v14.5517

48 Peacock, A. E: The Successful Prosecution of the Factory Acts, 1833-55. The Economic History Review.1984; 37: 197–210. https://www.jstor.org/stable/2596881?casa_token=L3LbtsDq3WwAAAAA%3AIJb_0ILgAw6xJ5gJPvCZDFN0TFh6PGSVLpk6p1ZBwxXybDOXHidtJK5KCR64RXGdVpR6mouJ_thF9qH81Ep7vPytvVmdaD5gukFyBGlEIKo-yqkb3AM&seq=1

49 Mary Vaishali P, Boopathy N: Edwin Chadwick: A Pioneer of Public Health Reform and His Role in Sanitary Awakening. Cureus. 2024; 16(9): e68858. https://pmc.ncbi.nlm.nih.gov/articles/PMC11457289/

50 Fee E, Brown TM: The Public Health Act of 1848. Bull World Health Organ. 2005; 83(11): 866-7. https://pmc.ncbi.nlm.nih.gov/articles/PMC2626469/

51 Rosenfeld L: Clinical chemistry since 1800: growth and development. Clin Chem. 2002; 48(1): 186-97. https://academic.oup.com/clinchem/article-abstract/48/1/186/5641731?login=false

52 Snow J: Cholera and the Water Supply in the South Districts of London in 1854. J Public Health Sanit Rev. 1856; 2(7): 239-257. https://pmc.ncbi.nlm.nih.gov/articles/PMC6004154/

53 Tröhler U: The introduction of numerical methods to assess the effects of medical interventions during the 18th century: a brief history. J R Soc Med. 2011; 104(11): 465-74. https://journals.sagepub.com/doi/10.1258/jrsm.2011.11k025?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed

54 Allen, B., Qin, J., Lancaster, F. W: Persuasive Communities: A Longitudinal Analysis of References in the Philosophical Transactions of the Royal Society, 1665-1990. 1994; Social Studies of Science, 24(2), 279-310. https://doi.org/10.1177/030631279402400204

55 Holloway S: Significance of the Apothecaries' Act, 1815. Pharm Hist (Lond). 1970; 1(5): 6-9.

56 Moreno-Pérez de Tudela R, Romero-Ramos H, Cayuela-Rodríguez L, Gabaldón-Rodríguez I, Cayuela-Domínguez A, Ortega-Calvo M: La conferencia de Alma-Ata como final de un proceso histórico (1815-1979). Semergen. 2025; 51(8): 102535. https://www.sciencedirect.com/science/article/abs/pii/S1138359325000887?via%3Dihub

57 Hunting P: The worshipful Society of Apothecaries of London. Postgrad Med J. 2004; 80(939): 41-4. https://academic.oup.com/pmj/article-abstract/80/939/41/7033820?redirectedFrom=fulltext&login=false

58 Piterman L, Koritsas S: Part I. General practitioner-specialist relationship. Intern Med J. 2005; 35(7): 430-4. https://onlinelibrary.wiley.com/doi/10.1111/j.1445-5994.2005.00855.x