

Pharmacy Technician

History of Pharmacy



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Pharmacy Technician

The History of Pharmacy

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Acknowledgments

Author

Brian Kaufman

Editorial Staff

Trish Bowen

Bridget Tisthammer

Lindsay Hansen

Wayne Nirenberg

Design/Layout

Connie Hunsader

Scott Conner

D. Brent Hauseman

Sandy Petersen

FOR MORE INFORMATION CONTACT:

U.S. Career Institute

2001 Lowe Street • Fort Collins, CO 80525 • 1-800-347-7899

www.uscareerinstitute.edu

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The History of Pharmacy

The History of Pharmacy—An Introduction

Colic is the name given to a collection of symptoms suffered by infant children in the first five months of life. These symptoms include long, intense crying spells that can't be consoled, often beginning just after mealtime. Colic is also characterized by abdominal bloating. The baby may clench her fists or arch her back. The discomfort can cause sleeplessness or drowsiness.

Colic has more than one cause. Gas-producing foods, allergies, over-stimulation, an immature gastrointestinal system and even air intake during feeding can lead to colic. The pain produced by colic can be the most significant discomfort a baby feels during the first six months of life. Doctors use the *Rule of Three* to diagnose colic. If the baby cries for more than three hours, three times a week, within a three-month period, then the baby probably has colic.

Colic is bloating caused by trapped gas in the stomach and intestines, which leads to sleeplessness, intense crying and some very stressed out parents! Most colic can be treated with homeopathic remedies. *Colic Water* is a combination of natural ingredients. They include peppermint, fennel seed, lemon balm, chamomile, caraway, ginger, aloe and vegetable carbon. These ingredients have three general actions. They aid in digestion. They prevent gas and bloating. And they soothe pain and restlessness.

If the natural remedies don't work, the baby may be given sodium bicarbonate (baking soda), which acts as a mild antacid. The chemical is absorbed into the bloodstream. That can affect the function of folic acid and iron in the baby's body. Mylicon (Simethicone) available in over-the-counter drugs can break up gas in the GI tract. Allergic reactions to Mylicon include rash, shortness of breath, and a swelling of the mouth, face, lips or tongue. Prescription sedatives or anti-spasmodic drugs could relieve colic symptoms. But adverse reaction to those drugs include eye pain, difficulty urinating, disruption of the respiratory system and even death.



Colic is a collection of symptoms.

In the vast majority of cases, there are three reasons why pediatricians prefer not to use drugs to treat colic. First, colic is a collection of symptoms, not a disease. Second, the side effects of drugs far outweigh the advantages. Finally, most children simply grow out of colic symptoms by the time they reach six months of age.

In ancient times, the treatment for colic was different. The Egyptian cure consisted of poppy pods and “fly dirt.” The second ingredient seems suspect! But if the poppy pods mentioned were the seed capsules of opium poppy plants, the Egyptian colic cure would have provided morphine. Morphine would certainly calm a crying child!

The colic example is useful in several ways. First, it shows how different modern medicine is from ancient medicine. How did modern medicine get from a shaman armed with a papyrus to computers and specialization? What were the important steps along the way that deserve notice?

The colic example also illustrates the difficulty in defining diseases. Colic is a set of similar symptoms that can be caused by a number of different problems. In modern medicine, if you choose the wrong cause, your cure might not work!

The colic example also illustrates the ways modern medicine weighs alternatives before prescribing a drug. Drugs have *side effects* and *adverse effects*. That means they provide relief, but they also cause problems. All substances, from herbs to engineered medications, alter the internal balance of body chemistry. Drugs are chemicals that interact with the body’s chemicals. That interaction can have a positive result. Or, it can have a negative result. Most often, *drug interactions have both positive and negative aspects*.

Finally, the colic example shows the modern tendency towards specialization. In Egypt, a physician would diagnose and prescribe cures, preparing the medications himself. Today, we have specialists. Pediatricians are experts in diagnosing the conditions that affect babies. Pharmaceutical companies manufacture drugs. Pharmacists make those drugs available to the public, ensuring the purity and the dosage size. This specialization is important to your future. The division of labor has created a need for a special kind of individual who can communicate with the public and expedite their pharmaceutical needs. That person is the pharmacy technician!

In this supplement, we’ll trace the steps in the development of the science and art of Pharmacy. Along the way, we’ll discover the important changes that affected the way health care operates today.

Neolithic Medicine: Magic and Herbs

Let’s go back to the beginning of mankind. The human body is surprisingly durable, but it’s far from perfect. People age. People get sick. It’s not a stretch to imagine that people have always wanted to intervene when their friends and family fell ill.

During the transition from Paleolithic to Neolithic times (sometime around 5000 B.C.), nomadic tribes began settling into communities. Wherever communities gathered, the health of the tribe would have been a cultural concern. Anthropologists have studied archeological sites to learn about Neolithic peoples.



Neolithic peoples used herbs and rituals to treat illness.

To these primitives, medicine, religion and magic were one. Inanimate objects, the natural environment and the spirit world combined to direct the fate of everyone. Neolithic peoples knew nothing of germs. Illness was a manifestation of spirits. Helping or harming others involved invoking spirits. Cures for illness required herbs. Cures also required rituals and magic rites.¹

Neolithic peoples had a *mind-body* approach to medicine. A **mind-body** approach focuses on the way mental and physical health affect each other. The mind-body approach to medicine isn't mere superstition. Today we know that faith and belief systems play an important part in restoring good health to ill patients. The mind is considered a powerful ally in attaining wellness.

Celsus, a Roman who wrote *On Medicine* a generation before Christ was born, theorized the development of early medicine this way:

“Some of the sick on account of their eagerness took food on the first day, some on account of loathing abstained; and the disease in those who refrained was more relieved. Some ate during a fever, some a little before it, others after it had subsided, and those who had waited to the end did best. For the same reason some at the beginning of an illness used a full diet, others a spare, and the former were made worse. Occurring daily, such things impressed careful men, who noted what had best helped the sick, then began to prescribe them. In this way medicine had its rise from the experience of the recovery of some, of the death of others, distinguishing the hurtful from the salutary things”²

In other words, through trial and error, the use of certain substances became associated with certain maladies.

Over the next two thousand years, the first division of labor in health care occurred, a split that developed along gender lines. Women cared for the children and sick within a family or tribe. They also prepared foods and selected the ingredients. Anthropologists believe that lake dwellers identified more than 200 species of plants and trees. Some of those species had medicinal value.³ Because herbs were part of the ancient mind-body approach to health, women became the first pharmacists. Men, however, compiled the recipes, writing them down to pass along the acquired wisdom.⁴

Medicine at the Dawn of Civilization

The Sumerians lived between the Tigris and Euphrates Rivers more than 4,300 years ago. Archaeologists are certain that Sumerians took medicines to cure illness. Sumerian doctors wrote on clay tablets, recording recipes for the compounding of complex medicines. For example, one Sumerian tablet reads:

“The seed of the carpenter plant; gum resin of markhazi; thyme. Pulverize. Dissolve in beer. Let the man drink.”⁵

Unfortunately, Sumerian pharmacists did not record quantities or specify what illnesses their drugs were meant to cure!



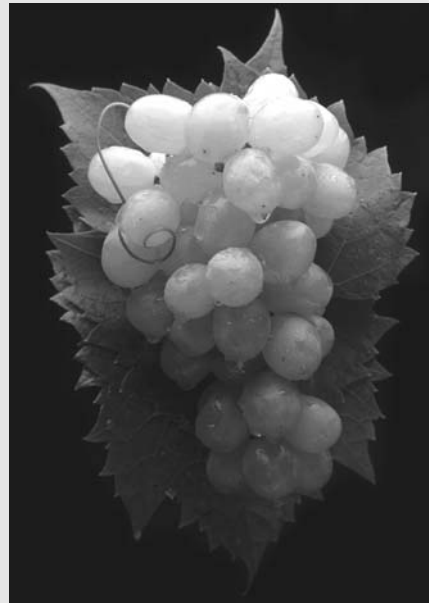
The warlike Assyrians had extensive medical knowledge of both plants and minerals.

The Sumerians were the first to systematically irrigate fields. Their agricultural knowledge was the basis of their success as a civilization. It is understandable that their expertise with plants would translate into an expertise in the field of plant medicine. In fact, the legendary Sargon I, the founder of the Sumerian empire, was supposedly a gardener who pleased the Gods and was elevated to kingship on the basis of his plant knowledge. That plant knowledge extended to the field of narcotics—the Sumerian ideogram for opium meant, “joy.”

To the north, Babylonian and Assyrian civilization continued the Neolithic link between spiritualism and medicine. Priests were *diviners* and *exorcists*. That is, they used signs and omens to tell what spirits inhabited the bodies of the ill. Their job, as medical practitioners, was to drive out those spirits to restore the patient to health. But that process included herbal medical treatment. Clay tablets in the library of King Assurbanipal included information on 120 minerals and 240 plants, including myrrh, cannabis, opium, calamus, mandragon and thymus.⁶

A second division of labor began late in these civilizations, splitting the roles of priest and physician. Two distinct kinds of medical practitioners arose. The **ashipu** was a priest who diagnosed the patient’s ailment. That meant identifying the spirit or demon that caused the illness. It also meant determining if the spirit’s actions were the result of some sin or transgression on the part of the patient.⁷ Then, if the ashipu felt it was necessary, he would call in an *asu*.

The **asu** was a healer, who used herbal medicines and treatments to supplement the ashipu’s charms and spells. In the case of body wounds, the asu might apply a plaster.



Alcohol—The First Drug

Alcohol has been produced and consumed by humanity since the dawn of civilization. Experts believe that every agricultural civilization in history produced some sort of alcoholic beverage. Alcohol can be fermented from grain, potatoes, fruit juices, honey or even cactus. In fact, some anthropologists believe that agriculture itself may have started out of a desire for fermented beverages, not a desire for a steady food supply!⁹

Archeological evidence of the importance of alcohol is plentiful. The very first Mesopotamian tablets found describe beer and bread as wages for labor. A common Egyptian boast of personal philanthropy, found in tombs, states, “I gave bread to the hungry and beer to the thirsty.”¹⁰ The Roman writer Pliny the Elder noted, “In no part of the world is drunkenness ever at a loss.”¹¹

Alcohol had both spiritual and medicinal value in ancient societies. The Mesopotamians used beer in several of their medicines. Egyptians used both beer and wine in prescriptions. In addition, wine had symbolic meaning. Red wine was easily equated to blood. And the frenzy of alcohol was a useful tool for priests who attributed the drug’s effects to the Gods.¹²

One of the common plaster ingredient combinations was animal fats, plant resins and alkali. Heated, these ingredients make soap, which would have helped sterilize wounds.⁸

It's important to note that the *asu* was subordinate to the *ashipu*. The separation of physician and priest was refined during the Egyptian era, something we'll discuss in the next segment!

Egypt: Cause and Effect Observation

Egyptian civilization gave birth to a number of healthcare practices that would influence the future of medicine. Medical recipes contained both ingredients and amounts. One record that survives is the **Ebers Papyrus**, named after George Ebers, a nineteenth-century German Egyptologist. Ebers discovered the document at the Theban Necropolis, an archaeological dig on the West Bank of the Nile River.

The Ebers Papyrus is a collection of drug recipes. Translation was difficult and painstaking. Some colorful ingredient names made it difficult to identify the ingredients. For example, fresh dill juice was called “the blood of the Ibis” (an Ibis is a species of bird).

Many of the ingredients were ultimately translated. Some of those ingredients are still in use today. These include juniper berries, poppy, honey, grapes, date blossoms, figs, beer, wine, turpentine and anise. From the Ebers Papyrus and other documents, we now know a lot about Egyptian medicine.

Medical treatment varied according to the patient's ability to pay. For example, gems were ground up in some preparations. A rich man might have a medicine compounded with emeralds. A poor person might have the same medicine prepared with green porcelain.

Some Egyptian medications may have been effective. For example, one recipe for curing intestinal roundworm contained pomegranate root. Pomegranate root contains a strong vermifuge—an anthelmintic used to treat parasites. A cure for night blindness involved the crushed, roasted liver of an ox. We now know that night blindness is caused by a vitamin A deficiency. Roasted ox liver would have been an excellent source of vitamin A.

Other recipes would have been less effective. Pig's eyes, antimony, red ocher and honey poured into the patient's ear probably didn't result in a cure for permanent blindness!

It would be wrong to belittle the work of Egyptian physicians. They were experts at *cause and effect* and medical experimentation. But how could some of the drugs they compounded have been so effective and others so useless?

Two phenomena confused their efforts. The first was the *placebo effect*. The **placebo effect** is the recovery of a patient despite the apparent worthlessness of the cure. In the last segment, we noted the close link between body and mind, a link that was echoed in the dual role of the priest/physician. If a patient believes he will be cured, then very often he will.



The Ebers Papyrus

The placebo effect can explain many recoveries. For example, modern medical tests give sugar pills to a control group. Results are compared to a second group that receives the actual medication. It's not unusual for the health patients receiving sugar pills to actually improve if they believe they're taking the real medication. The placebo effect shows that patients can improve if they believe the medication works. For the ancient Egyptian pharmacists, a cure was a cure—worth recording and repeating.

A second phenomenon that may have misled Egyptian medical professionals was *spontaneous recovery*. **Spontaneous recovery** is the recovery of a patient without intervention. Many diseases are limited in duration. The patient's own immune system can spur recovery. If the end of symptoms happened to coincide with the Egyptian physician's remedy, then a faulty cause-effect relationship might be recorded.

The Egyptian influence lasted for thousands of years. The pharmacopoeias of the Middle Ages used many of the same ingredients, including swine's teeth, putrid meat and moisture from pig's ears!¹³

One other important medical trend can be attributed to the Egyptians. **Specialization**—the separation of tasks within a system—began in ancient Egypt. In the fifth century B.C., the Greek physician Herodotus complained:

“The art of healing is with them divided up, so that each physician treats one ailment and no more. Egypt is full of physicians, some treating diseases of the eyes, others the head, others the teeth, others the stomach and others unspecified diseases.”¹⁴

Ancient Greece and Modern Medicine

Much of what we know about Greek medicine comes to us courtesy of the Islamic empire. During the Dark Ages, western civilization fell into disarray. Many records were lost. Muslim intellectuals admired and respected Greek ideas and translated original Greek documents, preserving and expanding on those ideas.

We now know enough about the Greek contribution to medical knowledge to attribute specific advances to the individuals who developed them. In this segment, we'll look at these men and their thoughts—ideas that still affect our understanding of medicine today.

Hippocrates

Hippocrates of Kos practiced medicine in the fourth century before Christ. He was a philosopher, a physician and a pharmacist. Today, he is renowned as the “Father of Modern Medicine.”

Hippocrates founded a school that treated medicine like a profession. Prior to Hippocrates, medicine was a murky combination of theology, philosophy and medical practice. Hippocrates focused on the medical aspect, insisting on a scientific discipline. He is credited with being the first to reject the idea of a supernatural cause for illness. He believed that environmental factors including diet and lifestyle were the major causes of disease.

Hippocrates' students were required to be clean, calm, understanding and serious. He insisted on meticulous record keeping and communication to enhance medical knowledge. His observation of body functions was so precise that he was said to have measured his patient's pulse to determine if the patient was lying—the first “lie-detector” test!¹⁵

Hippocrates' understanding of anatomy and physiology was limited. For example, he believed in **humorism**—the idea that a healthy body reflected a perfect balance of the four “humors,” including black bile, yellow bile, phlegm and blood. For example, a patient's diet might lead to too much black bile, causing melancholy. If a patient were suspected of too much yellow bile (bad-tempered), Hippocrates would prescribe citrus.

Hippocrates developed the concept of **homeostasis**—attainment of balance and equilibrium throughout the body's systems. Unfortunately, Hippocrates coupled this modern concept with humorism when prescribing drugs and diet. If a patient had a cold, which was viewed as cold and damp, it was treated with mustard, which is hot and dry. The prescription of opposites to restore equilibrium is called **allopathy**.

Even with his shortcomings, Hippocrates had a lasting impact on modern medicine, both through his sense of professionalism and through the *Hippocratic Oath*. The **Hippocratic Oath** was the first statement of ethics for doctors. Though today's medical practitioners do not take the original oath, Hippocrates' work served as a basis for all future medical ethics standards.

Theophrastus

Tyrtamus was a Greek philosopher, nicknamed Theophrastus by Aristotle because of the subtle grace of his conversation. Theophrastus is often called the “Father of Botany” because of his detailed classification of plants, including observations on the medicinal uses of plants. His two great works were titled, *Inquiry into Plants* and *On the Causes of Plants*.

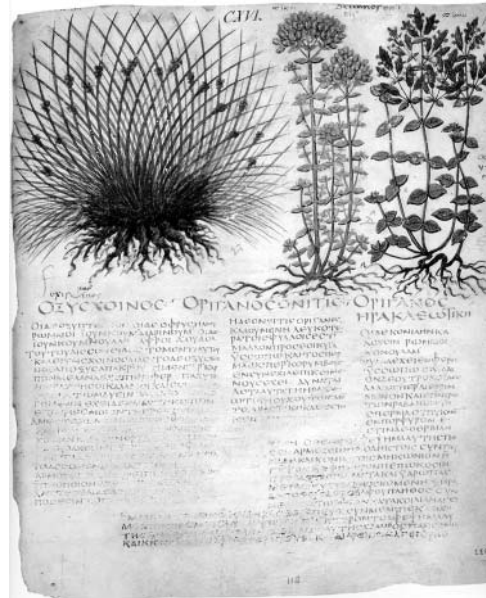
Hippocrates' Oath

The first important statement of medical ethics—the Hippocratic Oath—carried some interesting imperatives for medical students and practitioners. Hippocrates had some controversial views, including the following:

1. *Do not teach medicine to other people.* Medical knowledge was to be kept from those outside the professional circle. Whether this was to vouchsafe the knowledge, or simply to protect lay people from the danger of “partial knowledge” is debatable.
2. *Never induce an abortion.* Hippocrates' opinion was clear-cut, but it was contested. Soranus, a second-century Greek physician suggested a way around Hippocrates' rule—women who wanted to abort a pregnancy should try violent exercise, riding animals and the carrying of heavy objects.¹⁶
3. *Avoid doing what specialists can do better.* The modern debate over the role of medical specialists was alive and well in ancient Greece!
4. *Avoid sexual relationships with patients and their families.* Again, a seemingly modern problem is not so modern after all.

Pedanius Dioscorides

Pedanius Dioscorides was a botanist and pharmacologist who lived in the first century A.D. He practiced his trade in Rome during the reign of Nero. He was considered the major authority on drugs. His five-volume book *De Materia Medica* was the first modern Pharmacopeia. The book was so influential that it was still in use sixteen centuries later! The book traces more than 600 plants and 90 minerals, including medical uses, doses and side effects!



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Galen and Romans Medicine

Claudius Galen taught and practiced pharmacy and medicine in Rome in the second century A.D. His early medical experience included serving as a physician in a Gladiator school. There, he gained invaluable experience in treating wounds. He later wrote that wounds were “windows into the body.”¹⁷

Galen performed complex brain and eye surgeries, including cataract removals. His knowledge of anatomy was boosted by dissections of living animals. His favorite subject for experiments was Barbary Apes. A dissection of a living animal is called a **vivisection**. Galen used vivisections to study the functions of internal organs. Thirteen hundred years later, a Belgian anatomist named Andreas Vesalius used Galen’s writings to do the first dissection of a human cadaver. In the years between, Galen’s writings on anatomy were the most important anatomical resource available.

Roman medicine was typically a matter of charity. Wealthy citizens built hospitals. They even served as volunteers to tend to the sick. This approach to healing lasted for hundreds of years. After the fall of the Roman Empire, however, that pattern changed. Care of the sick became a civic matter. Local communities tended to their own ill patients. In larger cities, prisoners and prostitutes often tended to patients.

Now let’s turn our attention to some of the influences that affected the development of modern pharmaceutical practice.

The Judeo-Christian Influence on Medicine

The Jewish literary canon had medical advice to offer that influenced medical thinking as long ago as 1200 B.C. *The Wisdom of Yeshua Ben Sira*, also known as *Sirach*, stated:

“The Lord hath created medicines out of the earth; and he that is wise will not abhor them. Was not water made sweet with wood, that the virtue thereof might be known? And he hath given men skill, that he might be honored in his marvelous works. With such doth he heal men, and taketh away their pains. Of such doth the pharmacist make a confection...” (38:4-8).¹⁸

Many books in the Old Testament, including Genesis, Exodus, Ezekiel and the Song of Solomon mention herbal remedies. These references demonstrate the Jewish acceptance of the medical arts. Centuries later, a Jewish rabbi and medical practitioner named Maimonides crafted a prayer that was often inscribed on graduation scrolls for pharmacy students. The prayer included these passages:

“Inspire me with love for my art and for Thy creatures. Do not allow thirst for profit, ambition for renown and admiration, to interfere with my profession... In the sufferer let me see only the human being... Never allow the thought to arise in me that I have attained to sufficient knowledge, but vouchsafe to me the strength, the leisure and the ambition ever to extend my knowledge. For art is great, but the mind of man is ever expanding.”¹⁹

The fall of the Roman Empire saw a general decline in the medical arts. In fact, without the efforts of Islamic translators and Christian *Monasteries*, the medical wisdom of the ancient world might well have expired. **Monasteries** were small religious communities. These communities had infirmaries to care for the sick. They also had gardens that cultivated herbal ingredients and libraries that catalogued medical information.

During the Renaissance, Christian efforts helped improve the conditions of hospitals. St. Camillus de Lellis founded a religious order—the Order of Clerks; Regular Servants of the Sick. The order emphasized clean conditions and proper diet. His experiences with the Venetian army led him to establish a separate group of battlefield healthcare workers who wore a red cross to mark their role. The Red Cross has been a symbol of battlefield mercy ever since.

Camillus de Lellis also concerned himself with the hopelessness of terminal patients. He formed “The Brothers of the Happy Death” for plague victims in Rome. The brotherhood focused on making the last days of terminal patients as comfortable as possible.

Pharmacy in the Far East

The first reference to medicine and pharmacy in China was found on the **Pen T'sao**, a document inscribed on bamboo slats. Pen T'sao means, “The Botanical Basis of Pharmacy.” This incredible document was based on the work of the legendary Shennong—the “Father of Chinese Agriculture.” Shennong supposedly tested the medicinal value of hundreds of herbs by taking them himself. While searching for an antidote for various poisons, Shennong invented tea. Tea counteracts the toxic effects of more than 70 toxic herbs!

The Pen T'sao describes more than a thousand plants, and details 11,000 of Shennong's medical prescriptions, listing the drug name, dosage and medical uses. Shennong is also credited with developing *acupuncture*. **Acupuncture** is the use of needles in the skin to restore good health.



The Pen T'sao describes more than a thousand plants, and details 11,000 of Shennong's medical prescriptions, listing the drug name, dosage and medical uses.

Shennong and the Pen T'sao were instrumental in launching several thousand years of *Zhongyi Xue*—**Traditional Chinese Medicine (TCM)**. TCM views body systems as interrelated, interacting with the environment. That's a very modern notion! Treatment involves a combination of herbal remedies, acupuncture and massage therapy. One possible shortcoming to this approach is the lack of a scientific verification of therapy. In other words, no one knows how well these treatments really work. There's no research to prove the results. Today, some western medical professionals are adapting TCM to an evidence-based framework in order to make use of TCM techniques.

Mithradates the Great

Mithradates VI was a Persian King in the early first century B.C. He successfully fought against the eastern edge of the Roman Empire, defeating many famous Roman generals before finally falling to Pompey the Great. He was a cruel king who gained the throne by killing all of his brothers. He often slaughtered the inhabitants of occupied territories. In an incident known as the *Asiatic Vespers*, Mithradates executed 80,000 Roman citizens, including anyone with a Latin accent.

What did this cruel tyrant have to do with medicine? He is known today as the “Father of Toxicology.” Mithradates was very interested in poisons, wanting very much to make himself immune to them! He studied all forms of poisons, taking sub-lethal doses to build up tolerance to them. He also developed a “universal antidote” that he took every day to keep himself protected from a palace takeover. The formula for the antidote included:

- 1.6 g Costmary
- 20 g Sweet flag
- 16 g Gallic nard
- 16 g Gentian root
- 16 g Dried rose leaves
- 8 g Hypericum
- 8 g Gum
- 8 g Sagapenum
- 8 g Acacia juice
- 8 g Illyrian iris
- 8 g Cardamon
- 12 g Anise
- 17 g Parsley
- 17 g Poppy tears

- 20.6 g Casia
- 20.6 g Saxifrage
- 20.6 g Darnel
- 20.6 g Long pepper
- 21 g Storax
- 24 g Castoreum
- 24 g Frankincense
- 24 g Hypocistis juice
- 24 g Myrrh
- 24 g Opopanax
- 24 g Malabathrum leaves
- 24.6 g Flower of round rush
- 24.6 g Turpentine resin
- 24.6 g Galbanum
- 24.6 g Cretan carrot seeds
- 25 g Nard
- 25 g Opobalsam
- 25 g Shepherd's purse
- 28 g Rhubarb root
- 29 g Saffron
- 29 g Ginger
- 29 g Cinnamon²⁰

The ingredients were ground up and stirred into honey. When the mixture dried, it was broken into almond-sized doses. One dose could dissolve easily in wine! Eventually defeated by the Romans, Mithradates tried to avoid capture by poisoning himself. You may be surprised to find that his suicide attempt failed—between antidotes and immunity, the poison failed to work! Luckily, a servant with a sword happened to be handy....

Murder and Medicine

Our understanding of medications has often been directed by the desire to understand poisons. The toxic effects of plants have been used for hunting, warfare and murder since the beginning of recorded history. Consider the Greek word *toxicon*, which meant, "poison for arrows."²¹ Both Homer and Virgil mention natural poisons for arrows in their epic poems.

In some instances, poisons provided a unique form of execution. For example, the sap of the upas tree contains cardiac glycosides—used today to treat heart arrhythmia. One king of Java executed thirteen of his concubines for failing to satisfy him. The sap of the upas was administered through small incisions, killing the women within minutes. Later, the well belonging to Dutch colonists was poisoned using the same sap.

The ancient world was adept at poison usage, selecting toxins based on how fast the poison worked and the amount of pain inflicted. Legend says that when Cleopatra decided to commit suicide, she selected her toxin after testing several on her servants. Nightshade worked fast, but was painful. Strychnine left the corpse with a contorted face. Asp venom was fast, too, but death was comparatively tranquil. Cleopatra chose the Asp venom.

Poisons were also used in war. The first recorded chemical warfare attack occurred in 590 B.C. during the siege of Cirrha. Solon of Athens poisoned the defender's water with hellebore roots. During their wars with Athens, Sparta burned toxic woodpiles splashed with tar and sulfur—when the wind was right! The Chinese also used smoke in war, combining wolf dung and gunpowder to create the toxic "five-league fog."

Today, we understand the close connection between poisons and medicine. In fact, the words "poison" and "potion" come from the same root Greek word—*pharmakon*. The word is also the root source of "pharmacy." The fact is, most poisons can be used as drugs and depending on dose, most drugs can be poisonous.²²



The Queen of the Nile once conducted toxicity studies.

The Rise of Western Pharmacies

After the Renaissance, the spirit of scientific discovery began to affect the development of pharmacy. The Renaissance was called the “rebirth of learning.” During the Middle Ages, theology dominated all other aspects of life. There was little room for medical advancement. The Renaissance was followed by the Age of Reason, which spawned a scientific revolution. Reason, science and rationality were promoted and advocated. Medical science benefited from the sudden interest in all things scientific. There was a sense that all problems could be solved, if the right procedures were followed. It’s no surprise that medical advancements came out of that kind of approach.

But one important step preceded the great explosion of knowledge. A German king provided that step. Frederick II, known as Frederick the Great, was the Emperor of the Holy Roman Empire (Germany) from 1220-1250 A.D. It was said that he could speak nine different languages and write in seven—at a time when many kings were illiterate.

As emperor, Frederick wrote the “Edict of Salerno” in 1241. The edict, also known as the “Magna Carta of Pharmacy,” officially separated the duties of physician and pharmacists, forbidding doctors from doing both duties. The edict also made pharmacies subject to government inspection. Pharmacists were required to prepare drugs in a uniform manner, following accepted methods. This edict was extremely influential. It became the model by which all of Europe regulated its pharmacies.

The edict also fixed prices for certain drugs. Anyone who follows the debate over modern pharmaceutical prices might be interested to know that the price of drugs was an issue in the thirteenth century as well!

Maintaining uniform drug preparation was difficult to oversee, since pharmacies used different recipe books, known as **pharmacopoeias**. The first standardized pharmacopoeia was compiled in Nuremberg, Germany in 1546. *Dispensatorium Pharmacopolarum* was adopted by city authorities, and eventually used in cities from Rome to Cologne.

Research and Discoveries

While pharmacy was being established as its own profession, many discoveries were made that would greatly affect the future of medical therapy. For the first time, pharmacists made a lion’s share of these discoveries. Let’s take a look at some of these landmark discoveries.

India developed advanced medical knowledge at an early time as well. The legendary Chakara wrote about more than 2000 different drugs. In addition, he developed the eight primary concerns of professional medicine around 1000 B.C. These concerns included:

1. General Practice
2. Pathology
3. Diagnostics
4. Physiology and Anatomy
5. Prognosis
6. Therapeutics
7. Pharmacy
8. Successful Treatment

Notice that Chakara separated pharmacy from other aspects of treatment—more than three thousand years ago! This professional distinction was not made in Western Europe until the thirteenth century, something we’ll discuss in the next segment.

One particular problem had plagued the field of medicine for centuries—the problem of pain. Friedrich Serturmer was a twenty-one-year-old German pharmacist's apprentice who isolated an alkaloid from opium. He called the drug “morphine” after the Greek god of dreams, Morpheus. The drug was found to be very helpful in controlling previously unmanageable pain. By 1815, more than a decade after its discovery, the drug was in wide use throughout all of Europe. Serturmer eventually bought and operated his own pharmacy in Hamelin, Germany.



War and Pharmacy

What is it good for? Curiously, war has a positive effect on health care and healthcare technology. War increases the demand for health care. Throughout history, wars have resulted in medical improvements. Let's take a look at medical advances that came directly from armed conflict.

During the crusades, the *Hospitallers of the Order of St. John of God* were founded to run the hospitals built in the Holy Lands. The order, also known as the Knights Hospitaller, began in Jerusalem. The Knights Hospitaller established a trend that was repeated throughout Europe. Hospitals in the United States were often founded in the same way—permanent facilities were built on the site of field hospitals.

During the Civil War, Louisa May Alcott was a volunteer nurse. After seeing the deplorable condition of field hospitals, she wrote *Hospital Sketches*, a book that influenced President Abraham Lincoln to establish the U.S. Sanitary Commission. The result was vastly improved hospital conditions that carried over into post-war America.

World War I saw the development of tanks, chemical warfare and flamethrowers. The medical arts responded with new techniques in trauma surgery, floating hospitals and improved burn treatments. World War II featured air warfare and concentrated bombing. The medical arts responded with sulfonamides, penicillin and blood and plasma transfusions.

Because of the shortage of trained military personnel, the professions of occupational therapist and physical therapist were created. The understanding of psychiatric problems resulting from wartime experiences expanded our understanding of mental disorders.

This is not to say that medical advances depend on armed conflict. Great medical advances came out of the Space Program—the noble quest for the stars. However, war provides enough carnage for practice and experimentation. The resulting medical advances may well be the only positive dividend that some wars offer.

Johannes Buchner was a German pharmacist who discovered salicin in willow bark, which led to the invention of aspirin. Hippocrates had noted the medicinal value of willow bark. In North America, Cherokee Indians used the bark as medicine. But no one had researched the reasons for the bark's value. Buchner isolated salicin. An avid researcher, Buchner also discovered nicotine in tobacco!

Joseph Caventou was a French pharmacist who collaborated with Pierre Pelletier to discover quinine. Quinine quickly became the international treatment for malaria, an infectious tropical disease. Caventou and his partner decided not to patent the medicine, choosing instead to release the formula to the world. Later, Caventou discovered caffeine.

Paul Erlich was a German scientist who first observed the blood-brain barrier, and developed the first antibiotic. He also researched chemical combinations, hoping to find what he called a **magic bullet**—a chemical drug that would combat syphilis. Erlich believed that the correct combination of chemicals would be selectively toxic to the organism that caused the disease. The use of chemical substances to treat disease—**chemotherapy**—followed from Erlich's research on arsenic combinations.

Erlich later received the Nobel Prize for Medicine for a compound that was found effective against sleeping sickness. He eventually formulated a magic bullet for syphilis—*Salvarsan*. The success of his efforts led directly to the development of other drugs, including penicillin and sulfa drugs.

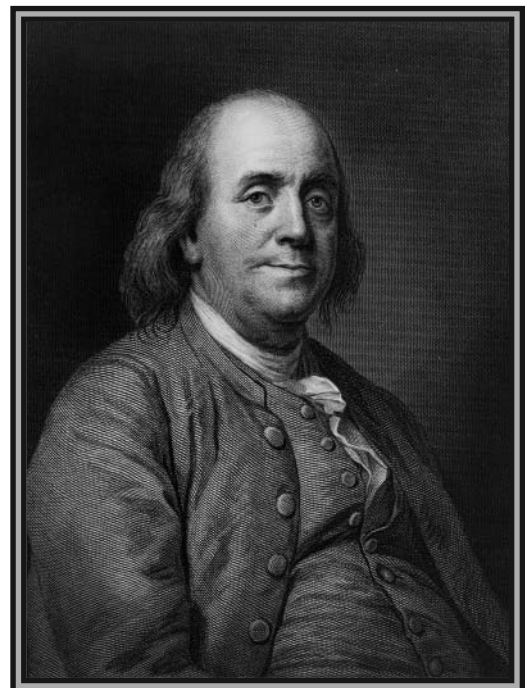
These discoveries helped to establish pharmacy, not only as a profession, but as an important part of the evolution of health care.

Modern Changes

After the Renaissance, western hospitals took several different forms. **Almshouses** were facilities for the poor. **Sanatoriums** were homes for victims of long-term diseases like tuberculosis. **Asylums** were facilities for incarcerating the mentally ill. **Hospices** cared for terminally ill patients. The care patients received at these institutions varied greatly.

In the early eighteenth century, nonmilitary hospitals were established in the thirteen colonies. Benjamin Franklin founded the Pennsylvania Hospital—the first American hospital. Jonathan Roberts was hired as the hospital's first pharmacist. That made Roberts the first institutional pharmacist!

In the early nineteenth century, American Benjamin Rush introduced new methods for treating the mentally ill. His ideas were driven by his moral principles—*asylum care* horrified him. Because Rush was a friend of Benjamin Franklin, he was invited to care for psychiatric patients at Pennsylvania Hospital.



When he wasn't researching electricity, Ben Franklin founded the Pennsylvania Hospital.

Rush's ideas were embraced, and the old asylums disappeared, replaced by hospital facilities for the mentally disturbed. The new trend was called **custodial care**—the mentally ill were separated from friends and family, watched over by medical professionals.

The custodial care trend was so prevalent that by the early part of the twentieth century, mental patients occupied more than half the hospital beds in the United States! This trend reversed after the 1950s. **Deinstitutionalization**—the release of mental patients to local communities or the streets—is still debated today. Critics believe that Deinstitutionalization was popular because it saved municipalities money. Unfortunately, Deinstitutionalization also increased the homeless population.

The first U.S. Pharmacopeia was compiled in Philadelphia in 1820 at the first U.S. Pharmacopeia Convention. In that first convention, only doctors were represented. By 1850, both doctors and pharmacists were represented. The U.S. Pharmacopeia is currently updated every decade. Charles Rice, a pharmacist at Bellevue Hospital in New York, was the first pharmacist to be chosen as convention chairman.

A steady stream of discoveries expanded the number and type of drugs that were available to patients. Biological “serum therapy” resulted from the work of Robert Koch, Edward Jenner and Emil von Behring. Smallpox vaccines were introduced in the early 1900s. More vaccines quickly followed, including those for typhus, tetanus, influenza and polio.

Beginning with adrenaline in 1897, hormones were isolated, allowing replacement therapy. Insulin was isolated in 1922, allowing the treatment of diabetes. Genetically engineered human insulin was introduced in 1982.

Synthetic chemicals were developed, including phenobarbital in 1912. Phenobarbital is a barbiturate used as an anti-convulsant. A steady stream of synthetics were designed to address medical problems in the major body systems.

Current drug development includes **immunomodulators**—drugs that focus on immune system deficiencies. Genetically engineered drugs push the boundaries of research. The first was a human growth hormone engineered to replace drugs that were previously extracted from human cadavers. In 1986, the FDA approved a vaccine for Hepatitis B—the first FDA approved engineered vaccine.



New discoveries increased the number and diversity of drugs.

The development of new kinds of drugs has increased the amount of knowledge professional pharmacists need to know. In ancient times, a healer might well know “everything” about the medical arts. He could study the properties and uses of a few hundred herbs in a relatively short time.

Today, there are literally thousands of drugs on the market. As a pharmacy technician, you will be asked to know the names, uses and side effects of more than 200 drugs. One reason for specialization in health care is the vast amount of available knowledge. No single person can know “everything” in the medical field. Instead, you will be a part of a team that cares for the health and well being of your patients.

Legislation and Pharmacy

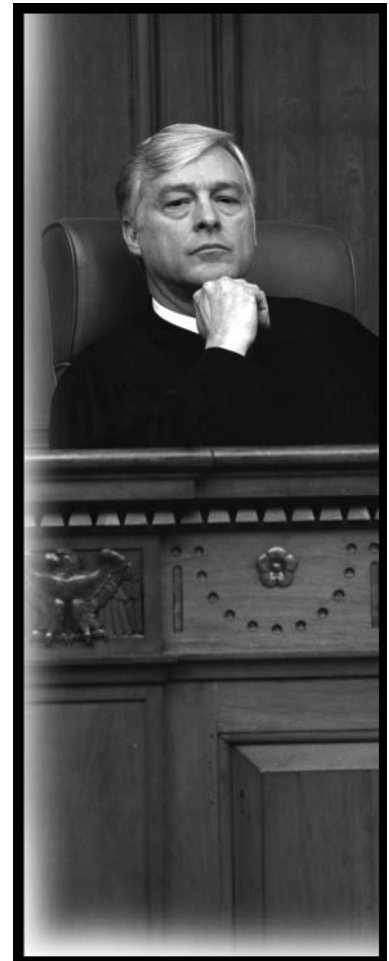
With new discoveries coming fast and furious, there was a need to regulate and oversee evolving pharmacy technology. In Lesson 18, you will learn about laws and regulatory agencies that currently direct pharmacy in the United States. There is more than one kind of pharmacy law. Laws include federal laws, which usually regulate drug products. State laws regulate the people who practice pharmacy. These laws may be **statutes**—laws passed by legislation. Or they may be **judicial law**—rules resulting from court decisions.

Some laws fall under the category of civil law—rules that govern how individuals relate to each other. Criminal law is comprised of rules that govern how individuals relate to society. For example, if a pharmacist operated without a license, that would be a matter for criminal law. If on the other hand, a patient wanted to sue a pharmacy for providing the wrong prescription, it would be an issue of civil law.

To further complicate matters, pharmacy is regulated by multiple agencies. The U.S. Food and Drug Administration (FDA), the Drug Enforcement Agency (DEA) and various state boards all have a say in how a pharmacy is run. It’s hard to imagine the unregulated world of the ancient apothecary. Remember that prior to 1241, there was no such thing as the regulation of pharmacies. The idea of government oversight has come a long way since the “Magna Carta of Pharmacy.”

The major laws that have altered the pharmacy industry since the early 1900s include:

- *The Pure Food and Drug Act of 1906*—This act prohibited the sale of mislabeled foods and drugs. Later versions prohibited false advertising statements about the curative powers of drugs.
- *The Food, Drug and Cosmetics Act of 1938*—This act founded the FDA. It also required the manufacturers of new drugs to apply for permission to sell from the FDA. The law attended to purity, safety and packaging concerns.



Pharmacy has become large enough to require legal oversight.

- *The Durham-Humphrey Amendment of 1951*—This law defined the difference between legend (prescription) drugs and over-the-counter drugs.
- *The Kefauver-Harris Amendment of 1962*—This act upgraded the Food, Drug and Cosmetics Act of 1938. It required that both legend and over-the-counter drugs be safe and effective.
- *The Comprehensive Drug Abuse Prevention and Control Act of 1970*—Also known as the “Controlled Substances Act,” this law set up five categories of drugs to define how they should be handled to avoid drug abuse.
- *The Medical Device Amendments of 1976*—These acts added medical devices to the scope of previous regulatory laws. Manufacturers of medical devices were required to ensure safety and report equipment problems.
- *The Dietary Supplement Health and Education Act of 1994*—This act added nutritional supplements to the list of products the FDA would oversee.

Current Trends

The history of pharmacy is still being written. In the last few decades, the job of pharmacist has expanded to include patient counseling. With so many specialists and so many drugs, the risk of adverse medical reactions or drug-to-drug interactions has greatly increased. The pharmacist must act as a coordinator—reviewing all of a patient’s drug therapies and spotting potential interaction problems. These potential problems must be communicated to the patient.

The expansion of medical roles has always resulted in a division of labor. Just as physicians and pharmacists began working as a team, now pharmacists and pharmacy technicians work together to shoulder an increased workload.

Remember Friedrich Serturner, the discoverer of morphine? If a young pharmacy apprentice can help change the medical world, it’s not such a stretch to imagine that the contribution of some young pharmacy technician might alter how future medical care is accomplished. Perhaps a future edition of this text might include *your* contribution to an ever-growing body of medical knowledge!



How will *you* help write the history of pharmacy?

Summary

The history of pharmacy begins as a history of medical care. As the amount of medical knowledge increased, medical care separated into specialties. One specialty involved the discovery, preparation and use of drugs—Pharmacy!

Ancient pharmacy began with the study of the medical uses of plants. Today, drugs come from plants, animals, chemicals, hormones and even from genetically engineered materials.

Many of our modern medical concepts date back to the Egyptians, Greeks and Romans. These important concepts include professionalism, observation, record keeping and homeostasis. But Western pharmacy declined after the fall of the Roman Empire. Luckily, the continued interest of the Muslim world translated and expanded on ancient discoveries.

After the Renaissance, drug knowledge expanded through a series of scientific discoveries. The Edict of Salerno established pharmacy as a separate, regulated industry. Meanwhile, hospitals evolved into modern facilities, and pharmacists like Jonathan Roberts established institutional pharmacies within these hospitals.

Today, the explosion of knowledge, including the increased number and scope of drugs, means an expanded role for pharmacists. Just as pharmacy and healing once divided to allow specialization of knowledge, today's pharmacies require a team to accomplish all of the important tasks that must be performed. The position of pharmacy technician is a reflection of that continued need for specialization.

And remember: The history of pharmacy is still being written!

Endnotes

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