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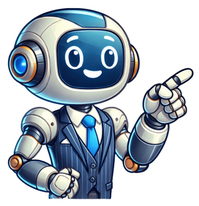

Medieval medical practices

We set the stage by examining the prevailing medical beliefs and theories during the medieval era. From the influence of ancient Greek and Roman medicine to the impact of religious doctrines and folk traditions, we uncover the diverse sources that shaped medical knowledge and practices. Physicians, often educated in universities and monastic schools, played a crucial role in medieval healthcare. We explore their training, qualifications, and social standing. Understanding the position of physicians within medieval society provides insight into the healthcare system of the time. At the core of medieval medical beliefs lay the humoral theory, which posited that health depended on maintaining a balance of bodily humors. We delve into the four humors (blood, phlegm, yellow bile, black bile), their imbalances, and the corresponding treatments prescribed by physicians. Herbal remedies formed a significant part of medieval medical practice. We examine the use of medicinal plants, the compilation of herbals and their influence on medical knowledge, and the roles of apothecaries and herbalists in providing treatments. Medieval surgeons, though limited in their understanding of anatomy and lacking advanced tools, performed various surgical procedures. We explore the techniques employed, including amputations, trepanation, and wound care, shedding light on the challenges they faced in an era devoid of modern surgical advancements. The influence of astrology and mystical beliefs on medieval medicine cannot be overlooked. We delve into the practice of medical astrology, which connected celestial movements with human health. Additionally, we explore the role of charms, talismans, and prayers in the treatment of illnesses. We examine the institutions and settings where medical care was provided. From monastic infirmaries and hospitals to private residences and the homes of physicians, we gain insights into the healthcare infrastructure available during the medieval period. Beyond the formal medical system, folk medicine played a significant role in the daily lives of medieval people. We explore the remedies and practices employed by lay healers, cunning folk, and wise women, revealing the close connection between magic, religion, and folk healing traditions. Medieval society was plagued by various diseases and epidemics. We discuss the prevalent illnesses of the time, such as the Black Death, and the efforts made to combat and prevent the spread of diseases. The role of quarantine, public health measures, and the response of society to epidemics are also examined. Medieval medicine, despite its limitations and misconceptions, laid the foundation for future medical advancements. We reflect on the contributions of medieval medical practices and theories, and their influence on the development of medicine in subsequent eras. Medieval medicine, with its blend of ancient knowledge, religious beliefs, and emerging science, shaped the healthcare landscape of the Middle Ages.Exploring the remedies, practices, and the role of physicians during this period provides a valuable glimpse into the medical knowledge and healthcare systems that prevailed.It serves as a reminder of the resilience and resourcefulness of medieval medical practitioners, as well as the enduring impact of their practices on the trajectory of medical progress. As a library, NLM provides access to scientific literature. Inclusion in an NLM database does not imply endorsement of, or agreement with, the contents by NLM or the National Institutes of Health. Learn more: PMC Disclaimer | PMC Copyright Notice . 2012 Oct-Dec;13(4):158–162. doi: 10.4103/1995-705X.105744 Superstition is the poison of the mind - Joseph Lewis “The glory that was Greece and the grandeur that was Rome” ended when Rome fell to Germanic tribes in the 5th century AD. The Ancient Romans, Greeks, and Egyptians had pushed forward medical knowledge, but after the demise of these civilizations, artistic, cultural, and scientific outputs were sadly lacking when compared to both earlier and later times. Medical knowledge stagnated in the Middle Ages and did not develop until the 17th/18th centuries. The center of Western learning shifted to Constantinople (now Istanbul), the capital of the Byzantine Empire, which had been Christian since the 4th century AD, with the conversion of the Roman emperor Constantine. The Church quickly gained converts – and power – throughout Western Europe. The Roman Catholic Church effectively dominated what direction the medical world took. Any view different from the established Roman Catholic view was labeled heresy and punished accordingly. The Roman Catholic Church stated that illnesses were punishments from God and those who were ill were so because they were sinners. No one contradicted such world view; it was accepted. Suffering was seen as part of the human condition. As people became obsessed with their souls, they neglected their bodies; medicine became a matter of faith and prescriptions became prayers. Medicine became steeped in superstition. Ideas about the origin and cure of disease were based on factors such as destiny, sin, and heavenly influences. Therefore, in this period, there was no tradition of scientific medicine, and observations went hand in hand with spiritual and religious influences. Medicine during the Middle Ages was composed of a mixture of existing ideas from antiquity and spiritual influences. Standard medical knowledge was based chiefly upon surviving Greek and Roman texts preserved in monasteries and elsewhere. Bleeding a patient In the Middle Ages, the practice of medicine was still rooted in the Greek tradition. The body was made up of four humors: yellow bile, phlegm, black bile, and blood. These were controlled by the four elements: fire, water, earth, and air. An imbalance of humors caused disease and the body could be purged of excess by bleeding, cupping, and leeching – medical practices that continued through the Middle Ages. Many diseases were thought to be caused by an excess of blood in the body and bloodletting was seen as the obvious cure. An important aspect in the treatment of ailments was diet. The food choices we make can have an important impact on health. This was known since antiquity for Hippocrates is quoted as saying, “Let food be thy medicine and medicine be thy food.” The Greek concept of the four humors as revised by Galen was the basis of all diagnosis and treatment, but it had evolved into a theory of temperament, which accounted for psychological and social as well as physical characteristics. An excess of blood, phlegm, yellow bile, or black bile made a person sanguine, phlegmatic, choleric, or melancholic. Physicians were, however, trained in the art of diagnosis: observation, palpation, feeling the pulse, and urine examination were the tools of the doctor throughout the Middle Ages. They were often shown in manuscripts holding a urine flask up for inspection or feeling the pulse. On first visiting patients, doctors noted their appearance, listened to their stories, felt their pulses, and examined their urine. Urine inspection was the most common method of diagnosis and the urine flask became the symbol of the doctor. In our time of course, the stethoscope is the symbol of the doctor, but that too may change. Medieval doctors used the color of urine to diagnose an illness. Physician examining a urinal Monks weighing out herbsThe belief in classical antiquity that the moon and planets played an important part in good health continued in the Middle Ages. They believed that the human body and the planets were made up of the same four elements (earth, fire, air, and water). For the body to operate well, all four elements had to be in harmony with no imbalances. It was believed that the moon had the greatest influence on fluids on earth, and that it was the moon that had the ability to affect positively or negatively the four elements in the body. Where the moon and planets were, a knowledge of this was considered important when making a diagnosis and deciding on a course of treatment. Physicians needed to know when to treat a patient and when not to, and the position of the planets determined this. A so-called Zodiac Chart also determined when bloodletting should be done as it was believed by some that the moon and planets determined this as well. Medical charts informed physicians what not to do for people born under a certain astrology sign. Galen was the most influential ancient physician during the Middle Ages. He held undisputed authority over medicine in the Middle Ages. He described the four classic symptoms of inflammation (redness, pain, heat, and swelling) and added much to the knowledge of infectious disease and pharmacology. His anatomic knowledge of humans was defective because it was based on dissection of animals, mainly apes, sheep, goats, and pigs. Some of Galen's teachings tended to hold back medical progress. His theory, for example, that the blood carried the pneuma, or life spirit, which gave it its red color, coupled with the erroneous notion that the blood passed through a porous wall between the ventricles of the heart, delayed the understanding of circulation and did much to discourage research in physiology. His most important work, however, was in the field of the form and function of muscles and the function of the areas of the spinal cord. He also excelled in diagnosis and prognosis. The importance of Galen's work cannot be underestimated, for through his writings, knowledge of Greek medicine was subsequently transmitted to the Western world by the Arabs. “How can a man die who has sage in his garden?” Herbs, flowers, and perfumes formed a large part of everyday life in the Middle Ages and were inextricably linked with magic and medicine. Medicinal plants and herbs were an important and major part in the pharmacopeia. Medicines were made from herbs, spices, and resins. Dioscorides, a Greek, wrote his Materia Medica in 65 AD. This was a practical text dealing with the medicinal use of more than 600 plants in the second century. Although the original text of Dioscorides is lost, there are many surviving copies. His texts formed the basis of much of the herbal medicine practiced until 1500 . Some plants were used for specific disorders, while others were credited with curing multiple diseases. In many cases, preparations were made of many different herbs. The oldest surviving English herbal manuscript is the Saxon Leech Book of Bald written in about AD 900–950. Vapor and herb baths were prescribed for all kinds of ailments. The book shows how common it was to “smoke” the sick with fragrant woods and plants. Scented garlands decorated homes. Every herb, every tree, and every flower had its own special quality. But of all the scents, the rose is the one most associated with the Middle Ages. Crusaders brought home many different kinds of perfumes from the Middle East; one among them was rosewater and the nobility put bowls of rosewater for guests to wash their hands after meals. Rose petals were also used to perfume baths. However, in the Middle Ages, the study of medicinal plants was in the hands of monks who in their monasteries planted and experimented on the species described in classic texts. No monastic garden would have been complete without medicinal plants. The sick went to the monastery, local herbalist, or apothecary to obtain healing herbs. Most monasteries developed herb gardens for use in the production of herbal cures, and these remained a part of folk medicine, as well as were being used by some professional physicians. Books of herbal remedies were produced by monks as many monks were skilled at producing books and manuscripts and tending both medicinal gardens and the sick. However, works of this period simply imitated those of classical antiquity. Pliny's work Naturalis Historia, a work that includes myths and folklore, trees, and medicinal plants, and written in about 77–79 AD, and Dioscordes’ De Materia Medica are frequently mentioned in classical antiquity and translations are widely copied in the Middle Ages. Medieval doctor's blood letting blades Doctors giving medicineHeadache and aching joints were treated with sweet-smelling herbs such as rose, lavender, sage, and hay. A mixture of henbane and hemlock was applied to aching joints. Coriander was used to reduce fever. Stomach pains and sickness were treated with wormwood, mint, and balm. Lung problems were treated with a medicine made of liquorice and comfrey. Cough syrups and drinks were prescribed for chest and head-colds and coughs. Wounds were cleaned and vinegar was widely used as a cleansing agent as it was believed that it would kill disease. Mint was used in treating venom and wounds. Myrrh was used as an antiseptic on wounds. There was no experimentation to test the efficacy of a particular herb treatment on ailments. If successful, it was ascribed to their action upon the humors within the body and the belief that such natural herbal remedies must have been intended for such purpose by God. As Origen, an early Christian theologian and Biblical scholar stated, “For those who are adorned with religion use physicians as servants of God, knowing that he himself assigned both herbs and other things to grow on the earth.” Such interweaving of medicine and religion, of medical thought and theological considerations is striking in the medieval period. The use of herbs also drew on the doctrine of signatures, a philosophy shared by herbalists from the time of Dioscorides to Galen and which stated that herbs that resemble various parts of the body can be used to treat ailments of that part of the body. For example, the spotted leaves of lungwort, which was used for tuberculosis, bear a similarity to the lungs of a diseased patient. The medieval Christian Church provided a theological justification for this philosophy by reasoning that God had provided some form of alleviation for every ill, and these things, be they animal, vegetal, or mineral, carried a mark or a signature upon them that gave an indication of their usefulness. This of course is regarded as superstition since there is no scientific evidence whatsoever that plant shapes and colors help in the discovery of medical uses of plants. “… and so many died that all believed it was the end of the world.” The Plague in Siena: An Italian Chronicle One of the most devastating pandemics in human history was The Black Death. It is thought to have started in China or central Asia before spreading west. It swept through the Mediterranean and Europe in the 13th and 14th centuries. By 1349, one-third of the Islamic world had perished and is thought to have killed 30–60% of Europe's population. It took 150 years for Europe's population to recover. The plague reoccurred occasionally in Europe until the 19th century. The aftermath of the plague created a series of religious, social, and economic upheavals which had profound effects on the course of European history. The Black Death arrived in Europe by sea in October 1347 when 12 Genoese trading ships docked at the Sicilian port of Messina after a long journey through the Black Sea. The people who gathered on the docks to greet the ships were met with a horrifying surprise: Most of the sailors aboard the ships were dead, and those who were still alive were gravely ill. They were overcome with fever, unable to keep food down, and were delirious from pain. Strangest of all, they were covered in mysterious black boils that oozed blood and pus and gave their illness its name, the “Black Death.” The Sicilian authorities hastily ordered the fleet of “death ships” out of the harbor, but it was too late: Over the next 5 years, the mysterious Black Death would kill more than 20 million people in Europe – almost one-third of the continent's population. Even before the “death ships” pulled into port at Messina, many Europeans had heard rumors about a “Great Pestilence” that was carving a deadly path across the trade routes of the Near and Far East. (Early in the 1340s, the disease had struck China, India, Persia, Syria, and Egypt.) However, they were not equipped for the horrible reality of the Black Death. The Italian poet Giovanni Boccaccio wrote: “In men and women alike at the beginning of the malady, certain swellings, either on the groin or under the armpits ¼ waxed to the bigness of a common apple, others to the size of an egg, some more and some less, and these the vulgar named plague-boils. Blood and pus seeped out of these strange swellings, which were followed by – fever, chills, vomiting, diarrhea, terrible aches and pains – and then, in short order, death ¼ the mere touching of the clothes appeared to itself to communicate the malady to the toucher.” The Black Death was terrifyingly contagious. When people who were perfectly healthy went to bed at night, they could be dead by morning. How did the people of the Middle Ages cope with such a horrible disease? No medical knowledge existed at the time to deal with the infection. Bacteria and contagion were unknown. Medieval doctors tended to blame a “pestilential atmosphere” caused either by planetary conjunction or by earthquakes and volcanic eruptions that had occurred before the disease appeared. Doctors tried every possible cure and prevention. Physicians relied on crude and unsophisticated techniques such as bloodletting and boil-lancing (practices that were dangerous as well as unsanitary) and superstitious practices such as burning aromatic herbs and bathing in rosewater or vinegar. Some stressed that “olive oil, as an article of food is fatal ¼ Bathing is injurious.” Others believed that the air had become “stiff” and had to be broken up by loud noises. So, bells were rung, guns were fired, and birds were released to fly around rooms. In the absence of medical understanding of such a frightful disease, people turned to prayers and pilgrimage. According to the Church, the Black Death was God's punishment for the sinfulness of humankind. People invoked Christ, the Virgin Mary, and saints for help. People who believed that they had sinned showed their true repentance by inflicting pain on themselves – the so-called flagellants who whipped themselves to show their love of God and their true repentance at being a sinner, a practice that is still re-enacted during Holy Week in some Catholic countries. Clearly, of course, this custom was no cure for the plague, but power of faith was potent medicine for the sick in the Middle Ages. Plague doctorToday, physicians understand that the Black Death, now known as the plague, is spread by a bacillus called Yersina pestis. (The French biologist Alexandre Yersin discovered this germ at the end of the 19th century.) They know that the bacillus travels from person to person through the air and saliva, as well as through the bite of infected fleas and rats. Both of these pests could be found almost everywhere in medieval Europe, but they were particularly at home aboard ships of all kinds – which is how the deadly plague made its way through one European port city after another. Not long after Genoese trading ships brought the disease to Messina, Sicily, the Black Death spread to the port of Marseilles in France and the port of Tunis in North Africa. Then it reached Rome and Florence, two cities at the center of an elaborate web of trade routes. By the middle of 1348, the Black Death had struck Paris, Bordeaux, Lyon, and London. This grim sequence of events is terrifying, but comprehensible to us today. In the middle of the 14th century, however, there seemed to be no rational explanation for it. No one knew exactly how the Black Death was transmitted from one patient to another. According to one doctor, for example, “instantaneous death occurs when the aerial spirit escaping from the eyes of the sick man strikes the healthy person standing near and looking at the sick.” No one knew how to prevent or treat it. Healthy people panicked and did all they could to avoid the sick. Doctors refused to see patients; priests refused to administer last rites. Shopkeepers closed stores. Many people fled the cities for the countryside, but even there they could not escape the disease – it affected cows, sheep, goats, pigs, and chickens, as well as people. And many people, desperate to save themselves, even abandoned their sick and dying loved ones. Boccaccio wrote, “Each thought to secure immunity for himself.” The Black Death epidemic had run its course by the early 1350s, but the plague reappeared every few generations for centuries. Modern sanitation, public-health practices, and antibiotics have greatly diminished the impact of the disease, but have not eliminated it. Currently, plague occurs in fewer than 3000 people per year worldwide. It can be deadly if not treated promptly with antibiotics. This man's leg wound is being treated, while herbs for a soothing ointment or healing drink are being prepared [Rieux] knew that ... the plague bacillus never dies or vanishes entirely ... it can remain dormant for dozens of years in furniture or clothing ... it waits patiently in bedrooms, cellars, trunks, handkerchiefs and old papers, and ... perhaps the day will come when, for the instruction or misfortune of mankind, the plague will rouse its rats and send them to die in some well-contented city. The Plague, Albert Camus The Black Death epidemic in the 14th century was catastrophic to European medicine for prevailing medical theories focused on religious rather scientific explanations for this epidemic. “Formerly, when religion was strong and science weak, men mistook magic for medicine; now, when science is strong and religion weak, men mistake medicine for magic.” Thomas Szasz (15 April 1920 - 8 September 2012), Professor of Psychiatry and Author Jenny Sutcliffe, Nancy Duin. A history of medicine from history to the year 2020. USA: Barnes and Noble Inc; 1992. Albert Lyons, R. Joseph Petrucelli II. Medicine An Illustrated History. New York: Henry N. Atnams Inc., Publishers; 1987. Roy Genders. A History of Scent. New York, USA: Hamilton Publishers; 1972. Albert Camus. Tr. Robin Buss. The Plague. Penguin Classics 2002. Articles from Heart Views : The Official Journal of the Gulf Heart Association are provided here courtesy of Wolters Kluwer -- Medknow Publications "Anatomical Man" (also "Zodiacal Man"), Très Riches Heures du Duc de Berry (Ms.65, f.14v, early 15th century) In the Middle Ages, the medicine of Western Europe was composed of a mixture of existing ideas from antiquity. In the Early Middle Ages, following the fall of the Western Roman Empire, standard medical knowledge was based chiefly upon surviving Greek and Roman texts, preserved in monasteries and elsewhere. Medieval medicine is widely misunderstood, thought of as a uniform attitude composed of placing hopes in the church and God to heal all sicknesses, while sickness itself exists as a product of destiny, sin, and astral influences as physical causes. But, especially in the second half of the medieval period (c. 1100–1500 AD), medieval medicine became a formal body of theoretical knowledge and was institutionalized in universities. Medieval medicine attributed illnesses, and disease, not to sinful behavior, but to natural causes, and sin was connected to illness only in a more general sense of the view that disease manifested in humanity as a result of its fallen state from God. Medieval medicine also recognized that illnesses spread from person to person, that certain lifestyles may cause ill health, and some people have a greater predisposition towards bad health than others. Further information: History of medicine The Western medical tradition often traces its roots directly to the Ancient Greek civilization, much like the foundation of all of Western society. The Greeks certainly laid the foundation for Western medical practice but much more of Western medicine can be traced to the Near East, Germanic, and Celtic cultures. The Greek medical foundation comes from a collection of writings known today as the Hippocratic Corpus.[1] Remnants of the Hippocratic Corpus survive in modern medicine in forms like the "Hippocratic Oath" as in to "Do No Harm".[2] The Hippocratic Corpus, popularly attributed to an Ancient Greek medical practitioner known as Hippocrates, lays out the basic approach to health care. Ancient Greek philosophers viewed the human body as a system that reflects the workings of nature and Hippocrates applied this belief to medicine. The body, as a reflection of natural forces, contained four elemental properties expressed to the Greeks as the four humors. The humors represented fire, air, earth, and water through the properties of hot, cold, dry, and moist, respectively.[3] Health in the human body relied on keeping these humors in balance within each person. Maintaining the balance of humors within a patient occurred in several ways. An initial examination took place as standard for a physician to properly evaluate the patient. The patient's home climate, their usual diet, and astrological charts were regarded during a consultation. The heavens influenced each person in different ways by influencing elements connected to certain humors, important information in reaching a diagnosis. After the examination, the physician could determine which humor was unbalanced in the patient and prescribe a new diet to restore that balance.[4] Diet included not only food to eat or avoid but also an exercise regimen and medication. Hippocratic medicine was written down within the Hippocratic Corpus, therefore medical practitioners were required to be literate.[5] The written treatises within the Corpus are varied, incorporating medical doctrine from any source the Greeks came into contact with. At Alexandria in Ancient Egypt, the Greeks learned the art of surgery and dissection; the Egyptian skill in these arenas far surpassed those of Greeks and Romans due to social taboos regarding treatment of the dead.[6] The early Hippocratic practitioner Herophilus engaged in dissection and added new knowledge to human anatomy in the realms of the human nervous system, the inner workings of the eye, differentiating arteries from veins, and using pulses as a diagnostic tool in treatment.[7] Surgery and dissection yielded much knowledge of the human body that Hippocratic physicians employed alongside their methods of balancing humors in patients. The combination of knowledge in diet, surgery, and medication formed the foundation of medical learning upon which Galen would later build upon with his own works. The Greeks were influenced by their Egyptian neighbours, in terms of medical practice in surgery and medication. They also absorbed many folk healing practices, including incantations and dream healing. In Homer's epic poems Iliad and Odyssey, the Greek gods are implicated as the cause of plagues or widespread disease and that those maladies could be cured by praying to them. The religious side of Greek medical practice is clearly manifested in the cult of Asclepius, whom Homer regarded as a great physician and who was deified in the 4th and 3rd centuries BCE.[8] Hundreds of temples devoted to Asclepius were founded throughout the Hellenistic and Roman Empire to which untold numbers of people flocked for cures. Healing visions and dreams formed the foundation for the curing process as the person seeking treatment from Asclepius slept in a special dormitory. The healing occurred either in the person's dream or advice from the dream could be used to seek out the proper treatment for their illness elsewhere. Afterwards the visitor to the temple bathed, offered prayers and sacrifice, and received other forms of treatment like medication, dietary restrictions, and an exercise regiment, in keeping with the Hippocratic tradition.[9] Some of the medicine in the Middle Ages had its roots in Pagan and folk practices. This influence was highlighted by the interplay between Christian theologians who adopted aspects of Pagan and folk practices and chronicled them in their own works. The practices adopted by Christian medical practitioners around the 2nd century CE, and their attitudes toward Pagan and folk traditions, reflected an understanding of these practices, especially humoralism and herbalism. The practice of medicine in the early Middle Ages was empirical and pragmatic. It focused mainly on curing diseases rather than discovering the cause of diseases.[10] Often it was believed the cause of disease was supernatural. Nevertheless, secular approaches to curing diseases existed. People in the Middle Ages understood medicine by adopting the ancient Greek medical theory of humors. Since it was clear that the fertility of the earth depended on the proper balance of the elements, it followed that the same was true for the body, within which the various humors had to be in balance.[11] This approach greatly influenced medical theory throughout the Middle Ages. Folk medicine of the Middle Ages dealt with the use of herbal remedies for ailments. The practice of keeping physic gardens teeming with various herbs with medicinal properties was influenced by the gardens of Roman antiquity.[10] Many early medieval manuscripts have been noted for containing practical descriptions for the use of herbal remedies. These texts, such as the Pseudo-Apuleius, included illustrations of various plants that would have been easily identifiable and familiar to Europeans at the time.[10] Monasteries later became centers of medical practice in the Middle Ages, and carried on the tradition of maintaining medicinal gardens. These gardens became specialized and capable of maintaining plants from the Southern Hemisphere as well as maintaining plants during winter.[10] Hildegard of Bingen was an example of a medieval medical practitioner who, while educated in classical Greek medicine, also utilized folk medicine remedies.[12] Her understanding of the plant based medicines informed her commentary on the humors of the body and the remedies she described in her medical text Causae et curae were influenced by her familiarity with folk treatments of disease. In the rural society of Hildegard's time, much of the medical care was provided by women, along with their other domestic duties.[citation needed] Kitchens were stocked with herbs and other substances required in folk remedies for many ailments.[11] Causae et curae illustrated a view of symbiosis of the body and nature, that the understanding of nature could inform medical treatment of the body. However, Hildegard maintained the belief that the root of disease was a compromised relationship between a person and God.[11] Many parallels between pagan and Christian ideas about disease existed during the early Middle Ages.[citation needed] Christian views of disease differed from those held by pagans because of a fundamental difference in belief: Christians' belief in a personal relationship with God greatly influenced their views on medicine.[13] Evidence of pagan influence on emerging Christian medical practice was provided by many prominent early Christian thinkers, such as Origen, Clement of Alexandria, and Augustine, who studied natural philosophy and held important aspects of secular Greek philosophy that were in line with Christian thought. They believed faith supported by sound philosophy was superior to simple faith.[13] The classical idea of the physician as a selfless servant who had to endure unpleasant tasks and provide necessary, often painful treatment was of great influence on early Christian practitioners. The metaphor was not lost on Christians who viewed Christ as the ultimate physician.[13] Pagan philosophy had previously held that the pursuit of virtue should not be secondary to bodily concerns. Similarly, Christians felt that, while caring for the body was important, it was second to spiritual pursuits.[13] The relationship between faith and the body's ailments explains why most medieval medical practice was performed by Christian monks.[citation needed] Dominican doctor taking a pulse. Rare Book & Manuscript Library University of Pennsylvania LJS 24 Monasteries developed not only as spiritual centers, but also centers of intellectual learning and medical practice. Locations of the monasteries were secluded and designed to be self-sufficient, which required the monastic inhabitants to produce their own food and also care for their sick. Prior to the development of hospitals, people from the surrounding towns looked to the monasteries for help with their sick. A combination of both spiritual and natural healing was used to treat the sick. Herbal remedies, known as Herbals, along with prayer and other religious rituals were used in treatment by the monks and nuns of the monasteries. Herbs were seen by the monks and nuns as one of God’s creations for the natural aid that contributed to the spiritual healing of the sick individual. An herbal textual tradition also developed in the medieval monasteries.[14] Older herbal Latin texts were translated and also expanded in the monasteries. The monks and nuns reorganized older texts so that they could be utilized more efficiently, adding a table of contents for example to help find information quickly. Not only did they reorganize existing texts, but they also added or eliminated information. New herbs that were discovered to be useful or specific herbs that were known in a particular geographic area were added. Herbs that proved to be ineffective were eliminated. Drawings were also added or modified in order for the reader to effectively identify the herb. The Herbals that were being translated and modified in the monasteries were some of the first medical texts produced and used in medical practice in the Middle Ages.[15] Not only were herbal texts being produced, but also other medieval texts that discussed the importance of the humors. Monasteries in medieval Europe gained access to Greek medical works by the middle of the 6th century.[16] Monks translated these works into Latin, after which they were gradually disseminated across Europe. Monks such as Arnald of Villanova also translated the works of Galen and other classical Greek scholars from Arabic to Latin during the Middle Ages.[17] By producing these texts and translating them into Latin, Christian monks both preserved classical Greek medical information and allowed for its use by European medical practitioners. By the early 1300s these translated works would become available at medieval universities, forming the foundation of medical education.[18] Hildegard of Bingen, a well known abbess, wrote about Hippocratic Medicine using humoral theory and how balance and imbalance of the elements affected the health of an individual, along with other known sicknesses of the time, and ways in which to combine both prayer and herbs to help the individual become well. She discusses different symptoms that were common to see and the known remedies for them.[19] In exchanging the herbal texts among monasteries, monks became aware of herbs that could be very useful but were not found in the surrounding area. The monastic clergy traded with one another or used commercial means to obtain the foreign herbs.[20] Inside most of the monastery grounds there had been a separate garden designated for the plants that were needed for the treatment of the sick. A serving plan of St. Gall depicts a separate garden to be developed for strictly medical herbals.[21] Monks and nuns also devoted a large amount of their time in the cultivation of the herbs they felt were necessary in the care of the sick. Some plants were not native to the local area and needed special care to be kept alive. The monks used a form of science, what we would today consider botany, to cultivate these plants. Foreign herbs and plants determined to be highly valuable were grown in gardens in close proximity to the monastery in order for the monastic clergy to hastily have access to the natural remedies. Monks preparing herbs for medicinal use Medicine in the monasteries was concentrated on assisting the individual to return to normal health. Being able to identify symptoms and remedies was the primary focus. In some instances identifying the symptoms led the monastic clergy to have to take into consideration the cause of the illness in order to implement a solution. Research and experimental processes were continuously being implemented in monasteries to be able to successfully fulfill their duties to God to take care of all God's people. Christian practice and attitudes toward medicine drew on Middle Eastern (particularly from local Jews) and Greek influences. The Jews took their duty to care for their fellow Jews seriously. This duty extended to lodging and medical treatment of pilgrims to the temple at Jerusalem.[22] Temporary medical assistance had been provided in classical Greece for visitors to festivals and the tradition extended through the Roman Empire, especially after Christianity became the state religion prior to the empire's decline. In the early medieval period, hospitals, poor houses, hostels, and orphanages began to spread from the Middle East, each with the intention of helping those most in need.[23] Charity, the driving principle behind these healing centers, encouraged the early Christians to care for others. The cities of Jerusalem, Constantinople, and Antioch contained some of the earliest and most complex hospitals, with many beds to house patients and staff physicians with emerging specialties.[24] Some hospitals were large enough to provide education in medicine, surgery and patient care. St. Basil (AD 330–79) argued that God put medicines on the Earth for human use, while many early church fathers agreed that Hippocratic medicine could be used to treat the sick and satisfy the charitable need to help others.[25] Medieval European medicine became more developed during the Renaissance of the 12th century, when many medical texts both on Ancient Greek medicine and on Islamic medicine were translated from Greek and Arabic during the 13th century.[16] The most influential among these texts was Avicenna's The Canon of Medicine, a medical encyclopedia written in circa 1030 which summarized the medicine of Greek, Indian and Muslim physicians until that time. The Canon became an authoritative text in European medical education until the early modern period. Other influential texts from Jewish authors include the Liber pantegni by Isaac Israeli ben Solomon, while Arabic authors contributed De Gradibus by Alkindus and Al-Tasrif by Abulcasis. At Schola Medica Salernitana in Southern Italy, medical texts from Byzantium and the Arab world (see Medicine in medieval Islam) were readily available, translated from the Greek and Arabic at the nearby monastic centre of Monte Cassino. The Salernitan masters gradually established a canon of writings, known as the ars medicinae (art of medicine) or articella (little art), which became the basis of European medical education for several centuries. During the Crusades the influence of Islamic medicine became stronger. The influence was mutual and Islamic scholars such as Usamah ibn Munqidh also described their positive experience with European medicine – he describes a European doctor successfully treating infected wounds with vinegar and recommends a treatment for scrofula demonstrated to him by an unnamed "Frank".[26] Anglo-Saxon translations of classical works like Dioscorides Herbal survive from the 10th century, showing the persistence of elements of classical medical knowledge. Other influential translated medical texts at the time included the Hippocratic Corpus attributed to Hippocrates, and the writings of Galen. Galen of Pergamon, a Greek, was one of the most influential ancient physicians. Galen described the four classic symptoms of inflammation (redness, pain, heat, and swelling) and added much to the knowledge of infectious disease and pharmacology. Galen also found that an excess of the fluids could make someone sanguine, phlegmatic, choleric, or melancholic.[27] His anatomic knowledge of humans was defective because it was based on dissection of animals, mainly apes, sheep, goats and pigs.[28] Some of Galen's teachings held back medical progress. His theory, for example, that the blood carried the pneuma, or life spirit, which gave it its red colour, coupled with the erroneous notion that the blood passed through a porous wall between the ventricles of the heart, delayed the understanding of circulation and did much to discourage research in physiology. His most important work, however, was in the field of the form and function of muscles and the function of the areas of the spinal cord. He also excelled in diagnosis and prognosis. Through Galen, knowledge of Greek medicine was transferred to the Western world by Arabs. [29] Medieval surgery arose from a foundation created from ancient Egyptian, Greek and Arabic medicine. An example of such influence would be Galen, the most influential practitioner of surgical or anatomical practices that he performed while attending to gladiators at Pergamon.[30] The accomplishments and the advancements in medicine made by the Arabic world were translated and made available to the Latin world. This new wealth of knowledge allowed for a greater interest in surgery.[31] In Paris, in the late thirteenth century, it was deemed that surgical practices were extremely disorganized, and so the Parisian provost decided to enlist six of the most trustworthy and experienced surgeons and have them assess the performance of other surgeons.[32] The emergence of universities allowed for surgery to be a discipline that should be learned and be communicated to others as a uniform practice. The University of Padua was one of the "leading Italian universities in teaching medicine, identification and treating of diseases and ailments, specializing in autopsies and workings of the body." The most prestigious and famous part of the university, the Anatomical Theatre of Padua, is the oldest surviving anatomical theater, in which students studied anatomy by observing their teachers perform public dissections.[33] Surgery was formally taught in Italy even though it was initially looked down upon as a lower form of medicine. The most important figure of the formal learning of surgery was Guy de Chauliac. He insisted that a proper surgeon should have a specific knowledge of the human body such as anatomy, food and diet of the patient, and other ailments that may have affected the patients. Not only should surgeons have knowledge about the body but they should also be well versed in the liberal arts. In this way, surgery was no longer regarded as a lower practice, but instead began to be respected and gain esteem and status.[32] During the Crusades, one of the duties of surgeons was to travel around a battlefield, assessing soldiers' wounds and declaring whether or not the soldier was deceased. Because of this task, surgeons were deft at removing arrowheads from their patients' bodies.[34] Another class of surgeons that existed were barber surgeons. They were expected not only to be able to perform formal surgery, but also to be deft at cutting hair and trimming beards. Some of the surgical procedures they would conduct were bloodletting and treating sword and arrow wounds. In the mid-fourteenth century, there were restrictions placed on London surgeons as to what types of injuries they were able to treat and the types of medications that they could prescribe or use, because surgery was still looked at as an incredibly dangerous procedure that should only be used appropriately. Some of the wounds that were allowed to be performed on were external injuries, such as skin lacerations caused by a sharp edge, such as by a sword, dagger and axe or through household tools such as knives. During this time, it was also expected that the surgeons were extremely knowledgeable on human anatomy and would be held accountable for any consequences as a result of the procedure.[35] A dentist with silver forceps and a necklace of large teeth, extracting the tooth of a well seated man. Omne Bonum (England - London; 1360–1375). The Middle Ages contributed a great deal to medical knowledge. This period contained progress in surgery, medical chemistry, dissection, and practical medicine. The Middle Ages laid the ground work for later, more significant discoveries. There was a slow but constant progression in the way that medicine was studied and practiced. It went from apprenticeships to universities and from oral traditions to documenting texts. The most well-known preservers of texts, not only medical, would be the monasteries. The monks were able to copy and revise any medical texts that they were able to obtain. Besides documentation the Middle Ages also had one of the first well known female physicians, Hildegard of Bingen. Hildegard was born in 1098 and at the age of fourteen she entered the double monastery of Dissibodenberg.[36] She wrote the medical text Causae et curae, in which many medical practices of the time were demonstrated. This book contained diagnosis, treatment, and prognosis of many different diseases and illnesses. This text sheds light on medieval medical practices of the time. It also demonstrates the vast amount of knowledge and influences that she built upon. In this time period medicine was taken very seriously, as is shown with Hildegard's detailed descriptions on how to perform medical tasks.[37] The descriptions are nothing without their practical counterpart, and Hildegard was thought to have been an infirmarian in the monastery where she lived. An infirmarian treated not only other monks but pilgrims, workers, and the poor men, women, and children in the monastery's hospice. Because monasteries were located in rural areas the infirmarian was also responsible for the care of lacerations, fractures, dislocations, and burns.[38] Along with typical medical practice the text also hints that the youth (such as Hildegard) would have received hands-on training from the previous infirmarian. Beyond routine nursing this also shows that medical remedies from plants, either grown or gathered, had a significant impact of the future of medicine. This was the beginnings of the domestic pharmacy.[39] Although plants were the main source of medieval remedies, around the sixteenth century medical chemistry became more prominent. "Medical chemistry began with the adaptation of chemical processes to the preparation of medicine".[40] Previously medical chemistry was characterized by any use of inorganic materials, but it was later refined to be more technical, like the processes of distillation. John of Rupescissa's works in alchemy and the beginnings of medical chemistry is recognized for the bounds in chemistry. His works in making the philosopher's stone, also known as the fifth essence, were what made he became known for.[41] Distillation techniques were mostly used, and it was said that by reaching a substance's purest form the person would find the fifth essence, and this is where medicine comes in. Remedies were able to be made more potent because there was now a way to remove nonessential elements. This opened many doors for medieval physicians as new, different remedies were made. Medical chemistry provided an "increasing body of pharmacological literature dealing with the use of medicines derived from mineral sources".[42] Medical chemistry also shows the use of alcohols in medicine. Though these events were not huge bounds for the field, they were influential in determining the course of science. It was the start of differentiation between alchemy and chemistry. The Middle Ages brought a new way of thinking and a lessening on the taboo of dissection. Dissection for medical purposes became more prominent around 1299.[43] During this time the Italians were practicing anatomical dissection and the first record of an autopsy dates from 1286. Dissection was first introduced in the educational setting at the university of Bologna, to study and teach anatomy. The fourteenth century saw a significant spread of dissection and autopsy in Italy, and was not only taken up by medical faculties, but by colleges for physicians and surgeons.[44] Roger Frugardi of Parma composed his treatise on Surgery around about 1180. Between 1250 and 1265 Theodoric Borgognoni produced a systematic four volume treatise on surgery, the Cyrurgia, which promoted important innovations as well as early forms of antiseptic practice in the treatment of injury, and surgical anaesthesia using a mixture of opiates and herbs. Compendiums like Bald's Leechbook (circa 900), include citations from a variety of classical works alongside local folk remedies. Although each of these theories has distinct roots in different cultural and religious traditions, they were all intertwined in the general understanding and practice of medicine. For example, the Benedictine abbess and healer, Hildegard of Bingen, claimed that black bile and other humour imbalances were directly caused by presence of the Devil and by sin.[45] Another example of the fusion of different medicinal theories is the combination of Christian and pre-Christian ideas about elf-shot (elf- or fairy-caused diseases) and their appropriate treatments. The idea that elves caused disease was a pre-Christian belief that developed into the Christian idea of disease-causing demons or devils.[46] Treatments for this and other types of illness reflected the coexistence of Christian and pre-Christian or pagan ideas of medicine. 13th-century illustration showing the veins. Main article: Humorism The theory of humours was derived from the ancient medical works and was accepted until the 19th century. The theory stated that within every individual there were four humours, or principal fluids – black bile, yellow bile, phlegm, and blood, these were produced by various organs in the body, and they had to be in balance for a person to remain healthy. Too much phlegm in the body, for example, caused lung problems; and the body tried to cough up the phlegm to restore a balance. The balance of humours in humans could be achieved by diet, medicines, and by blood

mediated with Arabic medical texts for their "independent contributions to treatment and to herbal pharmacology".[76] Although anatomy was taught in academic medicine through the dissection of cadavers, surgery was largely independent from medical universities.[77] The University of Bologna was the only university to grant degrees in surgery. Academic medicine also focused on actual medical practice where students would study individual cases and observe the professor visiting patients.[73] The required number of years to become a licensed physician varied among universities. Montpellier required students without their masters of arts to complete three and a half years of formal study and six months of outside medical practice.[78][79] In 1309, the curriculum of Montpellier was changed to six years of study and eight months of outside medical practice for those without a masters of arts, whereas those with a masters of arts were only subjected to five years of study with eight months of outside medical practice.[79] The university of Bologna required three years of philosophy, three years of astrology, and four years of attending medical lectures.[79] Members of religious orders were major sources of medical knowledge and cures. There appears to have been some controversy regarding the appropriateness of medical practice for members of religious orders. The Decree of the Second Lateran Council of 1139 advised the religious to avoid medicine because it was a well-paying job with higher social status than was appropriate for the clergy. However, this official policy was not often enforced in practice and many religious continued to practice medicine.[48] There were many other medical practitioners besides clergy. Academically trained doctors were particularly important in cities with universities. Medical faculty at universities figured prominently in defining medical guilds and accepted practices as well as the required qualifications for physicians.[48] Beneath these university-educated physicians there existed a whole hierarchy of practitioners. Wallis[citation needed] suggests a social hierarchy with these university educated physicians on top, followed by "learned surgeons; craft-trained surgeons; barber surgeons, who combined bloodletting with the removal of "superfluities" from the skin and head; itinerant specialist such as dentist and oculists; empirics; midwives; clergy who dispensed charitable advice and help; and, finally, ordinary family and neighbors".[48] Each of these groups practiced medicine in their own capacity and contributed to the overall culture of medicine. In the medieval period, the term hospital encompassed hostels for travellers, dispensaries for poor relief, clinics and surgeries for the injured, and homes for the blind, lame, elderly, and mentally ill. Monastic hospitals developed many treatments, both therapeutic and spiritual. During the thirteenth century an immense number of hospitals were built. The Italian cities were the leaders of the movement. Milan had no fewer than a dozen hospitals and Florence before the end of the fourteenth century had some thirty hospitals. Some of these were very beautiful buildings. At Milan a portion of the general hospital was designed by Bramante and another part of it by Michelangelo. The Hospital in Sienna, built in honor of St. Catherine, has been famous ever since. Everywhere throughout Europe this hospital movement spread. Virchow, the great German pathologist, in an article on hospitals, showed that every city of Germany of five thousand inhabitants had its hospital. He traced all of this hospital movement to Pope Innocent III, and though he was least papistically inclined, Virchow did not hesitate to give extremely high praise to this pontiff for all that he had accomplished for the benefit of children and suffering mankind.[80] Hospitals began to appear in great numbers in France and England. Following the French Norman invasion of England, the explosion of French ideals led most medieval monasteries to develop a hospitium or hospice for pilgrims. This hospitium eventually developed into what we now understand as a hospital, with various monks and lay helpers providing the medical care for sick pilgrims and victims of the numerous plagues and chronic diseases that afflicted Medieval Western Europe. Benjamin Gordon supports the theory that the hospital – as we know it – is a French invention, but that it was originally developed for isolating lepers and plague victims, and only later undergoing modification to serve the pilgrim.[81] Owing to a well-preserved 12th-century account of the monk Eadmer of the Canterbury cathedral, there is an excellent account of Bishop Lanfranc's aim to establish and maintain examples of these early hospitals: But I must not conclude my work by omitting what he did for the poor outside the walls of the city Canterbury. In brief, he constructed a decent and ample house of stone…for different needs and conveniences. He divided the main building into two, appointing one part for men oppressed by various kinds of infirmities and the other for women in a bad state of health. He also made arrangements for their clothing and daily food, appointing ministers and guardians to take all measures so that nothing should be lacking for them.[82] Anathomia, 1541 Corpus physicum, from Liber de arte Distillandi de Compositis, 1512 High medieval surgeons like Mondino de Liuzzi pioneered anatomy in European universities and conducted systematic human dissections. Unlike pagan Rome, high medieval Europe did not have a complete ban on human dissection. However, Galenic influence was still so prevalent that Mondino and his contemporaries attempted to fit their human findings into Galenic anatomy. During the period of the Renaissance from the mid 1450s onward, there were many advances in medical practice. The Italian Girolamo Fracastoro (1478–1553) was the first to propose that epidemic diseases might be caused by objects outside the body that could be transmitted by direct or indirect contact.[83] He also proposed new treatments for diseases such as syphilis. In 1543 the Flemish Scholar Andreas Vesalius wrote the first complete textbook on human anatomy: "De Humani Corporis Fabrica", meaning "On the Fabric of the Human Body". Much later, in 1628, William Harvey explained the circulation of blood through the body in veins and arteries. It was previously thought that blood was the product of food and was absorbed by muscle tissue. During the 16th century, Paracelsus, like Girolamo, discovered that illness was caused by agents outside the body such as bacteria, not by imbalances within the body. The French army doctor Ambroise Paré, born in 1510, revived the ancient Greek method of tying off blood vessels. After amputation the common procedure was to cauterize the open end of the amputated appendage to stop the haemorrhaging. This was done by heating oil, water, or metal and touching it to the wound to seal off the blood vessels. Pare also believed in dressing wounds with clean bandages and ointments, including one he made himself composed of eggs, oil of roses, and turpentine. He was the first to design artificial hands and limbs for amputation patients. On one of the artificial hands, the two pairs of fingers could be moved for simple grabbing and releasing tasks and the hand looked perfectly natural underneath a glove. Medical catastrophes were more common in the late Middle Ages and the Renaissance than they are today. During the Renaissance, trade routes were the perfect means of transportation for disease. Eight hundred years after the Plague of Justinian, the bubonic plague returned to Europe. Starting in Asia, the Black Death reached Mediterranean and western Europe in 1348 (possibly from Italian merchants fleeing fighting in Crimea), and killed 25 million Europeans in six years, approximately 1/3 of the total population and up to a 2/3 level in the worst-affected urban areas. Before Mongols left Crimean Kaffa in the siege of Kaffa, the dead or dying bodies of the infected soldiers were loaded onto catapults and launched over Kaffa's walls to infect those inside. This incident was among the earliest known examples of biological warfare and is credited as being the source of the spread of the Black Death into Europe. The plague repeatedly returned to haunt Europe and the Mediterranean from 14th through 17th centuries. Notable later outbreaks include the Italian Plague of 1629–1631, the Great Plague of Seville (1647–1652), the Great Plague of London (1665–1666), the Great Plague of Vienna (1679), the Great Plague of Marseille in 1720–1722 and the 1771 plague in Moscow. Before the Spanish discovered the New World (continental America), the deadly infections of smallpox, measles, and influenza were unheard of. The Native Americans did not have the immunities the Europeans developed through long contact with the diseases. Christopher Columbus ended the Americas' isolation in 1492 while sailing under the flag of Castile, Spain. Deadly epidemics swept across the Caribbean. Smallpox wiped out villages in a matter of months. The island of Hispaniola had a population of 250,000 Native Americans. 20 years later, the population had dramatically dropped to 6,000. 50 years later, it was estimated that approximately 500 Native Americans were left. Smallpox then spread to the area which is now Mexico where it then helped destroy the Aztec Empire. In the 1st century of Spanish rule in what is now Mexico, 1500–1600, Central and South Americans died by the millions. By 1650, the majority of the New Spain (now Mexico) population had perished. Contrary to popular belief[84] bathing and sanitation were not lost in Europe with the collapse of the Roman Empire.[85][86] Bathing in fact did not fall out of fashion in Europe until shortly after the Renaissance, replaced by the heavy use of sweat-bathing and perfume, as it was thought in Europe that water could carry disease into the body through the skin. Medieval church authorities believed that public bathing created an environment open to immorality and disease. Roman Catholic Church officials even banned public bathing in an unsuccessful effort to halt syphilis epidemics from sweeping Europe.[87] In order for an army to be in good fighting condition, it must maintain the health of its soldiers. One way of doing this is knowing the proper location to set up camp. Military camps were not to be set up in any sort of marshy region.[88] Marsh lands tend to have standing water, which can draw in mosquitos. Mosquitos, in turn, can carry deadly disease, such as malaria. As the camp and troops were needed to be moved, the troops would be wearing heavy soled shoes in order to prevent wear on soldiers' feet.[88] Waterborne illness has also remained an issue throughout the centuries. When soldiers would look for water they would be searching for some sort of natural spring or other forms of flowing water. When water sources were found, any type of rotting wood, or plant material, would be removed before the water was used for drinking. If these features could not be removed, then water would be drawn from a different part of the source.[88] By doing this the soldiers were more likely to be drinking from a safe source of water. Thus, water borne bacteria had less chance of making soldiers ill. One process used to check for dirty water was to moisten a fine white linen cloth with the water and leave it out to dry. If the cloth had any type of stain, it would be considered to be diseased. If the cloth was clean, the water was healthy and drinkable.[88] Freshwater also assists with sewage disposal, as well as wound care. Thus, a source of fresh water was a preemptive measure taken to defeat disease and keep men healthy once they were wounded. In Medieval Europe the surgeon's social status improved greatly as their expertise was needed on the battlefield.[89] Owing to the number of patients, warfare created a unique learning environment for these surgeons. The dead bodies also provided an opportunity for learning. The corpses provided a means to learn through hands on experience. As war declined, the need for surgeons declined as well. This would follow a pattern, where the status of the surgeon would flux in regards to whether or not there was actively a war going on.[89] Medical school also first appeared in the medieval period. This created a divide between physicians trained in the classroom and physicians who learned their trade through practice. The divide created a shift leading to physicians trained in the classroom to be of higher esteem and more knowledgeable. Despite this, there was still a lack of knowledge by physicians in the militaries.[90] The knowledge of the militaries' physicians was greatly acquired through first hand experience. In the Medical schools, physicians such as Galen were referenced as the ultimate source of knowledge. Thus, the education in the schools was aimed at proving these ancient physicians were correct. This created issues as medieval knowledge surpassed the knowledge of these ancient physicians. In the scholastic setting it still became practice to reference ancient physicians or the other information being presented was not taken seriously.[91] The soldiers that received medical attention was most likely from a physician who was not well trained. To add to this, a soldier did not have a good chance of surviving a wound that needed specific, specialized, or knowledgeable treatment.[90] Surgery was oftentimes performed by a surgeon who knew it as a craft. There were a handful of surgeons such as Henry de Mondeville, who were very proficient and were employed by Kings such as King Phillip. However; this was not always enough to save kings' lives, as King Richard I of England died of wounds at the siege of Chalus in AD 1199 due to an unskilled arrow extraction.[90] Treating a wound was and remains the most crucial part of any battlefield medicine, as this is what keeps soldiers alive. As remains true on the modern battlefield, hemorrhaging and shock were the number one killers. Thus, the initial control of these two things were of the utmost importance in medieval medicine.[90] Items such as the long bow were used widely throughout the medieval period, thus making arrow extracting a common practice among the armies of medieval Europe. When extracting an arrow, there were three guidelines that were to be followed. The physicians should first examine the position of the arrow and the degree to which its parts are visible, the possibility of it being poisoned, the location of the wound, and the possibility of contamination with dirt and other debris. The second rule was to extract it delicately and swiftly. The third rule was to stop the flow of blood from the wound.[90] The arrowheads that were used against troops were typically not barbed or hooked, but were slim and designed to penetrate armor such as chain mail. Although this design may be useful as wounds were smaller, these arrows were more likely to embed in bone, making them harder to extract.[92] If the arrow happened to be barbed or hooked it made the removal more challenging. Physicians would then let the wound putrefy, thus making the tissue softer and easier for arrow extraction.[93] After a soldier was wounded he was taken to a field hospital where the wound was assessed and cleaned, then if time permitted the soldier was sent to a camp hospital where his wound was closed for good and allowed to heal.[94] Another common injury faced was those caused by blades. If the wound was too advanced for simple stitch and bandage, it would often result in amputation of the limb. Surgeons of the medieval battlefield had the practice of amputation down to an art. Typically it would have taken less than a minute for a surgeon to remove the damaged limb, and another three to four minutes to stop the bleeding.[93] The surgeon would first place the limb on a block of wood and tie ligatures above and below the site of surgery. Then the soft tissue would be cut through, thus exposing the bone, which was then sawed through. The stump was then bandaged and left to heal. The rates of mortality among amputation patients was around 39%, that number grew to roughly 62% for those patients with a high leg amputation.[93] Ideas of medieval surgery are often construed in modern minds as barbaric, as our view is diluted with our own medical knowledge. Surgery and medical practice in general was at its height of advancement for its time. All procedures were done with the intent to save lives, not to cause extra pain and suffering. The speed of the procedure by the surgeon was an important factor, as the limit of pain and blood loss lead to higher survival rates among these procedures.[93] Injuries to major arteries that caused mass blood loss were not usually treatable as shown in the evidence of archeological remains.[92] We[who?] know this as wounds severe enough to sever major arteries left incisions on the bone which is excavated by archaeologists. Wounds were also taught to be covered to improve healing. Forms of antiseptics were also used in order to stave off infection. To dress wounds all sorts of dressing were used such as grease, absorbent dressings, spider webs, honey, ground shellfish, clay and turpentine. Some of these methods date back to Roman battlefield medicine.[94] Sieges were a dangerous place to be, as broken bones became an issue, with soldiers falling while they scaled the wall amongst other methods of breakage. Typically, it was long bones that were fractured. These fractures were manipulated to get the bones back into their correct location.[93] Once they were in their correct location, the wound was immobilized by either a splint or a plaster mold. The plaster mold (an early cast) was made of flour and egg whites and was applied to the injured area. Both of these methods left the bone immobilized and gave it a chance to heal.[93] Burn treatment also required a specific approach by physicians of the time. This was due to burning oil and arrows or boiling water, which were used in combat. In the early stages of treatment there was an attempt to stop the formation of blisters. The burn was prevented from becoming dry by using anointments placed on the burn. These anointments typically consisted of vinegar, egg, rose oil, opium, and a multitude of different herbs.[93] The ointment was applied to affected area, and then reapplied as needed. Byzantine medicine Cucupha History of hospitals History of medicine History of nursing Ibn Sina Academy of Medieval Medicine and Sciences Irish medical families Life expectancy Medicine in the medieval Islamic world Medieval demography Plague doctor Plague doctor contract Plague doctor costume Tacuinum Sanitatis Theriac Timeline of medicine and medical technology Treatise on Herbs

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