**Chapter 01: History of Medicine**

* **a,1, Ritika Maheshwari, MSc. bGajendra Singh, MS. cSharangouda J Patil, Ph.D.**

1. Department of Biotechnology, Dolphin PG Institute of Biomedical & Natural Sciences, Dehradun 248007, India
2. Department of Molecular Medicine and Biotechnology, Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow 226014, India
3. Department of Zoology, NMKRV College For Women (Autonomous), Bangalore, 560041, India

1Correspondence to: **Ritika Maheshwari**, Department of Biotechnology, Dolphin PG Institute of Biomedical & Natural Sciences, Dehradun 248007, India. [maheswari.ritika99@gmail.com](mailto:maheswari.ritika99@gmail.com)

**Authors details**

**Ritika Maheshwari**, Department of Biotechnology, Dolphin PG Institute of Biomedical & Natural Sciences, Dehradun 248007, India. [maheswari.ritika99@gmail.com](mailto:maheswari.ritika99@gmail.com)

**Gajendra Singh**, Department of Molecular Medicine and Biotechnology, Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow 226014, India. Email. [gajendrasgpgi@gmail.com](mailto:gajendrasgpgi@gmail.com)

**Sharangouda J. Patil,** Department of Zoology, NMKRV College For Women (Autonomous), Bangalore, 560041, India. Email. [shajapatil@gmail.com](mailto:shajapatil@gmail.com)

**Introduction:**

The field of medicine is all about understanding and treating illnesses and injuries to keep people healthy. It has been an essential part of human history since ancient times. In the beginning, early civilizations had healers and wise people who tried to help their communities stay well. They observed the human body and used ancient knowledge to develop the first ideas of medicine [1]. Places like India, China, and Egypt were pioneers in this field. They wrote down their medical knowledge in documents like the Ayurvedic texts and Ebers Papyrus, which taught how to heal and treat various conditions. As time passed, more great scholars, like the ancient Greeks, made significant contributions to medicine. Hippocrates, known as the father of Western medicine, was among them, and he left behind the Hippocratic Oath, a set of ethical precepts that doctors still follow today. [2, 3].

Medicine has played a crucial role in the survival and development of civilizations. Throughout history, terrible epidemics and pandemics have affected societies, leaving long-lasting effects on culture, religion, and politics [4]. For example, the Black Death in the 14th century caused a massive loss of life in Europe, changing the balance of power and work [5]. Moreover, the Coronavirus disease 2019 (COVID-19) pandemic began in Wuhan, China, and has since spread throughout the world, posing significant health and safety risks [6]. Medicine has also had an impact on military conflicts, influencing the outcomes of wars and conquests. Discoveries like COVAXIN in the twenty-first century and penicillin during World War II transformed how infections were treated and saved many lives. Understanding how our bodies work, along with advances in surgery and drugs, has increased life expectancy and improved the quality of life. Vaccines and antibiotics have eradicated dangerous diseases and brought in healthier times [7, 8].

Studying the history of medicine is more than just learning facts; it helps us understand our past and plan for the future. It demonstrates the cultural, social, and philosophical impacts on medical practises throughout history, allowing modern healthcare to be more understanding and patient oriented. Throughout history, medical progress has relied on people working together and being resilient, from ancient healers to modern research teams. By embracing this spirit of collaboration, we can inspire more medical breakthroughs [9]. Learning from past mistakes and successes guides us to make better choices based on evidence. Historical examples, such as the abolition of smallpox, demonstrate the effectiveness of public health measures. The story of medicine is amazing! It's about how humans faced challenges and achieved great things, all to improve our health [10]. By looking at this history, we can learn valuable lessons from the past. It also shows that we all share a common bond as humans and are always striving for better health. This knowledge can help us create a healthier and happier future for everyone.

**Early Medical Practices and Beliefs in India**

Throughout history, civilizations across the globe have developed their unique medical beliefs and practices. In ancient times, India stood out with its highly regarded and influential medical traditions. The roots of ancient Indian medicine can be traced back to the Vedas, which encompassed various sacred texts like Brahmanas, Aranyakas, and Upanishads [11-13]. The Vedic people held a profound belief that gods resided within every object, animate or inanimate, and this spiritual perspective laid the foundation for their medical practices. These ancient healers were revered for their seemingly magical healing abilities, as they chanted mantras to alleviate the suffering of the common people. This rich heritage eventually gave birth to Ayurveda, a more systematic and sophisticated medical system that is considered the mother of modern medicine in India. The practitioners of Ayurveda, known as Vaidyas, were esteemed as highly knowledgeable beings in the ancient world [14,15]. At the core of Ayurveda were two seminal Sanskrit medical texts: Charaka Sambita (Charaka's Collection) and Sushruta Sambita (Sushruta's Collection) [13]. Vagbhatta's Astangabrdaya also played a vital role in shaping Ayurvedic theory [11]. These texts laid down the principles of Ayurveda, which encompassed holistic approaches to healing, taking into account the interconnectedness of the mind, body, and spirit.

The Vaidyas shared many similarities with modern-day doctors, evident in their thorough and comprehensive patient examinations. They took into consideration various relevant details about the patient, including their innate physiology, mental health, age, food habits, and the season in which the disease occurred [15, 16]. This meticulous approach allowed them to tailor treatments to each individual's unique needs, recognizing that no two patients were exactly alike. Moreover, the ancient Vaidyas were not just healers but were also skilled surgeons [17]. They possessed a wide array of medical knowledge and were expected to perform various surgical procedures when necessary. Ayurveda emphasized the balance of the three doshas – Vata, Pitta, and Kapha – which are believed to govern various physiological and psychological processes in the body. When these doshas were in harmony, it was thought to result in good health, whereas imbalances were believed to lead to illness. The Vaidyas used various herbs, minerals, and natural substances to restore this balance and promote healing. Additionally, lifestyle recommendations such as diet, exercise, and meditation were integral parts of Ayurvedic treatment.

**Greek Contributions in the Medical Era**

In early times, medical practices were largely based on magical beliefs, superstitions and religious ideas. Then came a gentleman from Kos, a Greek island of South-eastern Aegean who is predominantly regarded as ‘The Father of Modern Medicine’ because of his observations based on clinical signs and symptoms and logical interpretations [18,19].

It was he who established the ordeals of medicine which are practiced even today. It required the physician to carefully examine the patient first followed by observing the signs and symptoms, making a correct diagnosis and finally providing suitable treatment [20-24]. Hippocrates lived in an era which had many epidemics. Reports suggested that he was persuaded by Illyrians and Persians to treat their citizens suffering from plague [18,19,17]. All the works of Hippocrates and his followers on medical theory and practices are compiled together in the form of Hippocratic Corpus. Hippocratic Oath, which is famous till today was given many centuries after he died but certainly similar ethical oral vows were laid down by him regarding correct medical conduct [21,24].

**Industrial revolution and modern medicine**

Industrial Revolution reached Europe at its ultimate heights during the nineteenth century and it tried to bridge the gap between early and modern medicinal practices. Urbanization accompanied it and people shifted from rural to urban areas for their betterment. Educational reforms made it possible for upcoming surgery students to learn efficiently and also for existing surgeons to share their work and knowledge easily. Royal College of Surgeons of England was established during this time which had immensely contributed for the welfare of surgeons [25].

Surgery in today’s world is regarded as a reputed and highly paid profession but in the eighteenth century, it had different opinions related to it. Removal of any abnormality in fetus while it is still in the womb or cysts and tumor removal by minimal invasion and pain is nowadays possible due to major advancements in the field of medicine and also invention of new technologies. But when we go back in past, the horror associated with surgery prohibited the physicians and doctors to practice surgery very often. It was considered as a last resort and people preferred to die rather experience surgery. Mortality rates were as high as 50% even for routine operations and despite the operation being successful, people died due to enormous pain which they endured as there was a lack of proper anesthetic [25]. Alcohol was the only element which could be identified as a pain reliever for surgical procedures. All these factors together paved the way for the invention and use of anesthesia and antiseptics. The first ever modern anesthesia Ether was invented back in 1540s by a German physician and botanist named Valerius Cordus. After this, the analgesic effect of other compounds like nitrous oxide were identified as early as eighteenth century by doctors to help people get rid ff pain but they were not prevalent until mid-nineteenth century. Due to industrial revolution, people started shifting towards urban areas for their betterment. Undoubtedly, this period marked an increase in work opportunities for the common mass but it also made people prone to acute, work site associated injuries. In the eighteenth century, many major painful surgeries were performed but the nineteenth century doctors were not ready to risk the lives of people as already many lost it [26]. These factors then contributed towards the discovery of better anesthetics by Dr. William Morton, The Father of Modern Anesthetics who pioneered the use of Ether as an anesthetic compound which can be used in surgeries [27]. Gradually, with acceleration in the use of anesthesia, doctors also experimented with new approaches in operation. Anesthesia therefore not only helped to subside the pain of patients but also removed time constraint in surgeries which directly provided relief to doctors as well. Anesthesia therefore changed the line of thinking of people and allowed them to consider surgery not as a last resort but as an effective way of treatment.

As urbanization accompanied industrial revolution, cities became densely populated. This increased filth around cities which lighted major infectious outbreaks even in large major cities. This caused a shift towards public health. Apart from anesthesia, surgeries also demanded an aseptic environment, free of any microbial contamination. Hence came Louis Pasteur, a common figure in today’s world who did some of the majorly required inventions in his time. He revised the germ theory and also mentioned that these microscopic creatures travelled via air surrounding us and are invisible to naked eyes. Pasteur’s work significant in surgical field was the creation of aseptic technique which aimed to cut infections by sterilizing operating areas, surgical instruments and also surgeon’s hands.

**Medical Discoveries and Innovations**

Medical discoveries and innovations have played a crucial role in improving healthcare in the 19th and 20th centuries. Some key breakthroughs during this period include vaccinations, antibiotics, and X-rays. These developments have transformed the way we prevent and treat disease. Vaccinations have been a significant milestone in medical history. They are a way of introducing weakened or inactive pathogens into the body to trigger an immune response without causing the actual disease. This immune response helps the body build immunity against the disease, protecting individuals from future infections. Vaccines have successfully eradicated or controlled many deadly diseases like smallpox, polio, measles, covid19 and hepatitis, saving millions of lives worldwide [28].

Antibiotics have been another ground breaking discovery that revolutionized medicine. It has always been considered one of the wonder discoveries of the 20th century. These are powerful drugs that can kill or inhibit the growth of bacteria. Before antibiotics, bacterial infections were a leading cause of death, and there were limited treatment options available. With the discovery of antibiotics such as penicillin, streptomycin, and tetracycline, doctors gained the ability to effectively treat bacterial infections and save countless lives [29]. Moreover, X-rays, a form of electromagnetic radiation, have transformed medical diagnosis. X-rays can pass through soft tissues but are blocked by dense materials like bones. This property allows medical professionals to visualize internal structures without the need for surgery. X-rays have become a common diagnostic tool, assisting in the detection of fractures, tumours, and other medical disorders, resulting in more accurate and quicker treatment [30].

Furthermore, the development of medical technology has significantly enhanced patient care. Medical technology encompasses a wide range of tools and equipment used in healthcare settings. From simple instruments like stethoscopes and thermometers to sophisticated machines like MRI scanners and robotic surgical systems, medical technology has transformed the way we diagnose and treat illnesses [31].

In the 19th and 20th centuries, medical researchers and scientists worked tirelessly to understand the causes of diseases and find ways to combat them. Their dedication and perseverance led to ground breaking discoveries and medical breakthroughs that have had a profound impact on global health. However, it is essential to acknowledge that medical progress also faces challenges. The overuse and misuse of antibiotics have led to the emergence of antibiotic-resistant bacteria, posing a significant threat to public health. Additionally, vaccinations have faced controversies and resistance in some communities, leading to outbreaks of preventable diseases [32]. Despite these challenges, medical research and technological advancements continue to push the boundaries of healthcare. New and innovative treatments, such as gene therapy and immunotherapy, offer promising avenues for addressing previously untreatable conditions. In conclusion, the 19th and 20th centuries witnessed remarkable medical discoveries and innovations that have shaped modern healthcare. Vaccinations, antibiotics, and X-rays have become cornerstones of medicine, preventing diseases, saving lives, and improving diagnostics. While there are difficulties to overcome, the ongoing search for medical knowledge continues to propel us towards a better future.

**Artificial intelligence in medicine**

Artificial Intelligence is a term which basically means the use of computers to channel intelligent behavior with minimum human intervention. It came into existence with the invention of Robots. With latest research advancements, it has become a prominent tool to diagnose human health issues at a deeper level and thus a significant contributor in the medicinal world. The use of data and algorithms has provided scientists a better vision to learn about diseases and find suitable cure. Currently, the most basic and widespread example of AI in medicine is the use of glucose monitoring chips. Continuous glucose monitoring allows diabetics to assess their real time glucose levels which provides an insight about the change of direction and blood glucose level [33].

Another example of use of AI in medicine are carebots. These are care providing robots that are highly sophisticated in their work [34]. Japanese carebots are a highly skilled example of these carebots. Robots can be used to provide assistance to aging patients with decline in brain activity or restricted mobility. The advancement in the use of robots for performing surgeries is a breakthrough in today’s world. These non-living yet highly efficient entities need less/no human assistance and can perform either solo or as assistant surgeons in the operation theatres. [35]. In the near future, we can expect AI to take control of our lives and also replace us completely if their use is defined by certain ethical protocols.

**Conclusions**

In conclusion, medicine has been crucial to human history since ancient times, with healers and wise individuals striving to keep communities healthy. From early civilizations like India, China, and Egypt to the contributions of great scholars like Hippocrates, medicine has continuously advanced. It played a significant role in the survival and development of civilizations, facing and overcoming terrible epidemics and pandemics throughout history. Medicine's impact on society extends beyond health, shaping culture, religion, and politics. Recent events like the COVID-19 pandemic highlighted its importance in safeguarding global well-being. Medical discoveries such as COVAXIN and penicillin revolutionized treatments, increasing life expectancy and eradicating dangerous diseases. Studying the history of medicine allows us to understand our past and better plan for the future. It reveals the cultural and social influences on medical practices and emphasizes the value of collaboration for medical progress. By learning from the past, we can make informed choices based on evidence and continue striving for better health for all. The story of medicine is a testament to human resilience and the drive to achieve remarkable feats in the pursuit of improved well-being.

**References:**

1. Micozzi, M.S., 2014. *Fundamentals of complementary and alternative medicine-E-book*. Elsevier Health Sciences.
2. Alamgir, A.N.M. and Alamgir, A.N.M., 2017. Origin, definition, scope and area, subject matter, importance, and history of development of pharmacognosy. *Therapeutic Use of Medicinal Plants and Their Extracts: Volume 1: Pharmacognosy*, pp.19-60.
3. Dobanovački, D., Milovanović, L., Slavković, A., Tatić, M., Mišković-Skeledžija, S., Škorić-Jokić, S. and Pećanac, M., 2012. Surgery before common era (BCE). *Archive of oncology*, *20*(1-2), pp.28-35.
4. Jakovljevic, M., Bjedov, S., Jaksic, N. and Jakovljevic, I., 2020. COVID-19 pandemia and public and global mental health from the perspective of global health security. *Psychiatria Danubina*, *32*(1), pp.6-14.
5. Herlihy, D., 1997. *The Black Death and the transformation of the West*. Harvard University Press.
6. Peeri, N.C., Shrestha, N., Rahman, M.S., Zaki, R., Tan, Z., Bibi, S., Baghbanzadeh, M., Aghamohammadi, N., Zhang, W. and Haque, U., 2020. The SARS, MERS and novel coronavirus (COVID-19) epidemics, the newest and biggest global health threats: what lessons have we learned?. *International journal of epidemiology*, *49*(3), pp.717-726.
7. Quinn, R., 2013. Rethinking antibiotic research and development: World War II and the penicillin collaborative. *American journal of public health*, *103*(3), pp.426-434.
8. Rappuoli, R., Mandl, C.W., Black, S. and De Gregorio, E., 2011. Vaccines for the twenty-first century society. *Nature reviews immunology*, *11*(12), pp.865-872.
9. Foley, H. and Steel, A., 2017. The nexus between patient-centered care and complementary medicine: allies in the era of chronic disease?. *The Journal of Alternative and Complementary Medicine*, *23*(3), pp.158-163.9
10. Subbarayappa, B.V., 2001. Medicine and life sciences in India. *(No Title)*.
11. Lochan, K., 2003. *Medicines of Early India: With Appendix on a Rare Ancient Text* (Vol. 49). Chaukhambha Publications.
12. Mazars, G., 2006. *A concise introduction to Indian medicine* (Vol. 8). Motilal Banarsidass Publishe.
13. Gopinath, B.G., 2001. Foundational ideas of Ayurveda. *Medicine and Life Sciences in India. New Delhi: Centre for Studies in Civilizations*, pp.59-107.
14. Lochan, K., 2003. *Medicines of Early India: With Appendix on a Rare Ancient Text* (Vol. 49). Chaukhambha Publications.
15. Mazars, G., 2006. *A concise introduction to Indian medicine* (Vol. 8). Motilal Banarsidass Publishe.
16. Nuraliev, Y.N., 1990. Doctor's ethics in ancient east written classics and in the works of middle age medical scientists. *Interaction between Indian and Central Asian Science and Technology in Medieval Times. Medicine, Technology, Arts and Crafts, Architecture and Music*, *2*, pp.11-8.
17. de Boer, W., 1930. Sorani Gynaeciorum libri IV. De signis fracturarum. De fasciis. Vita Hippocratis secundum Soranum.
18. Yapijakis, C., 2009. Hippocrates of Kos, the father of clinical medicine, and Asclepiades of Bithynia, the father of molecular medicine. *in vivo*, *23*(4), pp.507-514.
19. Farrington, B., 1949. *Greek Science: Its Meaning for Us. Theophrastus to Galen*. Penguin Books.
20. Edelstein, L., 1967. Ancient Medicine: Selected Papers, ed. by O. Temkin and CL Temkin.
21. Yapijakis, C., 2009. Hippocrates of Kos, the father of clinical medicine, and Asclepiades of Bithynia, the father of molecular medicine. *in vivo*, *23*(4), pp.507-514.
22. Temkin, O., 1991. *Hippocrates in a World of Pagans and Christians*.
23. Jones, W.H., 1868. Hippocrates collected works I. *Cambridge Harvard University Press. Retrieved on March*, *25*, p.2008.
24. Melin, M.D., 2016. The industrial revolution and the advent of modern surgery. *Intersect: The Stanford Journal of Science, Technology, and Society*, *9*(2).
25. Pernick, M.S., 1985. A calculus of suffering: Pain, professionalism, and anesthesia in nineteenth-century America.
26. Melin, M.D., 2016. The industrial revolution and the advent of modern surgery. *Intersect: The Stanford Journal of Science, Technology, and Society*, *9*(2).
27. Pollard, A.J. and Bijker, E.M., 2021. A guide to vaccinology: from basic principles to new developments. *Nature Reviews Immunology*, *21*(2), pp.83-100.
28. Walesch, S., Birkelbach, J., Jézéquel, G., Haeckl, F.J., Hegemann, J.D., Hesterkamp, T., Hirsch, A.K., Hammann, P. and Müller, R., 2023. Fighting antibiotic resistance—strategies and (pre) clinical developments to find new antibacterials. *EMBO reports*, *24*(1), p.e56033.+9
29. Rullhusen, P., Artru, X. and Dhez, P., 1998. *Novel radiation sources using relativistic electrons: from infrared to x-rays* (Vol. 4). World Scientific.
30. Dhawan, A.P., Heetderks, W.J., Pavel, M., Acharya, S., Akay, M., Mairal, A., Wheeler, B., Dacso, C.C., Sunder, T., Lovell, N. and Gerber, M., 2015. Current and future challenges in point-of-care technologies: a paradigm-shift in affordable global healthcare with personalized and preventive medicine. *IEEE journal of translational engineering in health and medicine*, *3*, pp.1-10.
31. Davies, J. and Davies, D., 2010. Origins and evolution of antibiotic resistance. *Microbiology and molecular biology reviews*, *74*(3), pp.417-433.
32. Lawton, J., Blackburn, M., Allen, J., Campbell, F., Elleri, D., Leelarathna, L., Rankin, D., Tauschmann, M., Thabit, H. and Hovorka, R., 2018. Patients’ and caregivers’ experiences of using continuous glucose monitoring to support diabetes self-management: qualitative study. *BMC endocrine disorders*, *18*(1), pp.1-10.
33. Cornet\*\*, G., 2013. Chapter 4. Robot companions and ethics: A pragmatic approach of ethical design. *Journal international de bioéthique*, *24*(4), pp.49-58.
34. Larson, J.A., Johnson, M.H. and Bhayani, S.B., 2014. Application of surgical safety standards to robotic surgery: five principles of ethics for nonmaleficence. *Journal of the American College of Surgeons*, *218*(2), pp.290-293.
35. Morris, B., 2005. Robotic surgery: applications, limitations, and impact on surgical education. *Medscape General Medicine*, *7*(3), p.72.