THE EVOLUTION OF ANAESTHESIA

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(Continued from Vol. 28, page 283)

THE history of anaesthesia is a large subject; paradoxically, it is also true that it does not exist at all. Anaesthesia is merely a branch of medicine, and its history can only be understood by examining the whole subject. Equally, medicine is a branch of science, while science is but one facet of human activity; it follows, therefore, that the history of anaesthesia can only be interpreted correctly by viewing it in the perspective of other human activities, medical, scientific and social; inventions, discoveries, wars, religious beliefs, and all the manifestations of art and culture.

C. The Scientific Age (585 B.C.-A.D. 200).

The prediction by Thales of an eclipse of the sun in 585 B.C. marks the beginning of the rise of Greek science, which, in medicine, was to come to an end with the death of Galen. The attitude of the Greek philosophers to life in general was quickly reflected in the physician’s attitude to disease: the natural history of disease was studied and rational treatment was instituted. Because the causation and nature of disease were often misunderstood, the treatment was frequently incorrect, although it was nevertheless rational.

Parallel with the treatment of disease by physicians, magical treatment by priests was also carried on in temples erected for the worship of Asklepios. Here, again, treatment became more rational, employing baths, physiotherapy and some degree of “mental rehabilitation”, but the essentially magical nature of treatment in the Asklepieia must not be forgotten. The final defeat of the Persians ensured the success of rational medicine in its fight against superstition.

Greek medicine reached its first peak in the time of Hippocrates of Cos, and much evidence of its modernity in outlook is to be found in the Hippocratic writings, the majority, if not all, of which were written by members of the “Hippocratic” school; they certainly reflect the teachings of the “Father of Medicine”. From Asia Minor Greek medicine spread to, and flourished in, Athens during the Golden Age of Pericles, which ended with the plague and the Spartan victory. Later the conquests of Alexander the Great, whose father had brought all Greece under his rule, led to the founding of Alexandria, with its “University”. Here Greek medicine reached its second peak with Erasistratus of Chios and Hero philus of Chalcedon. Hitherto, respect for the dead had prevented human dissection, although animals had been frequently examined. Now, for the first time, human anatomy was closely inspected.

The conquest of Greece, and later Egypt, by the Romans, shifted the medical centre to Rome, but the light of Alexandria still burned, although not so brightly as of yore. The interest of Rome in war and conquest attracted those with medical leanings to the post of military surgeon, a craft which, even in those days, was considered separate from, and of a lower social status than that of physician. The physicians were mainly Greeks, and wrote in that language (e.g. Asklepiades and Galen). The only medical works in Latin which have come down to us are the De re medicina of Celsus and the Historia Naturalis of Pliny, both written in the 1st century A.D. It is here that mandragora makes its appearance in medical literature.

Galen was the last great physician of the scientific era, and this was in part his own fault. A prolific author, he wrote more than 100 books, and he influenced posterity to a greater degree than any other medical man. His dogmatism and the teleology of his ideas would have smothered scientific spirit in suitable surroundings: the spreading of Christianity was not favourable to
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Science, while, in Arabia, Islam also resisted scientific advance. Thus Galen remained the supreme authority until the Renaissance.

Greeks and Romans alike seem to have had no knowledge of anaesthesia, although the soothing and pain-relieving attributes of opium were appreciated certainly in the 4th century B.C., and probably earlier. Belief in the narcotic power of mandrake sprang up towards the end of the scientific era, while opium seems to have been less and less used. Mandragora will, however, be dealt with in the next section, where it logically belongs.

B.C.

C. 624–565. Thales of Miletus (see above).
C. 580–500. Pythagoras, probable originator of the doctrine of the four elements and four qualities, later applied to medicine. The four humours, Blood (like Fire, hot and dry), Phlegm (like Water, cold and wet), Yellow Bile (like Air, hot and wet), and Black Bile (like Earth, dry and cold), regulated the action of the body, and an upset in the proper proportions of these humours was a cause of disease. Later, therefore, herbals listed drugs as being "dry and cold", or "wet" and so on "to such-and-such a degree", to indicate the sort of complaint for which they would be suitable. The theory received much support from Aristotle.

509. Expulsion of the Tarquins from Rome and the foundation of the Roman Republic.

496–406. Sophocles, the great tragedian.

490. Battle of Marathon: the Persian army is defeated by the Greeks under Miltiades.

480. Battle of Salamis: the Persian fleet of Xerxes was destroyed by the Greeks.

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480–425. Herodotus, the first historian. His history of the struggle between Greece and Persia has been mentioned above.

469–399. Socrates. According to Xenophon, Socrates was aware of the sedative action of opium.

C. 460. Birth of Hippocrates on the island of Cos. His name survives in the "Facies Hippocratica" and in the "Hippocratic Oath", which still remains the foundation of the code of medical ethics. The celebrated aphorisms contain the famous saying, "Life is short, and the Art is long, opportunity fleeting, experiment dangerous and judgment difficult." He lived to old age.

C. 450. The time of Nehemiah in Jerusalem. About this time the Hexateuch (i.e. the Pentateuch and the Book of Joshua) was compiled from earlier documents. The account of the birth of Eve (Genesis ii, 21) has been used as evidence of anaesthesia at an early date. It seems much more likely, however, that the sleep which was cast upon Adam was a device to keep God's secret rather than that

The human chronicler had any idea of surgical anaesthesia. There is no evidence that the Israelites used any form of pain-relief.

The Hebrew word "dodaim" translated as "mandrakes", occurs also (Genesis xxx, 14–17), but only with magical significance in connexion with fertility.

443–429. Pericles rules Athens, the "Golden Age".

382–322. Demosthenes, Athenian orator and statesman. In one of his speeches he referred to the lethargy of the Athenians as resembling the sleep induced by mandragora or some other narcotic.

371–287. Theophrastus, pupil and friend of Aristotle, sometimes called the "Father of Botany", described the poppy, and also mentions mandragora.

323. Death of Alexander the Great; the empire which he created fell to pieces on his death, the Seleucids obtaining the East, and the Ptolemies, Egypt. Ptolemy I Soter began the great library in Alexandria, a city founded by Alexander in 331.

C. 300. Herophilus of Chalcedon; famous anatomist of Alexandria, was probably the first to regard the brain as the central organ of the nervous system. He carried out human dissections in public. His younger contemporary, Erasistratus of Chios, recognized the function of muscles. He believed that disease was caused by an excess of blood (plethora) in one or other locality of the body. He tried to explain respiration in terms of "Pneuma", an almost nonmaterial substance in air which was the cause of life.

C. 300. Erasistratus of Chios emphasizes the dangers of opium.

168. Revolt of Judas Maccabaeus against the Seleucids.

146. Conquest of Greece by Rome; destruction of Carthage.

70–19. Virgil.

63. Pompey extends the Roman boundaries to the Euphrates.

58. Julius Caesar makes the Rhine the Roman frontier in the North.

54 and 54. Caesar in Britain.

44. Caesar murdered.
B.C.
31. Octavian (Augustus) defeats the fleets of Antony and Cleopatra at Actium. Their suicide brought the end of Ptolemaic rule to Egypt, which became a Roman province.
4. Death of Herod the Great.

A.D.
23–79. Caius Plinius Secundus (Pliny the Elder). A prolific author, he wrote, among other works, his famous Historia Naturalis, which was dedicated to Titus in A.D. 77 and was largely issued posthumously; it was translated into English in 1601. Pliny died in the eruption of Mount Somma (the lower summit of Vesuvius) which overwhelmed Pompeii, Herculanenum and Stabbia, and which is described by his nephew, Pliny the Younger.

The Historia Naturalis, in 37 books, contains a vast amount of miscellaneous knowledge, but is entirely indiscriminating; Pliny wrote down everything that came to hand, from old wives' tales to personal observations. His account of the mandrake mentions its use for diseases of the eyes, and describes, inadequately, the two forms of the plant (male and female). "Persons when about to gather the plant, take every precaution not to have the wind blowing in their faces; and, after tracing three circles round it with a sword, turn towards the West and dig it up." Directions are given for the extraction of the juice, which strikes some people dumb. A dangerous poison, the juice can be used as a narcotic before incisions are made in the body. It can also be used for snakebites and as an emetic. Notice is also taken of the soporific action of opium, but Pliny does not approve of its use.

37–c. 100. Flavius Josephus, Jewish statesman and soldier. He wrote the Antiquities of the Jews and the Wars of the Jews. It is in the latter (Bk. 7, Chap. 6, Sec. 3) that he describes the plant Baaras, which has strong affinities to the mandrake but is without soporific action. The method of obtaining the plant by means of a dog, later the standard procedure in mandrake catching, is here described for the first time.

c. 30–40. Issue of the De Re Medicina, by Celsus. This was the first classical medical work to be printed (1478), probably on account of the purity of its Latin. Celsus was not a physician and this book is all that remains of an encyclopaedia of natural science. Mention is made of the soporific qualities of poppy (Bk. 2, Chap. 32); mandrake is recommended as an ingredient in an eye ointment (Bk. 6, Chap. 6).

55–117. Tacitus.
64. Traditional date of the martyrdom of Saint Peter and Saint Paul.
68. Death of Nero.
c. 100. Pedanius or Pedacius Dioscorides of Anazarba in Cilicia issues his Herbal, which was to remain the chief authority on pharmacy until the end of the 16th century. There is some doubt about his date, but there seems to be no reason for believing that he was a surgeon in the army of Nero. His book leans heavily on Pliny and on other early writers. His accounts of the poppy and the mandrake are obviously drawn from the Historia Naturalis. He was, however, a physician, and is apparently the first medical man to describe the soporific effect of mandragora. His use of the word "anaesthesia" has already been mentioned.

c. 130–200. Galen of Pergamum. The system of medicine and physiology which Galen formulated remained authoritative until Vesalius and other anatomists in the 16th, and William Harvey in the 17th century, exposed the fallacies of his ideas. His more than 100 works, all dogmatic and plausible, played their part in preventing further scientific investigation for 1,300 years. He recommended a paste containing opium as an application for toothache; opium has no analgesic action.

D. The Age of Superstition (A.D. 200–1454)
This period, from the death of Galen to the invention of movable type by Gutenberg, is contemporaneous with the decline and fall of the Roman Empire: Constantinople fell to the Turks in 1453. With the death of Galen Graeco-Roman medical science may be said to have come to an abrupt end. What medical authors there were contented themselves with writing commentaries on the works of Galen, which were kept alive, at least in Byzantium (Constantinople) after the transference of the seat of government thither from Rome in A.D. 330. However, the anarchical state of the rest of Europe led to a rapid decline in learning, and the Greek texts could no longer be read outside the domains of the Eastern Roman Empire. Grossly distorted translations of excerpts from such classical authors as Aristotle and Galen passed current for true learning, while much ingenuity was wasted in syllogistic quibbles about these texts. Observation was no longer used: what the ancients had written was true, and, if observation differed, observation was wrong. For instance, anatomical dissection ceased and was replaced by reading the Galenic texts, although Galen himself had probably never dissected a human being. This is the period of scholastic authoritarianism.
Three other forces also militated against science at this time: Religion, Astrology and Alchemy. The spread of Christianity in Europe with its answers to all problems, spiritual as well as temporal, disposed men to think of the world to come rather than the world in being. Furthermore, the accepted implication of religion was that pain and disease, like famine or poverty, were punishments prescribed by God for wickedness, either of the sufferer or of mankind at large. There was, therefore, something sacrilegious in attempting to fight disease or to prevent pain. It must not be forgotten, however, that in Western Europe at least, the Church was the sole repository of learning, the preservation of which was later to bear fruit. Until after the Reformation the Church had a vested interest in fostering antipathy to science, and she virtually forbade all experimental investigation; thus it was only at the risk of a charge of heresy that the doctrines of Aristotle could be challenged. This had a close bearing on the second factor, Astrology, for the close interdependence between Microcosm (Man) and Macrocosm (the Universe) which Aristotle had postulated came to be interpreted as meaning that worldly events could be foretold by the movements of the heavenly bodies, and there are certain passages in the Bible which will support such a construction. Such belief could not but be fatal to scientific enquiry.

Alchemy, the theoretical basis of which was laid down towards the end of the first millennium in the Moslem Empire, spread to Europe, partly as a result of the Crusades. Being a scientific investigation, it came into conflict with the Church, and, being based on false premises, weakened the cause of science still further. The establishment of Christianity as the Roman official religion was soon followed by the growth of heresies: many of the heretics migrated rather than conform, and thus the Nestorians (Monophysites) carried into Asia Minor and the Near East the works of Galen in Greek. Later came the flood of Moslem conquest, followed in due course by the great period of Moslem culture. Galen’s works were translated into Arabic, and commentaries were written on them by such men as Rhazes and Avicenna. These translations were infinitely better than anything available in Western Europe and were gratefully accepted when they began to appear in Latin, a further translation which was facilitated by contacts with the Moslem Empire, not only by the Crusades, but also in Spain, the southern two-thirds of which was Moorish, and in Sicily. The improved texts of Galen stimulated learning but not observation, for scholastic authoritarianism was still the ruling force and was to remain so until the Renaissance. However, a greater appreciation of what Galen and others had actually written became apparent, and schools of learning (universities) began to be founded, first in Italy and then elsewhere.

From this it can be seen that there was little possibility of an extension of medical knowledge during this period of twelve and a half centuries; indeed, there had been a diminution of it through over-emphasis on the wrong things. Furthermore, the inadequacy of the description of plants led to obvious difficulties, the more so as Herbals written, for example, in Asia Minor, were used in France and elsewhere where the flora was very different. The systematic identification of plants was, of course, not yet conceivable.

MANDRAGORA

We have seen the first reference to mandrakes and mandrake-like plants in Homer and the Bible. References multiply as time passes and are beginning to appear in medical works at the end of the scientific period, usually copied from Pliny, whose “authority”, although he was not a medical man, was great. The adoption of the mandrake in medicine, chiefly as a soporific, was parallel to its use socially in magic. That no such plant exists, or ever did exist, in no way interfered with this. The finding of any anthropomorphic root blended well with earlier tales, and fantastic stories about the dangers and difficulties of obtaining specimens explained the absence of supplies. Later the name atropa mandragora was to be given to a plant of the family of Solanaceae, and this added to the confusion of thought about mandrakes.

As we have seen, primitive man naturally turns to magic in his attempts to master disease, and sympathetic magic, in which, for instance, a stone like a tooth can cure dental disease, is a method
which has had its appeal in all ages. The outstanding feature of the mandrake is its anthropomorphism, and this human shape led automatically to belief in its magical properties. Andrew Lang has summed up well the medieval ideas about this impossible root in Custom and Myth (1893): "He who desires to possess a mandrake must stop his ears with wax, so that he may not hear the deadly yells which the plant utters as it is being dragged from the earth. Then, before sunrise on a Friday, the amateur goes out with a dog, 'all black', makes three crosses round the mandrake, loosens the soil about the root, ties the root to the dog's tail and offers the beast a piece of bread. The dog runs at the bread, drags out the mandrake root, and falls dead, killed by the horrible yell of the plant. The root is now taken up, washed in wine, wrapped in silk, laid in a casket, bathed every Friday, and clothed in a little new white smock every new moon. The mandrake acts, if thus considerately treated, as a kind of familiar spirit, 'Every piece of coin put to her overnight is found double in the morning'.'"

All this is similar to belief in the healing power of the unicorn's horn, and strange tales about impossible animals and the methods of catching them, which passed for truth in these credulous days. Belief in magic was, of course, universal; the mandrake was especially magical in nature, and its use in medicine was merely one instance out of many in which magic and superstition were introduced into therapeutics. (For further evidence see the entry "1431. Execution of Joan of Arc" below.)

Very occasionally rational attempts at pain relief were employed in the "Age of Superstition", but these events failed to influence mankind and played no part in the discovery of anaesthesia. The statements by John Arderne, Theodoric and others must not be taken at their face value. The methods which they describe were merely amplifications of the tales by Pliny and Dioscorides, and depend on "authority", not on personal observation. In this regard, Arderne's Treatise of Fistula in Ano, etc., although describing a method of pain relief (which would not have worked), also describes how his patients were restrained at operation.

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c. 220–230. Hua-T'o, Chinese surgeon. According to the Kou-kin-i-tong, he used a preparation called "mayo" in order to induce surgical anaesthesia. Unfortunately the Kou-kin-i-tong is dated some thirteen or fourteen centuries after Hua-T'o's death, and cannot therefore be relied upon as evidence.

c. 250. Approximate date of the De Animalium Natura of Claudius Aelianus, in which Josephus's story of using a dog to uproot the magical plant "Baaras" is first applied to the mandrake.

296–373. St. Athanasius. The date of his birth is doubtful, and may have been as late as 326. The creed which bears his name is probably 5th century.

303. Martyrdom of Saint Cosmas and Saint Damian, later the patron saints of Medicine and Pharmacy, in the persecution of Diocletian. They were held in special honour by the Confraternity of Surgeons in Paris and are remembered in the name of the College of St. Côme.

318. Arian Controversy begins.

325. The first great church council, held at Nicea.

330. Constantine removes the seat of government from Rome to Byzantium, renamed Constantinople.

335. Closing of the temples in Constantinople by order of Constantine. Among the temples closed were, of course, the Asklepieia.

354–430. St. Augustine. He was Bishop of Hippo, in North Africa, from 395 until his death.

361–363. Julian the Apostate, Emperor of Byzantium, tries to re-establish the pagan religion.

c. 400. Apuleius (Lucius Apuleius Barbarus) prepared a Herbal, mainly by copying Pliny or Dioscorides. The mandrake receives attention in a manner which remains fairly constant in future medical works. The "dog story" is copied from Aelianus. The Herbal of Apuleius was frequently re-issued and translated into many languages.

410. Alaric the Visi-Goth sacks Rome.

431. Deposition of Nestorius, Patriarch of Constantinople, starts the Nestorian schism. The Nestorians carried the Greek classical works to Asia, where they were later translated into Arabic, and filtered back into Europe, as described above.

449. The Saxons settle in Britain.

452. Attila the Hun.

493. Theodoric the Ostro-Goth tries to establish a civilized kingdom in Italy.

c. 502–565. Aetius of Amida, the first Christian physician of note. Mandrake is mentioned in his Tetrabiblon.

c. 570–636. Isidorus, Bishop of Seville. He mentions the pre-operative use of mandragora wine.

622. Muhammad (born 571) flees from Mecca to Medina (the Hajira, or flight, from which the Moslem calendar is dated). Since the Moslem calendar is lunar, not solar, conversion of dates to the European calendars is not easy.
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625–690. Paul of Aegina, the last Byzantine surgeon of note.
634. St. Aidan.
644. Moslem conquest of Egypt.
651. The Umayyad Caliphate begins; Damascus now the capital of the Arab world.
672–735. The Venerable Bede, first English historian.
732. Charles Martel defeats the Arabs at the Battle of Tours.
750. The 'Abbasid Caliphate begins; Baghdad becomes the capital of the Eastern Arab Empire.
756. Establishment of the Umayyad Western Caliphate at Cordova.
763–809. Harun ar-Rasheed. He succeeded to the throne of the Moslems in 763, and established the golden age of Baghdad. Although many of the stories in “The Thousand and One Nights” refer to him, it is not to be supposed that the tales approach to this antiquity.
776. Jabir ibn Hayyan, whose name appears in modern anaesthetic books as Djafer Yeber and who was known to medieval scholars as Geberus, flourished in al-Kufah at about this date. He was the father of alchemy, and began the search for the magical substance which would transmute base metals into gold (the “Philosopher’s Stone”). He is the reputed author of many treatises, some of which were translated into Latin. In one of these translations there is an interpolated passage, absent from the Arabic original, describing the manufacture of “oleum vitreoli” (sulphuric acid). This led to a belief that at the end of the nineteenth century that he was the discoverer of “oleum vitreoli dulce” (sulphuric ether).
800. Charlemagne, King of the Franks, rules from the Elbe to the Ebro.
850–923. Abu-Bakr Muhammad ibn Zakariya, known from his place of birth as Rhazes, was probably the greatest and most original of all the Moslem physicians and one of the most prolific as an author. He was the first to distinguish between smallpox and measles.

850. Compilation of the Bamburg Antidotarium, which contains an account of the “spongia somnifera”, made by steeping a sponge in a decoction of many herbs, including mandrake. Inhalation of the fumes from the sponge were said to produce unconsciousness. A similar recipe is found in the Codex of the Abbey of Monte Cassino, which had been founded by St. Benedict in 529. Since the drugs used were not volatile, the prescription could have been of little use: perhaps it was never used.
855. The Northmen begin to settle in France and England.
871–901. Alfred the Great.
962. Otto the German becomes Roman Emperor of the West.
980–1037. Ibn Sina (Avicenna), the most illustrious name in Arabic medical annals after Rhazes. His Canon of Medicine was mainly a recapitulation of Galenic writings and was in great demand up to the time of the Renaissance. He repeats the usual nonsense about mandragora, omitting the dog. However, he thought poppy extract a better sedative.
994. Death of 'Ali ibn al-'Abbas (Haly Abbas), author of al-kitab al-Maliki (Liber Regius) and Thesaurus of Medicine. His greatest contribution to medicine was a proof that, in the act of parturition, the child does not come out by its own efforts but is pushed out by the muscular contractions of the uterus.
1001. Moslem conquest of Northern Hindustan.
1050. Compilation of the Saxon Leechbook, known as the Lacnunga. Amongst a great deal of magic are a few rational notions, one of which is that chilling a part by the application of cold water deadens the pain of opening an abscess. This seems to be the first recorded use of refrigeration analgesia.
1066. William the Conqueror defeats Harold at the Battle of Hastings.
1095. Peter the Hermit preaches the Crusade.
1098–1179. “St.” Hildegard of Bingen. In her book, De Plantis, she describes the mandrake which, being “formed of the moistened earth wherever with Adam was created,” has magical properties.
1099. The capture of Jerusalem by the Crusaders.
1126–1198. Ibn Rushd (Averroës), great physician of the Western Caliphate, did much to aid the spread of Aristotelian ideas from Arabia to Europe. He knew that smallpox conferred immunity from future attacks. His work as a physician was eclipsed by his reputation as a philosopher.
1135–1204. Mosheh ben Maimon (Maimonides), court physician to Salahud-Din (Saladin) and pre-eminent among Jewish medical men of all ages. Like ibn Rushd, he was even more respected as a philosopher than as a physician.
1137. Foundation of St. Bartholomew’s Hospital by Rahere.
1140. Nicolaus Salernitanus revives the “spongia somnifera” in his Antidotarium.
1162. The first use of heraldry in England (Great Seal of Henry II).
1170. The murder of Thomas à Becket at the altar in Canterbury Cathedral.
1187. Jerusalem falls to the Moslems. The diminishing Frankish kingdom survives for a further century.
1200. Charter delivered to the University of Oxford.
1205–1296. Theodoric Borgognoni; his Cyrurgia describes a method of surgery which approaches to the aseptic. His description of the spongia somnifera is very well known and is quoted in all histories of anaesthesia.
1252. The death of Ugone di Lucca (Hugo of Lucca), his teacher and, perhaps, father, died in 1252. The
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description of the "mandrake broth" is presumably derived from the Antidotarium of Nicholas Salernitanus.

1214-1294. Roger Bacon.

1214. At the Battle of Bouvines King John loses all his French possessions.

1215. Magna Carta sealed by King John at Runnymede.

1216. St. Francis of Assisi and St. Dominic found orders of friars; they meet.

1227-1274. St. Thomas Aquinas.

1234-1315. Raymond Lull or Lully; he is said to have described a substance which he called "oleum vitreoli dulce", but Keys could find no evidence of this on searching his works.

1265-1321. Dante.

1276-1326. Mondino; became professor of anatomy at Bologna in 1306. He carried out his first public dissection of the human body in 1315, and this occasion marks the revival of interest in anatomy.

1285. Armati (?) of Florence, died 1317, invents spectacles.

1295. First sitting of the complete English parliament. c. 1298-1368. Guy de Chauliac. He was probably the greatest of the medieval European surgeons. His Chirurgia Magna, first issued in 1363, continued to be much used until the end of the 16th century; in it he mentions the "spongia somnifera" of Theodoric but does not indicate that he himself advocates its use. He disapproves of the pre-operative use of opium, since some who have had it have gone mad and consequently died.

1307-c. 1390. John Arderne. From about the time of the Black Death, when his wife died, he practised at Newark, but removed to London in 1370. He issued two important treatises, that of "Fistula in Ano, Haemorrhoids and Clysters" being issued in 1376. In it there is a description of an ointment compounded of mandrake and many other herbs for producing surgical anaesthesia. Needless to say, such a prescription would have been valueless. D'Arcy Power (De Arte Phisicali et de Cirurgia, 1932, p. viii) writes: "His medical treatment was essentially that of the Saxon leeches, treatment by spells, herbs and nasty or innocuous substances. In such matters he had no critical faculty but believed what he was told regardless of its source." This, of course, is typical of the medieval period, and accounts for all the mandragora broths, ointments and sponges mentioned by various authors. As a surgeon he was of great repute and the treatise above mentioned describes, for the first time, the operation for fistula in ano still in use today.

1309. Removal of the Papal seat to Avignon.

1314. The Battle of Bannockburn.

1315. The Swiss secure their independence, a factor of great importance in the later establishment of printing presses in Basle.

1328-1400. Chaucer. His works contain several references to narcotic drugs at the level which might be expected.

1340. Edward III claims the French crown.

1346. The Battle of Crécy; the first use of guns in war.

1349. The Black Death ravages England, having spread across Europe in the previous two years. In addition to the important social effects, this plague opened men's eyes to the importance of infection as a cause of disease and led to the development of quarantine stations at strategic points. This was perhaps the greatest step forward taken in this period.


1411. Foundation of the University of St. Andrews.

1415. Battle of Agincourt.

1431. Execution of Joan of Arc. Her trial for witchcraft and heresy included a series of examinations, at one of which she was accused of possessing a mandrake. She denied this, and said that she knew mandrakes were dangerous and evil things to keep. The important point is that both she and her assessors knew that mandrakes were evil and magical. At about this time appeared an engraving by Jaspar Isaacs showing witches preparing for their Sabbath: a mandrake is shown in the foreground. Later about 1600, Franken used this engraving as the basis of his painting of a similar subject; he again depicts the mandrake.

1453. Constantinople falls to the Turks.

1454. Gutenberg prints from movable type. Printing was known to the Chinese many centuries earlier, but the discovery was stultified by the multiplicity of "characters". Gutenberg's discovery depended for its acceptance on the previous introduction of papermaking into Europe, which seems to have begun in Italy, about 1270. The knowledge of papermaking was carried by the Moslems from China to Europe, and paper was manufactured in Moorish Spain for some considerable time before the craft spread to Christian Europe.

(To be continued)