ISSN: 3144-5055

International Journal of Advanced Pharmaceutical and Healthcare

2026, Vol. 1, No. 4, 39–52

www.ijaph.com

Scan to view this Article

Review Article

Origins, History and Development of Pharmacy with Special Reference to Pharmacy Profession in India as a Brief Review

Dr. T. Mangilal*, Mrs. T. Sowmya, Miss. Afreen Banu

Department of Pharmaceutics, Smt. Sarojini Ramulamma College of Pharmacy, Seshadri Nagar, Mahabub Nagar-509001, Telangana, India.

***Corresponding Author: Dr. T. Mangilal**
Department of Pharmaceutics, Smt. Sarojini Ramulamma College of Pharmacy, Seshadri Nagar, Mahabub Nagar-509001, Telangana, India.
DOI: https://doi.org/10.5281/zenodo.23839420

Article Info:-

Received: 16 September 2026
Revised: 07 October 2026
Accepted: 28 October 2026

How to cite this Article:

Dr. T. Mangilal*, Mrs. T. Sowmya, Miss. Afreen Banu (2026) Origins, History and Development of Pharmacy with Special Reference to Pharmacy Profession in India as a Brief Review. *International Journal of Advanced Pharmaceutical and Healthcare*, 1(4), 39–52.

ABSTRACT

Pharmacy, one of the oldest health professions, has evolved over millennia from mystical herbalism and religious healing practices to a scientifically rigorous and globally regulated discipline. This comprehensive review traces the journey of pharmacy from its roots in ancient Civilisations-from the legendary Egyptian polymath Imhotep, often regarded as the first physician-pharmacist-through classical antiquity, the Islamic Golden Age and medieval monastic traditions, to the scientific enlightenment, industrial revolution and contemporary digital era. The article explores how ancient records such as the Ebers Papyrus and Mesopotamian clay tablets served as early pharmacopoeias. It highlights contributions of foundational figures like Galen, Dioscorides and Avicenna and examines how pharmacy developed in tandem with medicine, botany, alchemy and chemistry. The Islamic world's preservation and advancement of pharmaceutical knowledge significantly influenced European practices during the Middle Ages and the Renaissance. The emergence of apothecaries, the professionalisation of pharmacy through regulatory frameworks and the impact of scientific and technological revolutions-including mass production, synthetic chemistry and biotechnology-are thoroughly analysed. The review also addresses the rise of clinical pharmacy, the shift toward patient-centred care and the modern-day challenges and innovations in global health, digital transformation and pharmaceutical education. Focusing on Africa's unique contributions and current pharmaceutical landscape, the work underscores pharmacy's rich heritage and future potential on the continent. It concludes with a call to reclaim the pharmacy's independence and redefine its role in a rapidly changing health ecosystem. Through a detailed historical lens, this study celebrates pharmacy as both an ancient art and a modern science, central to the pursuit of health and human flourishing across civilisations. The history of pharmacy, one of the oldest professions, is a rich tapestry of science, art, and human care, deeply intertwined with advancing medicine and public health. From its origins in ancient civilisations to its present role in global healthcare, pharmacy has continuously evolved to meet the changing needs of society. Today, as we celebrate World Pharmacists Day on September 25, 2024, it is an opportune moment to reflect on the journey of pharmacy from the time of Imhotep, the first known pharmacist, and look ahead to the bright future of the profession in a rapidly advancing world. Pharmacy education in India has a rich history, originating with the establishment of Banaras Hindu University in 1917, and evolving to encompass diverse pharmacy programs across the country. The historical overview delves into ancient medicinal traditions, indigenous practices, foreign influences, and pivotal eras like Mughal rule and British colonialism. The emergence of modern pharmacy, marked by the growth of the pharmaceutical industry and the Pharmacy Act of 1948, paved the way for post-independence developments, including India's prominence in generic drug production. Traditional medicine integration, challenges in regulation, and the emphasis on research and innovation in drug discovery are key aspects. The pharmaceutical industry's trajectory from traditional medicines to global manufacturing hub is explored, as is the evolution of pharmacy practice towards a broader healthcare role. Professional associations like the Pharmacy Council of India and the Indian Pharmaceutical Association have played vital roles, while challenges and future directions underscore the need for standardization, regulatory compliance, and continued research in the evolving landscape of Indian pharmacy.

KEYWORDS: Pharmacy Professional, Revolutionary Discovery in Pharmacy, History of Pharmacy in India, Father of Pharmacy in India, Notable Works of Mahadeva Lal Schroff,Key Contributors in Medicine, Pharmacy,Prehistoric pharmacy,Industrialization,History of Pharmacy profession in India and Post-Independent Time History of the Pharmacy Profession in India.

INTRODUCTION

Origins of Pharmacy in Ancient Civilizations

Pharmacy began in ancient civilisations, notably Egypt and Mesopotamia, where early practitioners used herbs, minerals and animal parts for healing. In Egypt, Imhotep-regarded as the first physician-pharmacist-pioneered scientific methods in healing and is credited with writing one of the earliest medical texts.[1] The Ebers Papyrus (C. 1550 BCE) documented over 800 medical prescriptions and reflects a structured approach to medicine and pharmacy.[2] In Mesopotamia, clay tablets containing over 700 prescriptions marked the early use of written pharmacopoeias. Other ancient cultures, including those in India and China, independently developed herbal and drug traditions. Ancient Indian Ayurvedic texts and Chinese Materia medica laid the groundwork for comprehensive healing systems that survive today.[3]

The Arabic Golden Age (8th-14th Century)

The Arabic Golden Age marked a profound leap in pharmaceutical knowledge. Scholars such as Avicenna (Ibn Sina) and Al-Razi synthesised Greek and Roman teachings, enriched them with Persian and Indian insights and advanced chemical extraction methods, distillation and dosage formulation[3]. The establishment of Bimaristans (hospitals) and pharmacy shops in cities like Baghdad institutionalised pharmacy as a distinct profession. Avicenna's Canon of Medicine remained a central pharmacological reference in Europe and the Middle East for centuries, laying the foundations of regulatory systems and pharmaceutical ethics.[4]

Pharmacy in Medieval Europe

With the decline of Roman influence, Europe's pharmaceutical knowledge was preserved in monasteries, where monks cultivated medicinal herbs and translated Arabic texts.[5] By the 13th century, pharmacy began separating from medicine. The 1231 Edict of Frederick II in Sicily formally separated the roles of physician and pharmacist and introduced legal regulation via pharmacy guilds. The emergence of apothecaries-retailers of medicinal products-marked the evolution of drug preparation and sale as a specialised field.[6]

The Renaissance and Enlightenment

The Renaissance revived scientific inquiry and classical learning. Pharmacy benefited through advances in botany and chemistry, leading to the founding of botanical gardens and academic departments of pharmacognosy, such as at Padua (1545).[7] Pharmacists began employing empirical and experimental methods in drug preparation. The printing press allowed rapid dissemination of pharmaceutical knowledge and standardisation of herbal texts and compoundingtechniques.[8]

Industrial Revolution and Birth of Pharmaceutical Companies

The Industrial Revolution introduced machinery and chemical synthesis, transforming pharmacy from an artisanal to a scientific discipline.[9] Drugs were mass-produced and the first pharmaceutical companies emerged. Scientific discoveries, including the isolation of morphine (1806) and quinine (1820), revolutionised disease treatment and led to global expansion in pharmaceutical trade. Professional journals, regulatory bodies and pharmacy education institutions emerged, setting global standards.[10]

20th Century

Clinical Pharmacy and Modern Regulation the 20th century witnessed the rise of clinical pharmacy, which emphasised patient safety, rational drug use and healthcare team collaboration. The Pharm.D. degree became a global gold standard. [11] Pharmacy curricula expanded to include biopharmaceutics, pharmacokinetics and counselling. Regulatory reforms followed tragedies like the thalidomide crisis, prompting legislation such as the 1938 U.S. Food, Drug and Cosmetic Act and leading to stronger roles for regulatory bodies like the FDA and WHO.[12]

Digital Transformation in Pharmacy

Digital technology is reshaping pharmacy globally. Innovations such as tale pharmacy, AI-based drug discovery, automated dispensing and electronic prescriptions enhance patient access and safety.[13] These tools proved especially vital during the COVID-19 pandemic, which drove global reliance on virtual health platforms. However, data security, digital literacy and online counterfeit medicines persist.[14]

The Role of Pharmacy in Global Public Health

Pharmacists now play a frontline role in global health, especially in low- and middle-income countries (LMICs). They support immunisation programs, disease prevention, health education and medication access.[15] Modern pharmacy training increasingly incorporates public health, epidemiology and policy-making. Multilateral cooperation is crucial for building sustainable pharmaceutical systems.[16]

Pharmacy in Africa: Legacy and Renaissance

Africa's pharmacy heritage dates back to Imhotep and the Ebers Papyrus. Colonialism disrupted Indigenous pharmaceutical systems, but post-independence, Africa has sought to regain autonomy through education, local manufacturing and improved regulation.[17] South Africa's Pharmacy Act 1885 formalised the profession.[18] Today, regional production hubs, herbal research centres and professional associations are building momentum, despite challenges such as counterfeit drugs, weak infrastructure and a lack of investment.

Future of Pharmacy: Global and Digital

The future of pharmacy lies in personalised medicine, pharmacogenomics and technology-driven care. Pharmacists will act as healthcare integrators, linking diagnostics, drug therapy and patient outcomes. Technologies such as blockchain, 3D printing, mobile apps and big data analytics transform how drugs are discovered, distributed and monitored.[19] Pharmacy education is adapting through simulation labs, virtual learning and interprofessional collaboration. As global health challenges grow, pharmacy must evolve with them.

History of pharmacy

The history of pharmacy as an independent science is relatively young. The origins of historiography pharmaceutical back to the first third of the nineteenth century which is when the first historiographies that while not touching all aspects of pharmaceutical history is the starting point for the final start of this science. Until the birth of pharmacy as an independent science, there is a historical evolution from antiquity to the present day that marks the course of this science, always connected to the medicine.[20]

Paleopharmacological studies attest to the use of medicinal plants in pre-history. The earliest known compilation of medicinal substances was the Sushruta Samhita, an Indian Ayurvedic treatise attributed to Sushruta in the 6th century BC. However, the earliest text as preserved dates to the 3rd or 4th century AD. Many Sumerian (late 6th millennium BC - early 2nd millennium BC) cuneiform clay tablets record prescriptions for medicine.[21]

Ancient Egyptian pharmacological knowledge was recorded in various papyri such as the Ebers Papyrus of 1550 BC, and the Edwin Smith Papyrus of the 16th century BC. The earliest known Chinese manual on materia medica is the Shennong Bencao Jing (The Divine Farmer's Herb-Root Classic), dating back to the 1st century AD. It was compiled during the Han dynasty and was attributed to the mythical Shennong. Earlier literature included lists of prescriptions for specific ailments, exemplified by a manuscript "Recipes for 52 Ailments", found in the Mawangdui tomb, sealed in 168 BC. Further details on Chinese pharmacy can be found in the Pharmacy in China article. In Ancient Greece, according to Edward Kremers and Glenn Sonnedecker, "before, during and after the time of Hippocrates there was a group of experts in medicinal plants. Probably the most important representative of these rhizotomoi was Diocles of Carystus (4th century BC).[22] He is considered to be the source for all Greek pharmacotherapeutic treatises between the time of Theophrastus and Dioscorides. The Greek physician Pedanius Dioscorides is famous for writing a five volume book in his native Greek in the 1st century AD. The Latin translation De Materia Medica (Concerning medical substances) was used a basis for many medieval texts, and was built upon by many Middle Eastern scientists during the Islamic Golden Age. The title coined the term materia medica. In Japan, at the end of the Asuka period (538-710) and the early Nara period (710-794), the men who fulfilled roles similar to those of modern pharmacists were highly respected. The place of pharmacists in society was expressly defined in the TaihÅ• Code (701) and re-stated in the YÅrÅ• Code (718). Ranked positions in the pre-Heian Imperial court were established; and this organizational structure remained largely intact until the Meiji Restoration (1868). In this highly stable hierarchy, the pharmacistsâ”and even pharmacist assistantsâ”were assigned status superior to all others in health-related fields such as physicians and acupuncturists. In the Imperial household, the pharmacist was even ranked above the two personal physicians of the Emperor. There is a stone sign for a pharmacy with a tripod, a mortar, and a pestle opposite one for a doctor in the Arcadian Way in Ephesus near Kusadasi in Turkey.[23]

In Baghdad the first pharmacies, or drug stores, were established in 754, under the Abbasid Caliphate during the Islamic Golden Age. By the 9th century, these pharmacies were state-regulated.[23]

Pharmacy is the clinical health science that involves medical science and chemistry. It functions to discover, produce, dispose of, safe and effective use, and control medications and drugs. The birth and the history of the pharmacy began when the early humans realized that the extracts of the leaves have medicinal values. From that day, humans started trying various plants on several injuries and diseases based on previous observations. It kept on continuing till the late 18th century.[24]

In the late 18th century, people started experimenting with chemicals, which revolutionised pharmaceuticals. Scientists observed that some chemicals reacted differently at different temperatures.

Many medical experts did experiments with various chemicals intending to treat human health. It was also the time when there were widespread diseases without any medicines to cure them. Once people started mixing chemicals and herbal medicines, they started achieving better results. It was in the 19th century that bacteria was discovered, and microscopes started coming up.

A lot of researchers also understood the fact that a lot of diseases are caused because of bacteria. So, the researchers felt that to cure bacterial diseases, we have to study the bacteria to know how they function and their prevention. This was a huge shift in pharmacy; earlier, people were trying medicine on a trial and error basis, which is considered inhumane today.[25]

After people started to study the diseases and the bacteria causing them, the trial and error methods started fading away. Researchers today have discovered medications

for almost all bacterial diseases. But in history, there were many instances where people would die from cold and fever due to a lack of proper treatment and health care facilities. So sciences took over the responsibility of treating people with proper methods and application procedures of pharmaceuticals.[26]

Brief History of Pharmacy: Past and Future

The history of pharmacy is a fascinating chapter that dates back to the Arabs of the 2nd century, pioneers in the art of creating medicines. Their innovative techniques of distillation, plant extraction and mixing of substances gave rise to pharmacies, where apothecaries and apothecaries, true masters in the manipulation of medicines, served everyone from the local population to royalty. In ancient times, there was no distinction between doctors and pharmacists, and the same professional was responsible for diagnosing illnesses and preparing the necessary medicines. This separation was only made official around the 12th century.[27]

Pharmacies were not just places to sell medicines; they were true centers of knowledge and wisdom. Apothecaries not only prepared medicines, but also uncovered the secrets of medicinal plants, accumulating vast knowledge about their properties and therapeutic uses. In addition, these places became meeting places where people sought cures and advice on health and well-being, transforming apothecaries into trusted and respected advisors in their communities.[28]

Apothecaries' expertise was not limited to the preparation of medicines; they were consulted to create personalized mixtures, tailoring treatments to the individual needs of patients. This personalized approach to medicine and their ability to understand the different effects of substances have contributed to the reputation and trust placed in these professionals over the centuries.

In addition to providing medicines, apothecaries were places of learning where pharmacy students could hone their skills by following the teachings of master apothecaries. These establishments played a vital role in the preservation and dissemination of pharmaceutical knowledge, profoundly influencing the practice of pharmacy throughout history.[29]

Along the way, notable figures such as Hippocrates (460 BC) and Galen (XNUMXnd century) left a crucial legacy. Hippocrates, the notable Greek physician, not only introduced ethical principles but also profoundly influenced pharmacy with his practical approach. Galen, considered the father of pharmacy, considerably expanded medical and pharmaceutical knowledge, shaping the pharmaceutical practice we know today.

The very origin of the word "pharmacy", from the Greek "pharmakon", illustrates the duality of substances as medicine or poison, a duality present throughout the history of pharmacology. The emblematic symbol of the cup with a coiled serpent, originating from Greek mythology, represents power and healing, reflecting the essence of the pharmaceutical profession.[30]

In Brazil

Hospital Pharmacy

The evolution of pharmacy has also embraced hospital pharmacy over the centuries, focusing on the preparation and distribution of medicines in hospital settings. Over the centuries, hospital pharmacy has evolved to become a fundamental pillar in medical care, contributing significantly to the recovery and health of hospitalized patients. This practice remains an essential element in modern healthcare, ensuring the integrity and effectiveness of treatments in hospital settings.[31]

Pharmacy Professional

The regulation of the pharmaceutical profession in Brazil was established through Decree 20.377/1931 and Law 3.820/1960, which gave rise to the Federal Pharmacy Council (CFF) and the Regional Pharmacy Councils (CRF). These laws were fundamental to structuring the pharmaceutical field, establishing standards and guidelines that guide the practice and regulation of the profession in the country.[32]

Commemorative dates such as National Pharmacy Day (August 5), National Pharmacist Day (January 20) and International Pharmacist Day (September 25), the latter established by the International Federation of Pharmacists (FIP), recognize the importance of these professionals in public and private health in health organizations. The XNUMXth century witnessed impressive advances in pharmacy. New drugs were developed, regulations became stricter and scientific research gained focus to improve treatments. This technical, social and scientific evolution shaped contemporary pharmaceutical practice, a field in constant transformation and innovation for the well-being of society.

Looking ahead, the opportunities for pharmacists are vast and exciting. With technological advances, genomics and personalized medicine, a horizon of discovery and innovation opens up. Pharmacy is constantly changing, and pharmacists are at the forefront of this evolution, ready to embrace new challenges and shape an even brighter future for healthcare. Their role as public health stewards will continue to grow, always dedicated to improving the quality of life for people in all communities. Thus, the history of pharmacy is an inspiring journey of resilience, learning and commitment, with a future full of possibilities for pharmacists to continue to make a difference in people's lives.[33]

Revolutionary Discovery in Pharmacy

Earlier, people had no knowledge of the dosages that one had to take to avoid other side effects of the medicine. Today, we are aware of the medicine's functioning in the

human body, specific to the age and medical history of the patient.[34]

One of the best-known antibiotics in the history of humankind is known as Penicillin, discovered by Sir Alexander Fleming in 1928. It is not a myth that more than 75% of today's population must thank Penicillin. Without it, most of our parents and grandparents would get infections, and the population would have never reached the numbers it is today. Penicillin is an antibiotic that cures humans of a wide range of diseases. This was the pharmacy's single answer to many questions and cures.

The pharmacy also deals with various synthetic chemicals that can be used as painkillers and disease-curing drugs. These drugs are manufactured using various chemicals, mixing them with herbal extracts. These combinations are done based on individual chemical behaviours in humans. Until now, we have exclusively discussed the history of pharmacy in the entire world. Let us now look into the history of pharmacy in India.[35]

History of Pharmacy in India

Pharmacy in India also goes back to a very ancient past. The subject of Ayurveda and Yoga is considered to be very important in Indian pharmaceutical studies. The roots of Ayurveda and Yoga can be traced back to more than 5000 years ago.

The knowledge is a combined and collective knowledge of various sages and monks that used herbal juices to heal various diseases and injuries. It has to be noted that in Indian culture, there is no difference between a pharmacist and a doctor. Therefore, it gave a solid base for all the ancient doctors in our country to try medicines they felt would suit the patient's body better.

India is also a country where a majority of the people follow vegetarianism. If we look back into the reasons for this vegetarianism, you will realize that it was done to avoid diseases from the animals. Indians far back in the past observed that the root cause for most diseases is viruses caused by the contact of dead animals. So people in India started practising vegetarianism, avoiding dead meat. Today, people appreciate this practice all across the world as this gives us immunity to certain diseases from birth.[36]

Father of Pharmacy in India

The father of Pharmacy in India, Mahadeva Lal Schroff, was born on 6th March 1902 at Darbhanga in Bihar. He was not a trained pharmacist, but he introduced and led pharmaceutical education and pharmaceutical industries towards success in India.

During his time as a professor at Banaras Hindu University Schroff, he struck upon the idea to start a separate branch of pharmaceutical Sciences at BHU for the first time ever in India in 1932. First, he introduced Pharmaceutical Chemistry as the principal subject in the B.Sc. course. Then, two years later, he proposed an integrated two year B.Sc course with the subjects Pharma Chemistry, Pharmacy, and Pharmacognosy. It was later turned into a complete three-year B.Pharm course at BHU for the first time in India.[37]

In 1935 Professor Schroff established the United Provinces Pharma Association with branches globally. He soon gained the confidence and liking of the top intellectuals, scientists and industrialists, pharmacology and medical practitioners. He successfully created awareness of this science to develop pharmaceutical education of science and technology in India.

Notable Works of Mahadeva Lal Schroff

Prof Schroff started the M.Pharm education in 1940 at Banaras Hindu University. Slowly pharmacy education sprung up in different places in India. He left BHU in 1943 to join Birla Brothers as the Chief Chemist and Research Officer. Still, his efforts and interest earned him the position of principal at Birla Institute Technologys, Pilani, where he successfully introduced Pharmacy education at a degree level for the next five years.

His relentless efforts to make this course available in the entire country and encourage more and more students to opt for the course earned him the title of the father of pharmacy education in India. He revolutionised pharmacy in India by making the course available throughout the country for all students. Thus, aiding newer discoveries in the field.[38]

Key Contributors in Medicine and Pharmacy

Medicine is the most collaborative discipline; furthermore, today would be very different without the contributions of pioneers of the medical field.

Here is a brief text about the three key contributors in the history of India in the field of Indian medicine and pharmacy.[39]

Acharya Charak

Acharya Charak, born in 300 BC, is known as the Father of Indian Medicine. He was one of the essential contributors to the Ayurvedic system developed in ancient India. He is the author of 'Smahita Charaak, considered the Ayurvedic cyclopaedia. He also attempted to list the names of all 360 plants and animals then known to science.[40]

Sushruta

Sushruta is also considered the 'Father of Indian medicine' and 'Father of Surgeries' as he performed complicated facial plastic surgeries. He also did surgeries in dentistry, ophthalmology, obstetrics and gynaecology, back in the year 2 BC when microscopies, scanning machines weren't even invented. In his book "Suhrutha

Samhith", Sushruta wrote down his observation of more than 1000 plant medicines on his various patients and their reactions.[41]

Sir Ram Nath Chopra

Sir Ram Nath Chopra, born on 17th August 1882, was an Indian Medical Service officer and the most respected person in India's science and medicine field. His excellence in pharmaceuticals and his aim of making India self-sufficient in producing drugs earned him the honour of 'Father of Indian Pharmacology'.[42]

The history of pharmacy as a modern and independent science dates back to the first third of the 19th century. Before then, pharmacy evolved from antiquity as part of medicine. Before the advent of pharmacists, there existed apothecaries that worked alongside priests and physicians in regard to patient care.

Prehistoric pharmacy

Paleopharmacological studies attest to the use of medicinal plants in pre-history.[1][2] For example, herbs were discovered in the Shanidar Cave, and remains of the areca nut (*Areca catechu)* in the Spirit Cave.[3]:8 Prehistoric man learned pharmaceutical techniques through instinct, by watching birds and beasts, and using cool water, leaves, dirt, or mud as a soothing agent.[43]

Ancient Era

Mesopotamia and Egypt

Sumerian cuneiform tablets record prescriptions for medicine.[5] Ancient Egyptian pharmacological knowledge was recorded in various papyri, such as the *Ebers Papyrus* of 1550 BC and the *Edwin Smith Papyrus* of the 16th century BC.

The very beginnings of pharmaceutical texts were written on clay tablets by Mesopotamians. Some texts included formulas, instructions via pulverization, infusion, boiling, filtering and spreading; herbs were mentioned as well.[6] Babylon, a state within Mesopotamia, provided the earliest known practice of running an apothecary i.e. pharmacy. Alongside the ill person included a priest, physician, and a pharmacist to tend to their needs.[44]

Greece

In Ancient Greece, there existed a separation between physician and herbalist. The duties of the herbalist was to supply physicians with raw materials, including plants, to make medicines.[7] According to Edward Kremers and Glenn Sonnedecker, "before, during and after the time of Hippocrates there was a group of experts in medicinal plants. Probably the most important representative of these *rhizotomoi* was Diocles of Carystus (4th century BC). He is considered to be the source for all Greek pharmacotherapeutic treatises between the time of Theophrastus and Dioscorides."

Between 60 and 78 AD, the Greek physician Pedanius Dioscorides wrote a five-volume book, *De materia medica*, covering over 600 plants and coining the term *materia medica*. It formed the basis for many medieval texts, and was built upon by many Middle Eastern scientists during the Islamic Golden Age.[45]

Asia

The earliest known Chinese manual on materia medica is the *Shennong Ben Cao Jing* (*The Divine Farmer's Herb-Root Classic*), dating back to the first century AD. It was compiled during the Han dynasty and was attributed to the mythical Shennong. Earlier literature included lists of prescriptions for specific ailments, exemplified by a manuscript "Recipes for 52 Ailments", found in the Mawangdui, sealed in 168 BC. Present-day Chinese pharmacy is a result of pharmaceutical exchanges between China and the rest of the world in the past centuries.[9]

The earliest known compilation of medicinal substances in Indian traditional medicine dates to the third or fourth century AD (attributed to Sushruta, who is recorded as a physician of the sixth century BC).

There is a stone sign for a pharmacy with a tripod, a mortar, and a pestle opposite one for a doctor in the Arcadian Way in Ephesus, Turkey.[46]

Japan

In Japan, at the end of the Asuka period (538–710) and the early Nara period (710–794), the men who fulfilled roles similar to those of modern pharmacists were highly respected. The place of pharmacists in society was expressly defined in the Taihō Code (701) and re-stated in the Yōrō Code (718). Ranked positions in the pre-Heian Imperial court were established; and this organizational structure remained largely intact until the Meiji Restoration (1868). In this highly stable hierarchy, the pharmacists—and even pharmacist assistants—were assigned status superior to all others in health-related fields such as physicians and acupuncturists. In the Imperial household, the pharmacist was even ranked above the two personal physicians of the Emperor.[47]

Middle Ages

Middle East

In Baghdad the first pharmacies, or drug stores, were established in 754, under the Abbasid Caliphate during the Islamic Golden Age. By the ninth century, these pharmacies were state-regulated.

The advances made in the Middle East in botany and chemistry led medicine in medieval Islam substantially to develop pharmacology. Muhammad ibn Zakarīya Rāzi (Rhazes) (865–915), for instance, acted to promote the medical uses of chemical compounds. Abu al-Qasim al-Zahrawi (Abulcasis) (936–1013) pioneered the preparation of medicines by sublimation and distillation. His *Liber servitoris* is of particular interest, as it provides

the reader with recipes and explains how to prepare the "simples" from which were compounded the complex drugs then generally used. Shapur ibn Sahl (d. 869), was, however, the first physician to initiate a pharmacopoeia, describing a large variety of drugs and remedies for ailments. Al-Biruni (973–1050) wrote one of the most valuable Islamic works on pharmacology entitled *Kitab al-Saydalah* (*The Book of Drugs*), where he gave detailed knowledge of the properties of drugs and outlined the role of pharmacy and the functions and duties of the pharmacist.

Ibn Sina (Avicenna), too, described no less than 700 preparations, their properties, mode of action and their indications. He devoted in fact a whole volume to simple drugs in *The Canon of Medicine*. Of great impact were also the works by al-Maridini of Baghdad and Cairo, and Ibn al-Wafid (1008–1074), both of which were printed in Latin more than fifty times, appearing as *De Medicinis universalibus et particularibus* by 'Mesue' the younger, and the *Medicamentis Simplicibus* by 'Abenguefit'. Peter of Abano (1250–1316) translated and added a supplement to the work of al-Maridini under the title *De Veneris*. Al-Muwaffaq's contributions in the field are also pioneering. Living in the tenth century, he wrote *The Foundations of the True Properties of Remedies*, amongst others describing arsenious oxide, and being acquainted with silicic acid. He made clear distinction between sodium carbonate and potassium carbonate, and drew attention to the poisonous nature of copper compounds, especially copper vitriol, and also lead compounds. He also describes the distillation of sea-water for drinking.

Middle Eastern pharmaceutical practitioners would experience an upheaval of their craft come the beginning of the 13th and 14th centuries as pharmacists realigned their interests from developing medicinal theories to establishing practical and therapeutic applications of pharmaceuticals. For example, in 1260 CE an Egyptian Jewish physician and pharmacist named Abu ‘I-Munā al-Kuhín al-‘Attār published a 25-chapter manual, the *Minhāj al-dukkān* (How to run a pharmacy), wherein he documented: titles of drugs, their ingredients and quantities, preparation methods, and dosages. The manual noticeably lacks any chapters that highlight desirable characteristics and qualities aspiring physicians should display and Al Kuhín al-Attār covers very little of the ethical dilemmas or basic concepts that most pharmacists would normally discuss during this time in his manual. This demonstrates that after 1260 CE, interests lessened in discussing the culture and values surrounding pharmacy and a growing interest in developing archives of pharmacy knowledge for the public. It is worth mentioning that written manuals were not commonly produced by pharmacists in the Middle East.[14][15] It is also during the 13th and 14th centuries that Middle Eastern pharmacopoeias begin to resemble cookbooks more than medical encyclopedias, which Thomas Allsen attributes to the extensive cultural exchange between China, Iran, and the greater Mongol Empire.[48]

Europe

After the fifth century fall of the Western Roman Empire, medicinal knowledge in Europe suffered due to the loss of Greek medicinal texts and a strict adherence to tradition, although an area of Southern Italy near Salerno remained under Byzantine control and developed a hospital and medical school, which became famous by the 11th century.

In the early 11th century, Salerno scholar Constantinos Africanus translated many Arabic books into Latin, driving a shift from Hippocratic medicine towards a pharmaceutical-driven approach advocated by Galen. In medieval Europe, monks typically did not speak Greek, leaving only Latin texts such as the works of Pliny available until these translations by Constantinos. In addition, Arabic medicine became more widely known due to Muslim Spain.

In the 15th century, the printing press spread medicinal textbooks and formularies; the Antidotarium was the first printed drug formulary.

In *Europe* pharmacy-like shops began to appear during the 12th century. In 1240 emperor Frederic II issued a decree by which the physician's and the apothecary's professions were separated.

Old pharmacies continue to operate in Dubrovnik, Croatia located inside the Franciscan monastery, opened in 1317. The Town Hall Pharmacy in Tallinn, Estonia, which dates back to at least 1422, is the oldest continuously run pharmacy in the world still operating in the original premises.

The trend towards pharmacy specialization started to take effect in Bruges, Belgium where a new law was passed that forbid physicians to prepare medications for patients.

The oldest pharmacy is claimed to be set up in 1221 in the Church of Santa Maria Novella in Florence, Italy, which now houses a perfume museum. Florence is also the birthplace of the first official pharmacopeia, called the *Nuovo Receptario*, which all pharmacies use as guidance for caring for the sickly.

The Royal College of Apothecaries of the City and Kingdom of Valencia was founded in 1441, considered the oldest in the world, with full administrative and legislative powers. The apothecaries of Valencia were the first in the world to elaborate their medicines, with the same criteria that are currently required in the official pharmacopoeias.

The Republic of Venice was the first State with health policies which requires that the nature of the drug is

public. In actuality, thirteen secrets survive which were offered to sale to the Venetian Republic.[49]

Industrialization

The 1800s brought increased technical sophistication. By the late 1880s, German dye manufacturers had perfected the purification of individual organic compounds from tar and other mineral sources and had also established rudimentary methods in organic chemical synthesis.

Chloral hydrate was introduced as a sleeping aid and sedative in 1869. Chloroform was first used as an anesthetic in 1847.

Derivatives of phenothiazines had an important impact on various aspects of medicine, beginning with methylene blue which was originally used as a dye after its synthesis from aniline in 1876. Phenothiazines were used as antimalarials, antiseptics, and antihelminthics up to 1940. The "psychopharmacological revolution" began in 1950 when Chlorpromazine was discovered.

The United States formed the American Pharmaceutical Association in 1852 with its main purpose to advance pharmacists' roles in patient care, assist in furthering career development, spread information about tools and resources, and raising awareness about the roles of pharmacists and their contribution to patient care.

Frederick Banting and Charles Best found the hormone insulin to lower blood sugar of dogs in 1921. This inspired further work by James Collip who developed pure insulin used for human testing and dramatically changed the prospects for all diabetics.

In 1928 Alexander Fleming developed the first antibiotic, penicillin, after discovering a fungus that was able to kill off bacteria.[50]

Late Modern Period

Singapore

The first pharmaceutical infrastructure was the Medical Stores and Dispensary, organized by Sub-Assistant Surgeon Thomas Prendergast during Raffles' expedition to Singapore. British settlement in Singapore led to establishing three General Hospitals. Two were for military and sailors respectively, while the last one was for civilian use.

Medical staffing was ranked as Senior Surgeon, Assistant Surgeon, and Apothecaries. Apothecaries were medical subordinates; they were doctors that graduated from Indian Medical Colleges. To support staffing shortages at the General Hospital, a proposal to select local male students from Penang Free School to become assistant apothecaries were approved. The proposal outlined five years of training and rigorous requirements to be qualified as an apprenticeship. Those that complete the apprenticeship not only experienced strict expectations and responsibilities, but also little pay. Apothecaries resigned and left for private practice. Private practices heavily advertised in newspapers. This was considered the first system of pharmacy operations.

James Isaiah (J.I.) Woodford founded the Kampong Glam Dispensary. Another company was Martin & Line of the Singapore Dispensary. Both establishments were considered as chemists and druggists. In addition to traditional Chinese medicine, Western medicine and practices were also established. Dr. Christopher Trebing arrived in Singapore and opened a dispensary called German Medicine Deity Medical Office. Following Dr. Trebing's passing, the Medical Office continued to be operated by German owners until its demolition in 1970.

Singaporean consumers suffered from misinformation of drug advertisements and lacked standards and qualifications for dispensing drugs. There was also substance abuse with opium and poison accessibility for criminal attempt. This led to creating the Medical Ordinance in 1904 and Poisons Ordinance in 1905 to create standards for qualified chemists and druggists to handle these substances. The Poisons Ordinance established regulation for the retail of poisons. One criterion was possessing certificates from the Principal Civil Medical Officer. In the same year, King Edward VII College of Medicine was established. The Medical School hosted classes and exams for the pharmacy certificate.

Throughout the twentieth century, the government amended its ordinances for education and licensing. These early legal efforts led to Ordinance No. 30 of 1933. The ordinance formally required training and registration for pharmacists after training. King Edward VII College of Medicine admitted its first pharmacy students in 1935.[51]

History of Pharmacy profession in India

The pharmacy profession in India has evolved through centuries, from the traditional herbal practices of Ayurveda to the sophisticated pharmaceutical sciences of today. India, known for its rich history in medicine, has seen a transformative journey in pharmacy—from healers and herbalists to licensed pharmacists and pharmaceutical scientists. In this blog we can explore the history of the Pharmacy profession in India by its different milestones and transformations that have shaped pharmacy into a vital healthcare discipline in India.[52]

Early Beginnings: Traditional Medicine

India's pharmaceutical roots can be traced back over 3,000 years to the Ayurvedic system of medicine, documented in texts like the Charaka Samhita and Sushruta Samhita. Ancient practitioners, known as *Vaidyas*, were skilled in preparing and dispensing herbal medicines tailored to individual patient needs.

Key highlights of this period include
Use of natural herbs, minerals, and animal products.
Detailed descriptions of drug preparation, dosage, and preservation.
Emphasis on personalized medicine (Prakriti-based treatment).
Other traditional systems like Siddha**,** Unani, and Tibbi also contributed to early pharmacy practices in India.[53]

Colonial Time History of Pharmacy Profession in India
The pharmacy profession in India underwent significant transformation during the colonial period under British rule, shaping its modern foundation.

Key historical events include
18th Century Introduction of Western Medicine: The East India Company established apothecaries to serve European settlers, introducing Western pharmaceutical practices. These apothecaries dispensed medicines and trained local assistants, marking the initial integration of colonial medicine into India.

Establishment of Medical Institutions**:** In 1785, the British founded the Medical College of Bengal (now NRS Medical College), which included pharmacy training. This institution laid the groundwork for formal pharmaceutical education by training compounders and dispensers.

Apothecaries Act Influence (1815)**:** The British Apothecaries Act of 1815 influenced India, encouraging the regulation of drug preparation and dispensing. This led to the appointment of licensed apothecaries in major cities like Calcutta, Bombay, and Madras.

Drug Import and Regulation**:** The 19th century saw increased importation of Western drugs, prompting the British to regulate their quality. The Bengal Pharmacy Act of 1874 was an early attempt to control drug standards, reflecting growing recognition of pharmacy as a distinct profession.

Formation of Professional Bodies**:** By the late 19th century, the need for organized pharmacy led to the establishment of associations like the Bengal Chemists and Druggists Association (1888), advocating for better training and regulation.

These events during colonial rule bridged traditional Indian medicine with Western practices, setting the stage for the professionalization of pharmacy in the post-independence era.[54]

Post-Independent Time History of the Pharmacy Profession in India
The pharmacy profession in India experienced remarkable growth and transformation after independence in 1947, aligning with the nation's healthcare and industrial advancements.

Key developments include
Pharmacy Act of 1948**:** Enacted soon after independence, this legislation established the Pharmacy Council of India (PCI) to regulate education and practice, setting minimum standards for pharmacists and creating state pharmacy councils.

Expansion of Pharmaceutical Industry**:** The establishment of the Indian Drugs and Pharmaceuticals Limited (IDPL) in 1961 marked the beginning of public sector drug manufacturing. The 1970s saw the rise of generic drug production, with India emerging as a global leader, supported by pharmacists in quality control and research.

Indian Pharmacopoeia was first published in 1955 to standardize drug quality and formulations.

Educational Advancements: The introduction of the Bachelor of Pharmacy (BPharm) and Master of Pharmacy (MPharm) programs expanded training opportunities.

National Institute of Pharmaceutical Education and Research (NIPER)**:** Founded in 1998, NIPER boosted research and education, producing skilled professionals for the growing industry.

Regulatory and Global Integration**:** The Central Pharmacist Registration Number (CPRN) improved the global recognition of Indian pharmacists. Post-2000, pharmacovigilance and clinical research gained prominence, reflecting the profession's evolving scope.

These milestones have solidified pharmacy's role as a cornerstone of India's healthcare system, driving innovation and public health improvements.[55]

Modern Era Pharmacy Profession in India
The pharmacy profession in India has entered a dynamic modern era, marked by technological advancements, expanded roles, and global integration.

Key aspects include
Clinical Pharmacy Focus**:** The introduction of the Doctor of Pharmacy (PharmD) program in 2008 has emphasized patient-centered care, with pharmacists collaborating in hospitals for medication therapy management and counseling.

Technological Innovation**:** Digital tools, including e-pharmacies and telepharmacy, have transformed drug dispensing and patient access. Artificial intelligence and data analytics are enhancing drug research and pharmacovigilance.

Pharmaceutical Industry Growth**:** India, a global generics hub, continues to lead with companies like Sun Pharma and Dr. Reddy's, employing pharmacists in research, development, and regulatory affairs.

 © 2026 Author(s) | Published by IJAPH | Open Access under CC BY 4.0 License

Public Health Contributions**:** Pharmacists play a vital role in vaccination drives, health awareness campaigns, and managing pandemics, as seen during COVID-19.

The modern era positions pharmacy as an important healthcare discipline, adapting to contemporary needs and shaping India's pharmaceutical future.[56]

Early Beginnings: Traditional Medicine

India's pharmaceutical roots can be traced back over 3,000 years to the Ayurvedic system of medicine, documented in texts like the Charaka Samhita and Sushruta Samhita. Ancient practitioners, known as *Vaidyas*, were skilled in preparing and dispensing herbal medicines tailored to individual patient needs.

Key highlights of this period include

Use of natural herbs, minerals, and animal products.
Detailed descriptions of drug preparation, dosage, and preservation.
Emphasis on personalized medicine (Prakriti-based treatment).
Other traditional systems like Siddha**,** Unani**,** and Tibbi also contributed to early pharmacy practices in India.[57]

Colonial Time History of Pharmacy Profession in India

The pharmacy profession in India underwent significant transformation during the colonial period under British rule, shaping its modern foundation.

Key historical events include

18th Century Introduction of Western Medicine**:** The East India Company established apothecaries to serve European settlers, introducing Western pharmaceutical practices. These apothecaries dispensed medicines and trained local assistants, marking the initial integration of colonial medicine into India.

Establishment of Medical Institutions**:** In 1785, the British founded the Medical College of Bengal (now NRS Medical College), which included pharmacy training. This institution laid the groundwork for formal pharmaceutical education by training compounders and dispensers.

Apothecaries Act Influence (1815)**:** The British Apothecaries Act of 1815 influenced India, encouraging the regulation of drug preparation and dispensing. This led to the appointment of licensed apothecaries in major cities like Calcutta, Bombay, and Madras.

Drug Import and Regulation**:** The 19th century saw increased importation of Western drugs, prompting the British to regulate their quality. The Bengal Pharmacy Act of 1874 was an early attempt to control drug standards, reflecting growing recognition of pharmacy as a distinct profession.

Formation of Professional Bodies**:** By the late 19th century, the need for organized pharmacy led to the establishment of associations like the Bengal Chemists and Druggists Association (1888), advocating for better training and regulation.

These events during colonial rule bridged traditional Indian medicine with Western practices, setting the stage for the professionalization of pharmacy in the post-independence era.[58]

Post-Independent Time History of the Pharmacy Profession in India

The pharmacy profession in India experienced remarkable growth and transformation after independence in 1947, aligning with the nation's healthcare and industrial advancements.

Key developments include

Pharmacy Act of 1948**:** Enacted soon after independence, this legislation established the Pharmacy Council of India (PCI) to regulate education and practice, setting minimum standards for pharmacists and creating state pharmacy councils.

Expansion of Pharmaceutical Industry**:** The establishment of the Indian Drugs and Pharmaceuticals Limited (IDPL) in 1961 marked the beginning of public sector drug manufacturing. The 1970s saw the rise of generic drug production, with India emerging as a global leader, supported by pharmacists in quality control and research.

Indian Pharmacopoeia was first published in 1955 to standardize drug quality and formulations.

Educational Advancements**:** The introduction of the Bachelor of Pharmacy (BPharm) and Master of Pharmacy (MPharm) programs expanded training opportunities.

National Institute of Pharmaceutical Education and Research (NIPER)**:** Founded in 1998, NIPER boosted research and education, producing skilled professionals for the growing industry.

Regulatory and Global Integration**:** The Central Pharmacist Registration Number (CPRN) improved the global recognition of Indian pharmacists. Post-2000, pharmacovigilance and clinical research gained prominence, reflecting the profession's evolving scope.

These milestones have solidified pharmacy's role as a cornerstone of India's healthcare system, driving innovation and public health improvements.[59]

Modern Era Pharmacy Profession in India

The pharmacy profession in India has entered a dynamic modern era, marked by technological advancements, expanded roles, and global integration.

Key aspects include

Clinical Pharmacy Focus**:** The introduction of the Doctor of Pharmacy (PharmD) program in 2008 has emphasized patient-centered care, with pharmacists collaborating in hospitals for medication therapy management and counseling.

Technological Innovation**:** Digital tools, including e-pharmacies and telepharmacy, have transformed drug dispensing and patient access. Artificial intelligence and data analytics are enhancing drug research and pharmacovigilance.

Pharmaceutical Industry Growth**:** India, a global generics hub, continues to lead with companies like Sun Pharma and Dr. Reddy's, employing pharmacists in research, development, and regulatory affairs.

Public Health Contributions**:** Pharmacists play a vital role in vaccination drives, health awareness campaigns, and managing pandemics, as seen during COVID-19.

The modern era positions pharmacy as an important healthcare discipline, adapting to contemporary needs and shaping India's pharmaceutical future.[60]

CONCLUSION

The pharmacy has bridged science and healing across millennia from its mystical origins in temple rituals to modern, tech-enabled therapeutics. Though often overshadowed by medicine, pharmacy has long held its distinct legacy of innovation and service. Contributors like Imhotep, Dioscorides, Avicenna and Galen paved the way for scientific medicine and pharmacy. Africa's heritage in the field is rich and must be reclaimed and reimagined for the 21st century. The pharmacy's destiny is to lead in health innovation, patient care and global health equity, anchored in timeless principles and future-facing science.

Pharmacy's journey from its ancient roots to its modern prominence is a testament to the essential role it plays in healthcare. With a rich history of plant-based remedies and alchemical practices, pharmacy has transformed into a multidisciplinary field at the forefront of medical innovation. Today's pharmacists combine scientific knowledge with patient care, ensuring that medications are not only effective but also safe and well-tolerated. As pharmacy evolves, its potential to affect the future of healthcare remains enormous, with exciting advances that will improve global health outcomes and the quality of life for countless individuals.

From the time of Imhotep, who laid the foundation for pharmacy practice in ancient Egypt, to the present day, pharmacists have been central to the advancement of healthcare. As we celebrate World Pharmacists Day 2024, we honour the profession's rich history and recognise pharmacists' critical role in improving health outcomes across the globe.

Looking forward, the future of pharmacy is bright, with pharmacists positioned to continue making significant contributions to global health. Whether through innovative therapies, expanding clinical services, or integrating new technologies, pharmacists will remain critical to meeting the evolving healthcare needs of populations worldwide.

As we reflect on the past and embrace the future, we are reminded that the core of phar macy remains the same—caring for patients, advancing medicine, and improving lives.

We need to be incredibly proud of who we are as Pharmacists. Still, it is also time to act on the vast knowledge we have acquired to transform Pharmacy to make more Impact – Individuals Making Positive Accelerated Change for Transformations.

Looking forward, the future of pharmacy is bright, with pharmacists positioned to continue making signific. The history of the pharmacy profession in India reflects a journey of transformation—from traditional Ayurvedic roots to a modern, regulated, and globally respected profession. As healthcare continues to evolve, Indian pharmacists are poised to play even greater roles in ensuring medicine safety, innovation, and patient care.

Pharmacy education in India at the certificate level was started in 1842 in Goa by the Portuguese. Formal training of the compounds was started in 1881 in Bengal and as a university-level program in 1937 at the Banaras Hindu University (Varanasi). In Baghdad, the first pharmacies or drug stores were established in 754.

The revolution in the development of science and technology in post word war-2 started the change in the pharmacy profession.

Pharmacy being a health care profession, the independent government of India enacted 'The Pharmacy Act' to control the pharmacy profession as well as education, in 1948.

The word Pharmacy is derived from the Greek word 'pharmakon' meaning drug. Traditionally pharmacy has been known as an art and science of making drug/medicine.

In the ancient period, the physician themselves practiced pharmacy. It is believed that Hippocrates, the great Greek physician, regarded as the father of Medicine, used to make his own prescriptions or supervise their preparation.

Apothecary is a historical name of a medical professional who formulates and dispenses medicine to physicians and patients, now this role is served by the pharmacist. The earliest pharmacies were known as Apothecary shops.

Pharmacists play a role in, compounding most of the medicine needs of the people. Here the medicinal professional prepared and dispensed medicines to physicians and mixtures, ointments, pills, syrups, powder, etc. in their pharmacy, based on the prescriptions given by physicians. They packed them suitably labelled them and dispensed them along with appropriate advice for consuming them.

In the old times, direct crude drugs are used in the diagnosis by physicians, and required herbs and drugs are provided by pharmacists. At that time drugs are identified by their morphological appearance and organoleptic characteristics.

Like in other, countries In India too, the pharmacy was part of medicine in our Ayurvedic and Siddha systems of medical practice.

Pharmacy is a versatile, dynamic, growing, and increasingly diverse profession, one that creates excitement because there are so many opportunities for services. It is an old-age profession that has transformed into a hub for 'Global health Care' and evolved as a multidisciplinary and multifaceted field in recent times.

REFERENCES

1. Ellis, Linda, Archaeological Method and Theory: An Encyclopedia. Taylor & Francis, 2000; pp. 443–448. ISBN 978-0-8153-1305-2.
2. Samorini, Giorgio, "The oldest archeological data evidencing the relationship of Homo sapiens with psychoactive plants: A worldwide overview". Journal of Psychedelic Studies, 2019-06-01; 3(2): 63–80. doi:10.1556/2054.2019.008.
3. Sneader, Walter (2005-10-31). Drug Discovery: A History. John Wiley & Sons. ISBN 9780470015520.
4. Bender, George (1965). "Great Moments in Pharmacy" (PDF). Pharmacy at Auburn. Retrieved 26 July 2020.
5. John K. Borchardt, "The Beginnings of Drug Therapy: Ancient Mesopotamian Medicine". Drug News & Perspectives, 2002; 15(3): 187–192. doi:10.1358/dnp.2002.15.3.840015. ISSN 0214-0934. PMID 12677263.
6. "Becoming a Pharmacist & History of Pharmacy | Pharmacy is Right for Me". Pharmacy for me. Retrieved 2020-07-27.
7. "Pharmacy". Encyclopedia Britannica. Retrieved 2020-07-27.
8. Edward Kremers, Glenn Sonnedecker, "Kremers and Urdang's History of pharmacy". Amer. Inst. History of Pharmacy, 1986; p.17. ISBN 0-931292-17-4
9. Lu, D., The Global Circulation of Chinese Materia Medica, 1700-1949: A Microhistory of the Caterpillar Fungus. Medicine and Biomedical Sciences in Modern History. Palgrave Macmillan, 2023; pp. 1–294. doi:10.1007/978-3-031-24723-1. ISBN 978-3-031-24722-4.
10. Titsingh, Isaac, Annales des empereurs du japon, 1834; p. 434.
11. Hadzovic, S, "Pharmacy and the great contribution of Arab-Islamic science to its development". Medicinski Arhiv (in Croatian), 1997; 51(1–2): 47–50. ISSN 0025-8083. OCLC 32564530. PMID 9324574.
12. al-Ghazal, Sharif Kaf, "The valuable contributions of Al-Razi (Rhazes) in the history of pharmacy during the Middle Ages" (PDF). Journal of the International Society for the History of Islamic Medicine, October 2003; 2(4): 9–11. ISSN 1303-667X. OCLC 54045642.
13. Levey M., Early Arabic Pharmacology, E. J. Brill; Leiden, 1973.
14. Chipman, Leigh, "Islamic Pharmacy in the Mamluk and Mongol Realms: Theory and Practice". Asian Medicine, 2007; 3(2): 265–266. doi:10.1163/157342008X307875.
15. Ferrario, Gabriele; Kozodoy, Maud, "Science and Medicine", in Lieberman, Phillip I. (ed.), The Cambridge History of Judaism: Volume 5: Jews in the Medieval Islamic World, The Cambridge History of Judaism, 2021; vol. 5, Cambridge: Cambridge University Press, p. 858, ISBN 978-0-521-51717-1, retrieved 2025-07-14
16. Chipman, Leigh, "Islamic Pharmacy in the Mamluk and Mongol Realms: Theory and Practice". Asian Medicine, 2007; 3(2): 267. doi:10.1163/157342008X307875.
17. "History of Pharmacy Web Pages - Sweden´s oldest pharmacies". Archived from the original on 2011-06-23. Retrieved 2011-04-27.
18. "Ain Raal: apteegist maakeeli." Postimees 3. March 2020.
19. Valencia, MICOF-Muy Ilustre Colegio Oficial de Farmacéuticos de. "historia". MICOF - Muy Ilustre Colegio Oficial de Farmacéuticos de Valencia (in Spanish). Retrieved 2021-07-28.
20. Stevens Crawshaw, Jane, "Families, medical secrets and public health in early modern Venice". Renaissance Studies, 2014; 28(4): 597–618. doi:10.1111/rest.12081
21. "Top Pharmaceuticals: Introduction: EMERGENCE OF PHARMACEUTICAL SCIENCE AND INDUSTRY: 1870-1930".
22. Jones, Alan Wayne, "Early drug discovery and the rise of pharmaceutical chemistry". Drug Testing and Analysis, 2011-06-01; 3(6): 337–344. doi:10.1002/dta.301. ISSN 1942-7611. PMID 21698778.
23. Dingwall (April 2004). "A pioneering history: dentistry and the Royal College of Surgeons of Edinburgh" (PDF). historyofdentistry.co.uk. Archived from the original (PDF) on 1 February 2013.
24. Humans, IARC Working Group on the Evaluation of Carcinogenic Risk to Exposure Data. International Agency for Research on Cancer, 2016.

25. López-Muñoz, Francisco; Alamo, Cecilio; Cuenca, Eduardo; Shen, Winston W.; Clervoy, Patrick; Rubio, Gabriel, "History of the discovery and clinical introduction of chlorpromazine". Annals of Clinical Psychiatry, 2005-07-01; 17(3): 113–135. doi:10.1080/10401230591002002. ISSN 1040-1237. PMID 16433053.
26. "Pharmacy - Research". Encyclopedia Britannica. Retrieved 2020-07-25.
27. "APhA Vision, Mission, Value Statements". www.pharmacist.com. Archived from the original on 2020-10-23. Retrieved 2020-07-25.
28. The pharmacy technician. American Pharmacists Association. (Sixth ed.). Englewood Cliffs, N.J.: Perspective Press/Morton Pub. Co, 2016. ISBN 978-1-61731-487-2. OCLC 981462588.
29. Lee, Yong Kiat, "The Early History of Pharmacy in Singapore" (PDF). Singapore Medical Journal, 2006; 47(5): 436–443. PMID 16645698.
30. Pwee, Timothy, "The German Medicine Deity: Singapore's Earliest Pharmacy" (PDF). BiblioAsia, October–December 2018; 14(3): 46–48.
31. Zunic L, Skrbo A, Dobraca A. Historical contribution of pharmaceutics to botany and pharmacognosy development. Mater Sociomed, 2017; 29(4): 291-300.
32. Sonnedecker G. Kremers and Urdang's History of Pharmacy. 3rd ed. J.B. Lippincott Company, 1963.
33. Higby GJ. Evolution of pharmacy. In: Gennaro AR, eds. Remington: The Science and Practice of Pharmacy. 20th ed. Lippincott, 2000: 7-18.
34. Who were the apothecaries? Center for the History of Medicine – Harvard Countway Library of Medicine. Accessed September 10, 2024. https://collections.countway.harvard.edu/onview/exhibits/show/apothecary-jars/sequence
35. The history of pharmacy. Express Scripts Pharmacy blog. Published October 21, 2022. Accessed September 10, 2024. https://www.express-scripts.com/pharmacy/blog/history-of-pharmacy
36. Bailey S. America's first licensed pharmacy was established in New Orleans. NOLA Now - A Gray Local Media Station. Published April 14, 2020. Accessed September 10, 2024. https://www.nolanow.com/2020/04/14/americas-first-licensed-pharmacy-was-established-in-new-orleans/
37. Milenkovich N. New Orleans pharmacy museum and the beginnings of licensure. Pharmacy Times. Published August 9, 2018.
38. Swann JP. The evolution of the American pharmaceutical industry. Pharm Hist, 1995; 37(2): 76-86.
39. Walgreens historical highlights. Walgreen Co. Published 2024. Accessed September 10, 2024. https://www.walgreens.com/topic/about/press/facts.jsp
40. Lyons M. A long tradition of vaccine breakthroughs. NIH Intramural Research Program. I Am Intramural blog. Published May 18, 2020. Updated May 23, 2023. Accessed September 10, 2024. https://irp.nih.gov/blog/post/2020/05/a-long-tradition-of-vaccine-breakthroughs
41. Higby GJ. Professionalism and the nineteenth-century American pharmacist. Pharm Hist, 1986; 28(3): 115-124.
42. Urick BY, Meggs EV. Towards a greater professional standing: evolution of pharmacy practice and education, 1920-2020. Pharmacy (Basel), 2019; 7(3): 98.
43. Berger K. Soda fountains & their pharmacist inventors. Pharmacy Times. Published February 16, 2019. Accessed September 10, 2024. https://www.pharmacytimes.com/view/soda-fountains—their-pharmacist-inventors#
44. Robbins J. Pharmacy: A Profession in Search of a Role. Navillus Publishing Corporation, 1979.
45. Wax PM. Elixirs, diluents, and the passage of the 1938 Federal Food, Drug and Cosmetic Act. Ann Intern Med, 1995; 122(6): 456-461.
46. Quinn R. Rethinking antibiotic research and development: World War II and the penicillin collaborative. Am J Public Health, 2013; 103(3): 426-434.
47. ASHP early years. ASHP. Published 2024. Accessed September 10, 2024. https://www.ashp.org/about-ashp/our-history/ashp-early-years
48. Lam C, Patel P. Food, Drug, and Cosmetic Act. In: StatPearls. StatPearls Publishing, July 31; 2023.
49. Henderson ML. Charting the history of women pharmacists. HoPP, 2019; 61(3-4): 118-120.
50. Carter BL. Evolution of clinical pharmacy in the USA and future directions for patient care. Drugs Aging, 2016; 33(3): 169-177.
51. Blomstedt P. Imhotep and the discovery of cerebrospinal fluid. Surgical Neurology International, 2014.
52. Metwaly MA. Traditional ancient Egyptian medicine: A review. Journal of Ethnopharmacology, 2021.
53. Zunic L, Skrbo A, Dobraca A. Historical contribution of pharmaceutics to botany and pharmacognosy development. Materia Socio-Medica, 2017; 29(1): 53-56.
54. Papadopoulos V. Looking ahead to 2030: A survey of evolving needs in pharmacy education. Pharmacy Education Journal, 2021.
55. Tripathi S, Ansari S, Ahmad K, et al. Scope of pharmacist in future aspect. International Journal of Pharmacy Teaching & Practices, 2018; 9(1): 25-30.
56. Granger Ryan M. Aspects of the history of organised pharmacy in South Africa, 1983: 1885-1946.
57. Almeman A. The digital transformation in pharmacy: embracing online platforms and the cosmeceutical paradigm shift. NCBI, 2024.
58. Steeb DR. Defining opportunities for pharmacists in global public health in resource-limited settings. American Journal of Pharmaceutical Education, 2017.

59. Parle J, Hodes R, Waetjen T. Pharmaceuticals and modern statecraft in South Africa. South African Historical Journal, 2018.
60. Merks, P., et al., The legal extension of the role of pharmacists in light of the COVID-19 global pandemic. Research in Social and Administrative Pharmacy, 2021; 17(1): 1807–1812.

 © 2026 Author(s) Open Access under CC BY 4.0 License