

WELLCOME PRIZE IN THE HISTORY OF MEDICINE.

FROM HERBAL TO PHARMACOPOEIA.

VICTOR L. ROWE.

FIRST YEAR MEDICINE.

1971.



FROM HERBAL TO PHARMACOPOEIA.

The development of pharmacopoeias from herbals is a very complex, yet fascinating study because of the intricacy of the connections between the various lines of development.

The terms 'herbal' and 'pharmacopoeia' can be and are used in many different contexts. 'Herbal' is variously defined as:- 'an ancient manual for facilitating the identification of plants for medicinal purposes';<sup>1</sup> 'a treatise which aims at enabling the reader to identify and use medicinal plants';<sup>2</sup> 'a collection of descriptions of plants compiled for medicinal purposes';<sup>3</sup> and 'a book containing names and descriptions of herbs, or plants in general, with their properties and virtues'.<sup>4</sup> From these it can be seen that the function of a herbal is to provide a useful compilation of plant descriptions together with their medicinal properties. The word herbal is used as synonymous with 'materia medica' and both are distinguished from a scientific botanical treatise by their practical aims.

'Pharmacopoeia' is defined as a list of drugs prepared for a certain group of physicians, a hospital, city or country. The drugs contained in the list are chosen by agreement and are supposed to be accepted as valuable by the majority of those who use them.<sup>5</sup> It is expected to provide, for a specific area, standards of identity, quality and strength for those medicinals which represent the best teaching and practice of medicine. The primary function of a pharmacopoeia is thus to describe each drug on the approved list in such a way that whenever dispensed it meets the standards of quality and strength established for it. It is therefore a fundamental safeguard to public health.<sup>6</sup> 'In antiquity, 'pharmacopoeia' was used to describe a drug compounder, not a drug list. The English usage dates from the seventeenth century and Burton's Anatomy of Melancholy (1621) is perhaps responsible for it. A modern pharmacopoeia describes only the drugs and their preparation without discussing their application in detail.<sup>7</sup>

From prehistoric times there must have been knowledge of herbs and other drugs, knowledge that had been doggedly collected by trial and error over a period of thousands of years. It is difficult to see how such vague and casual experiments could have been repeated long enough, their results taken note of and transmitted from generation to generation, but nevertheless, our ancestors, like the primitive peoples who can still be observed, had managed to try many plants and other materials

and to classify them according to their utility or danger. The main discoveries concerned the pharmacological qualities of herbs and roots which might have been laxative, emetic, sedative, diuretic, emmenagogic, analgesic, antipyrite etc. It was observed also that the best results were obtained with a definite dose and that if the dose were excessive death might ensue.<sup>8</sup>

The accumulation of knowledge was in no other field so slow as it was in the empirical study of plants. The process of selection took place throughout pre-historic ages and the Egyptians and Sumerians of the first dynasties were already enjoying much knowledge bequeathed to them by distant ancestors. In their turn they must have passed on at least part of their experience to all the peoples with whom they were dealing - Aegeans, Phoenicians, Greeks and others. To determine what information was passed on would require the relevant word lists for the plants in Greek, for such lists might reveal what knowledge had originated from oriental sources. But any attempt to do this is a hazardous undertaking since the Greeks very probably applied completely new names to the most useful of the herbs.

The oldest record in the form of a drug-list is a stone tablet from Babylonia dating from about 1700 B.C.<sup>9</sup> A number of Egyptian inscriptions and papyri, which give drug-lists, have been found. Of the ancient documents which indicate drugs and dosages the oldest extant is the 'papyrus Ebers', dating from 1500 B.C. This 110 page 'book' contains well-known remedies like hartshorn and castor oil, with indications of the disease for which they were recommended as treatment.<sup>10</sup> In Egyptian times there was a lot of magic and superstition associated with the production and application of drug-lists. Natural remedies consisted largely of plants and involved :- all the trees and bushes from Egypt and many from abroad, e.g. acacia, sycamore, palm, juniper, pomegranate, perseae, fig, ricinus; all the edible and aromatic plants and herbs such as cucumber, melon, colocynth, celery, garlic, onion, pea, poppy, cypress wheat, spelt, corn, barley and millet - their leaves, seeds, fruits, resin and juices as well as the grape and date vines. Other remedies derived from the animal kingdom and to a smaller extent from minerals. In inscriptions, the ingredients of the various remedies - potions, electuaries, ointments, bandages, poultices, enemata and fumigations - were generally marked with a vertical stroke showing that they were to be used in equal parts. Others were measured in fractions of the hekat (about 15 ml.), all being measured rather than weighed, for it

was the Greeks who substituted weights for measures.<sup>11</sup>

The earliest significant Greek medical writings were the Hippocratic Collection which were formulated in the fifth and fourth century B.C. Drugs and plant remedies are mentioned in a great many of its books, but, in its present form, the 'Corpus Hippocraticum' contains no pharmacological book. A herbal, listing the various drugs used, describing their preparation and medical application would have been very useful, as would a collection of recipes such as we find in the Egyptian papyri. In fact there are references to a lost book on drugs, 'Φαρμακίτις', and some early printed editions have a short treatise of a page and a half 'On Drugs' ( Περὶ Φαρμάκων ) which deals with purgative remedies. It must have been a late addition for it is never mentioned in antiquity. Pharmacological therapy does not play an important part in the Hippocratic medicine. Its drugs are mostly 'house remedies', the kind of plants that the rhizotomoi and pharmacopolai gathered and kept for sale. The treatment of disease was by evaluating the symptoms, predicting the course of the disease and, using a highly developed dietary therapy, reinforced by pharmacology and very respectable surgery to make the conditions for the patient as ideal as possible for a natural recovery. Their drugs were gathered by rhizotomoi ( ῥιζοτομοί ) or 'root cutters', people who knew the nature and location of useful medicinal plants, knowledge which had been accumulating for centuries. They observed an elaborate superstitious ritual in the gathering of each herb, every part of their work being governed by magical concepts. These herb-gatherers got their name of rhizotomoi because the virtues i.e. useful medicinal properties of plants, were most often concentrated in their roots.<sup>12.13.</sup>

The herbal assumed a definite literary form in the fourth century B.C. and this form persisted with little alteration throughout the ages. The first known author of a Greek herbal is Diocles of Karystos, a reputable medical practitioner in Athens c350 B.C. His treatise, the 'ῥιζοτομικόν', a series of short descriptions of plants, their habitats and medical uses, is unfortunately lost, but it must have had considerable influence on the botany of Aristotle.<sup>14</sup> Theophrastos of Eresos (372-287 B.C.) certainly drew heavily from it. He was one of the greatest botanists of all times but unfortunately only fragments of his total work survive. However, the ninth book of his 'Historum plantarum' is the earliest remains of a Greek herbal that has reached us and is especially interesting because of its

descriptions of the rhizotomoi at work.<sup>15</sup>

Notable herbals written in the Alexandrian period are those of Herophilos c350 B.C., Martias c270 B.C., Andreas of Karystos c220 B.C. whom Dioscorides praised but Galen derided, and Apollonios of Mys c200 B.C. Nicandros of Colophon c275 B.C. was a poet, and his works included a poem, containing in total, descriptions of 125 different plant remedies. The most important of the Greek herbalists of the pre-Christian era was Krateuas who wrote a herbal 'ῥιζοτομικόν', containing at least five books which were illustrated. None of it survived but it is probable that his illustrations were the prototypes of those included in the famous sixth century manuscript kept in Venice as well as those in the Juliana Anicia Codex. Krateuas also wrote a materia medica wherein he showed much knowledge of the action of metals on the body.<sup>16</sup> Cassius Dionysius of Utica c88 B.C. was a Greek writer on botany and materia medica. He composed a treatise on herbs and their uses, rhizotomika (ῥιζοτομικά) and an illustrated pharmacopoeia is also ascribed to him.<sup>17</sup> Scribonos Largus, a Roman pharmacologist published c47 A.D. 'Compositiones medicamentorum', a collection of 271 prescriptions, 242 of which were derived from plants, the rest from minerals and animals. Some are popular and magical in origin but the majority are of scientific interest.<sup>18</sup> Menecrates was a Greek physician and druggist who flourished under the emperors Tiberius and Claudius I and he dedicated to the latter a work on drugs, with doses written in full words to avoid confusion. He describes Diachylon plaster, a name which survives in modern medicine though the plaster composition has changed. Most Latin herbals passed onto the dark ages were of Greek origin.<sup>19</sup> Pliny's books XX-XXV are in effect a herbal for they contain short paragraphs on the nature and uses of plants and much of his material is derived from Theophrastos or at least the same source as Theophrastos used. Pamphilos, a Roman physician of the first century A.D. was the first to arrange a herbal alphabetically, a technique which was widespread later.<sup>20</sup> Also in the first century A.D. Andromachos the younger, wrote a treatise on drugs and Damocrates of Athens, a Greek physician wrote pharmacological poems in iambic metre, it is said, to avoid the substitution of numbers by copyists.<sup>21</sup>

The best known of all the manuscript herbals is the encyclopaedia of materia medica, 'Περὶ ὕλης ἰατρικῆς', often called 'De materia medica libra quinque' written by Dioscorides (Dioskurides) a physician in Asia Minor. This book

written in the first century A.D., embodied the results of Greek research in pharmacy and applied botany and was far better arranged, though still not very systematic, and far more complete than earlier compilations. It was based, in part, on the early work of Krateuas and remained authoritative for fifteen centuries. It consisted of short sections or chapters, each of which discusses a single drug, with a short description of the plant from which it is derived, its place of origin or habitat followed by drug preparation and uses in medicine. In all, about 500 plants are described and some of these are traceable because we know that he collected them while travelling as a military physician in Asia Minor. The botanists de <sup>l'</sup>Toumefort (1656-1708) and John Sibthop (1758-1796) both recognised many of the plants described while travelling in Asia Minor. Some of the drugs mentioned by Dioscorides were retained in the modern official pharmacopoeias e.g. aniseed, belladonna, ginger, pepper, poppy, sugar and thyme, to name a few. All of these came through the copyists of the Middle Ages, though some came from and through the Arabic physicians as well. In the Renaissance period, the exposition of this work was the main concern of many botanists. Perhaps the most influential of such commentaries is that by the Italian writer Pierandrea Mattioli (1501-77) who, since he belonged to Southern Europe was familiar with the type of flora known to Greek and Roman botanists. Dioscorides' work was thus one of the most, if not, the most influential ever written on this subject for it had a great influence on Medieval herbals, being studied and published at least until the seventeenth century. It was also translated into Arabic in the tenth and Syriac in the thirteenth centuries. Thus, this material, together with some of Galen's persisted until the days of printing when it was diluted with new material.<sup>22</sup>

The only other Greek writer to have a significant effect on the development of the herbal was Galen, who lived at the end of the second century A.D. He wrote numerous treatises on pharmacology and also fourteen books on the therapeutic method, known as the 'Megatechne' or 'Ars Magna' which was the medical bible for centuries. Among his work in the fields of anatomy, physiology, embryology, pathology and therapeutics was his work on pharmacy of which the most important treatise is the 'De simplicium medicamentorum temperamentis et facultatibus libris' (Περὶ κρᾶσεως καὶ δυνάμεως τῶν ἐπιπλῶν φαρμακῶν) usually referred to as 'De simplicibus' - 'On Simples' i.e. single drugs as compared with compound drugs.

This consisted of eleven books of which eight were completed before 180 A.D. Part of it was incorporated in the Juliana Anicia Codex. In the first two books he described the composition of medicines; in books III - V he expounded his pharmacological theory on the balance of the Hippocratic Humours and the four principles, an idea which dominated medieval medicine; and in books VI - VIII he lists the drugs in alphabetical order, giving name and locality of plant, differences from allied plants, and medical application.<sup>23</sup>

The second century saw the end of the creative period of writing. Oribasos (325-403 A.D.) borrowed freely from Galen's 'On Simples' and Dioscorides' 'De materia medica' for his 'Synagoge' and 'Euporista'.<sup>24</sup> All these four works were translated into Latin early in the sixth century and there were no advances at all on these during the Middle Ages; indeed, they had serious competition in shorter and easier works which only gave the name and a very brief description of the plant. A typical example is the 'De medicamentis' of a Gallo-Roman physician, Marcellus Empiricus, written in the first half of the fifth century A.D., which is a popular work of medicine and superstition, containing a large number of mentions of plants.<sup>25</sup> A well-known work, 'De herbarium virtutibus (or medicaminibus) often called simply the 'Herbarium' used to be attributed to Apuleius Platonicus who lived in the second century A.D., but it is now thought to date from early in the fifth century. It describes plants as simples, -single constituents of medicines and was said to have been inspired by the demi-gods Centaur Chron and Asclepius and it became very popular in the middle ages. It was early translated from Greek into Latin and many modifications and additions were made,<sup>26</sup>

One of the most famous of herbal manuscripts is the Juliana Anicia Codex written in 512 A.D. as a gift for Juliana Anicia, whose father, Flavius Anicius Olybrius, was Emperor of the Roman West for a time. It is Byzantine in form and is the earliest surviving version incorporating Dioscorides' Materia Medica. It also draws from the works of Galen and from Krateuas for its illustration. This work, as has been previously said, was accepted in the Renaissance period as infallible and its fame still stood in the seventeenth century.<sup>27</sup>

So far I have only considered the Graeco-Roman tradition of herbals, but Asia also has a very long, if not longer history in this field. Hundreds of medicinal plants were known in India in the pre-Christian era and the Chinese have a compilation<sup>n</sup>

still authoritative of about a thousand ancient herbals. The most ancient of all the surviving Chinese herbals is the Shên-nung Pên Ts'ao Phing written in the first half of the fourth century B.C.<sup>28</sup> The title, when translated is 'Pharmacopoeia of the Heavenly Husbandman' and this work lists more than 300 plants and 30 mineral substances. One of the greatest works in Sanskrit literature was the Suśruta dating from the sixth century B.C. This contains surgical descriptions, anatomy, physiology, pathology, obstetrics and paediatrics, stress being laid on careful diagnosis. Some 760 medicinal plants are noted, many of them antidotes and aphrodisiacs but also some soporifics such as henbane (*Hyosyanus niger*) and Indian hemp (*cannabis indica*; hashish).<sup>29</sup> The Chinese word pên ts'ao cannot be translated simply as a 'herbal'. It is a much more comprehensive term, for often it was concerned with the use of plants or food, with agriculture and husbandry and also with the use of animal and mineral materials. The T'ao Hung-Ching pên ts'ao written in the fifth century A.D. added 365 more drugs to those mentioned in the Shên-nung pên ts'ao and thus is a revision of the earlier work. A further revision was carried out at the end of the seventh century A.D. when a pên ts'ao consisting of 53 volumes in all was published. This included a large section on herbs. Further editions of this materia medica were compiled in the rule of the third T'ang emperor, Kao Tsung, the first revision being carried out by Li Chi and the second by Su Kung.<sup>30</sup>

At the end of the eight century a Japanese educator and physician brought out a materia medica or herbal in two volumes called 'Yakkeitaiso'. This was derived from the Chinese pên ts'ao and deals with drugs, explaining preparation, preservation, use and effects. The writer's name was Wake Hiroyo.<sup>31</sup>

The Arabic tradition was by far the most important in the period from the ninth to the thirteenth centuries. In pharmacology (i.e. materia medica, uses in therapy, properties and descriptions) the medieval Islamic peoples far surpassed the Greeks and Romans. In the twelfth century they reached a peak and were supreme for centuries afterwards, some works still being used today in the Near East, North Africa, India, Pakistan and other parts of Asia. They were superior not only in the number of drugs described and their application but also in that they were accompanied by a rapid expansion in the related subjects of botany, zoology and mineralogy. The Latin and Greek herbalists could not avoid being influenced either directly or indirectly by Arabic models. The number of Arabic accretions in Latin

antidotaries increases with their date but did not keep pace with the contemporary Arabic trends which remained far ahead. Medieval Islam was therefore extremely productive in works on medicine and pharmacology and many survived from their 'Golden Age' around 1100 A.D. with the result that only the most important works can possibly be mentioned.<sup>32</sup>

In the ninth century Alkindi wrote a formulary, the 'Aqrābādhin' which lists many prescriptions without any definite organisation as to their medical purposes - a favourite type of format in Moslem Medicine.<sup>33</sup> At the beginning of the tenth century writings became much more prolific. Ibn Washiya wrote a work on poisons, 'Kitab al sumum' and in the second half of the century Ibn Jazla compiled an alphabetical list of simple and compound drugs with a title which means in English, 'The Patterning of Explanation as to that which man uses'. Abu Mansur Muwaffosh wrote 'Book of the Foundation of the True Properties of the Remedies' which syncretizes Greek, Syrian, Arabic and Hindu elements and deals with 585 remedies (466 derived from plants, 119 from animals and minerals) classified into four groups according to their action and also gives an outline of a general pharmacological theory. Al-Tamimi, a Palestinian physician, c970, made pharmaceutical experiments and wrote many medical works, chiefly materia medica. His main work is a guide or materia medica which contains much information on plants and minerals and is entitled 'Guide toward (the understanding of) the substances of food-stuffs and (of) the simple drugs'. Also writing in the tenth century were al-Razi who wrote an encyclopaedia of medicine, the 'Kitab al-hawi' and 'Ali-ibn' Abbas al-Majuri who wrote the famous 'Royal Book', 'Kitab al-Maliki', the best parts of which are devoted to dietetics and materia medica. Ibn Al-Wafid, a physician and pharmacologist of the eleventh century wrote a work on simple drugs, 'Kitab al-adwiya al-mufrada' based on Galen and Dioscorides and also on some personal observations. Masawaih Al-Murdini, a physician wrote a complete pharmacopoeia in twelve parts, 'Antidotarium sive Grabadin medicamentorum compositorum', based on Muslim knowledge. It was immensely popular and for centuries remained a standard textbook of

pharmacy in the West. The most well-known of the Arabic works in the eleventh century is Ibn Sina's (Avicenna) 'Qanun' (Canon), an encyclopaedia of medicine which is a codification of the whole of Moslem knowledge in this field and contains more than a million words. Similar in many respects to Galen's works, because of its perfection and intrinsic value it superseded al-Razi's 'Kitab al-hawi' and 'Ali-ibn 'Abbas al-Majuri's 'Kitab al-Maliki' and even the works of Galen so that it remained supreme for six centuries. The materia medica part outlines pharmacological methods and contains more than 750 drugs.<sup>34</sup>

In the twelfth century Ibn Sarabi (Serapion the Younger) wrote an antidotary on simples. It was written in Arabic but the Latin translation became so popular that it eclipsed the Arabic version. The foremost Arabic antidotary of the twelfth century was written by Ibn al-Tilmidh, head of the medical profession in Baghdad. Abu-l-Salt, also a Western muslim, wrote a treatise on simple drugs. Written in the second half of the twelfth century, Maimonides' (Moses ben Maimon) 'Discourse on Poisons, and Antidotes against Mortal Drugs' was one of the most important of the medieval books on pharmacology since it contained more than 1800 drugs. The best other work in the period was the 'Kitab al-adwiya al-mufrada' on simples written by al-Ghafiqi of Cordova. He travelled widely in Spain and Africa collecting simple drugs, made precise descriptions of the plants from which they were derived, giving their names in Arabic, Latin and Berber. The geographer al-Idrisi also composed a herbal containing a description of more than 360 simples. At the end of the twelfth century, an Egyptian Jew, Ibn Jami<sup>c</sup> wrote a very good treatise on simple and compound medicines, called the 'Irshad' and made up of four parts, on generalities; on simple medicines; on hygiene and therapeutics and; on compound medicines.<sup>35</sup>

At the beginning of the thirteenth century lived several Arabs who travelled extensively, collecting herbs in the Eastern Mediterranean area. Ibn al-Suri of Damascus collected from around Damascus in the Lebanon mountains and took great pains to observe and paint coloured pictures of plants in different stages of growth for he was always accompanied by an artist. In his writings he made full use of the herbals of Dioscorides, Galen and al-Ghafiqi. Abu-l- Abbas al-Natabi of Seville made a botanical exploration of Spain and the African coast to Arabia. Although a pharmacist, most of his botanical studies were done for their own sake. However, Ibn al-Baitar of Malaja, travelling, in the same areas as his teacher Abu-l- Abbas

al-Natabi, took great care in observing plants for use in medicinal purposes and he compiled an elaborate Arabic book 'Jami' fi-l-adwiya al-mufrada' on the subject, incorporating his own experience with that of such predecessors as Dioscorides, Galen, al-Razi, Ibn Sina, al-Ghafiqi, al-Idrisi etc. A pharmacopoeia entitled 'Al-dastur al-maristani' (The Hospital's Canon) is attributed to Ibn al-Mudawwar, an eastern Jew, though it may possibly have been written by David Ben Solomon.<sup>36</sup>

The most important work in the second half of the thirteenth century was the pharmacopoeia 'Minhaj al-dukkan' of an Egyptian Jew al-Kuhin al-Attar, which is still popular in the Arabic world today. In the fourteenth century only two Arabic writers are noteworthy. They are Muhammad al-Shafra; a renowned herbalist whose works have unfortunately failed to reach us and Muhammad ibn Mahmud, a Turkish physician who wrote an Arabic pharmacopoeia of 44 chapters, drawing on many Arabic sources which he enumerated in the preface, indicating that he must have had an excellent medical library.<sup>37</sup>

It can be seen from the preceding paragraphs that the Arabs amassed a large amount of knowledge on pharmacological matters and much of this was incorporated later into the herbals and pharmacopoeias of Western Europe. The majority of their treatises on this subject were antidotaries, often incorporated in larger encyclopaedias of medicine. It can also be seen that they had a 'golden age' of discovery and research culminating in the twelfth and thirteenth centuries to a peak and thereafter petering out.

Meanwhile progress had been continuing both in Europe and Asia. The Chinese traditions in the pên ts'ao continued their steady course. The earliest herbal printed from blocks, the K'ai-pao hsiang ting pên ts'ao, dates back to 973 A.D. and other pên ts'ao were printed in 1061, 1108, 1159, 1204 and 1249, all illustrated. The Chinese pên ts'ao was the natural foundation of Japanese materia medica. The first adaption was by Wake Hiroyo in the eighth century of a seventh century pên ts'ao. Henchiin's adaption in the twelfth was an eleventh century and Konemune's in the thirteenth century was a twelfth century pên ts'ao. Thus we have the Japanese tradition about a century behind the Chinese in a similar relation to that which Latin had to the Arabic tradition. The field of Chinese pên ts'ao has not been studied yet, for to do so would require an intimate knowledge of Japanese, Korean and Annamese texts also. However the most important lines of development can be

traced. The Cheng lei pên ts'ao dates from 1108 and is ascribed to T'ang Shên Wei of Shu in Ssü-chuan. It is important because it contains fragments of the text of the legendary Shên-Nung pên ts'ao ching and embodies what was considered most valuable in later works of the same kind. It was classified in the typical manner under headings :- precious stones, metals, herbs, cereals, vegetables, fruits, trees, insects, fishes, birds, quadrupeds and men; 1445 objects in all, together with 294 plates of illustrations. A supplement edition in 1468 contains 600 illustrations of plants. However an earlier modification to the Cheng lei pên ts'ao, the Pên ts'ao Yen-i was published by K'ou Tsung-shih in 1115. This contained twenty books and is often quoted in Chinese herbals and also a commentary was devoted to it by Chu Tan-Ch'i who died in 1358.<sup>38</sup>

In 1159 was published a Chinese pên ts'ao, the 'Shao hsing chiao tung ching shih cheng-lei pei chi pên ts'ao which was compiled by Wang Chi-hsien, Chang Hsiao-chih, Ch'ai Yüan and Kao Shao-king. This pên ts'ao was important for its effect on Japanese materia medica, as was the Cheng lei pên ts'ao of 1108.<sup>39</sup>

The state of the Sanskrit tradition and Hindu knowledge in the thirteenth century and before can only be inferred from the botanical glossary of Hemacandra and the materia medica of Sarngadhara. The latter's work 'Sarngadharasamhita' is a general pharmacopoeia which includes references to mercurial and metallic preparations.<sup>40</sup>

It is remarkable that no pên ts'ao was printed or reprinted during the fourteenth century and only one was reprinted in the Yüan dynasty in 1298. In the early fourteenth century however, Chu Tan Ch'i wrote a herbal, (Pên ts'ao yen-i pu-i), as a commentary on the pên ts'ao yen-i of K'ou Tsung-shih written in 1115. It dealt with 196 drugs, all but a very few herbs. It is one of the 42 sources quoted by Li Shih-chên in the great 'pên ts'ao kang mu' written in 1552-78 and printed in 1596. It was the first herbal to mention chaulmoogra oil although the actual discovery is undatable but is very valuable, for this is the only means of curing leprosy. The next pên ts'ao was completed and printed in 1400 by Chu Hsiao, fifth son of the first Ming emperor Hung Wu, the 'Chui huang pên ts'ao' (herbal to relieve famine) but it was the fruit of many years research and so must be considered as being in the fourteenth century. It contains descriptions and illustrations of 414 species of plants of which only 138 are in earlier herbals, many being taken from specimens cultivated in his own garden. It is thus one of the most original compilations of

its kind anywhere. It contained an unusually large number of plants that could be eaten especially those from which additional food could be obtained in times of scarcity. Herbs were not neglected (245 in all) but a very large number of other plants were described. The work was in two parts, the first describing 173 herbs of which only 40 had been mentioned before, the second containing 241 plants classified under trees, grains, fruits and vegetables of which only 98 had been mentioned before. The best-known pên ts'ao is a later one, the 'Pên ts'ao kang mu', first printed in 1596, compiled by Li Shih-chîn over a period of thirty years. He took extracts from 800 authors, selecting 1518 drugs, adding 374 new ones, giving a total of 1892, together with 742 illustrations. The drugs, he divided into 62 classes and 16 groups, the total number of prescriptions being 11,896. In it he mentions syphilis as a new disease spreading from the south. Western works on Chinese materia medica are derived almost exclusively from this treatise e.g. G.A. Stuart "Chinese materia medica" 1911; Bernard E. Read, "Chinese Medicinal Plants" 1936 and "Animal Drugs" in nine parts (1931-9). Though the pên ts'ao kang mu is the best-known and most used of the Chinese herbals, it is not the most recent, most elaborate or best. The 'Kuang ch'un fang p'u' of the 1630's is said to be fuller and more correct and better printed, though lacking in illustrations. Then in the encyclopaedia 'T'u shu chi ch'eng' of 1726, 320 well-illustrated books are devoted to materia medica. Finally Wu Ch'i-chun (d1846) wrote the 'Chih wu ming shih t'u kao', containing 1800 elaborate drawings, many of which are by his own hand, which is said to be the best Chinese botanical work.<sup>41</sup>

In Japan in the twelfth century Herichiin Seiken wrote three treatises derived from Chinese pên ts'ao and containing illustrations from the Ch'ung kuang pên ts'ao t'u ching which appeared in China in 1061 and is lost, thus making his works particularly valuable. One of these treatises, the 'Yakes shu sho' was on drugs, the others being on perfumery and cereals. In the fourteenth century the Japanese published 'Yurin fukuden-ho', by Yurin, largely a translation of Chinese texts, referring to more than 100 Chinese treatises though he does add his own observations. It consists of twelve books and begins with a critical examination of drugs in popular use and he urges his colleagues to exercise more care in their use.<sup>42</sup>

The Chinese tradition of pên ts'ao is thus a very long and complex one. Not only were the pên ts'ao herbals but they also contained pharmaceutical chapters and digressions onto other medical topics. To determine the relative merits of

European herbals, a detailed comparative analysis would be needed, which no-one has yet attempted. Each one may be expected to conform with local novelties in addition to the traditional 'common-places' especially with herbals written in colloquial languages i.e. non-Latin in Christian Europe, non-Arabic in the Dar al-Islam and non-Chinese in the Far East. There have been no studies made on Korean, Japanese, Balinese, Annamese or Malay herbals which would be necessary for such an undertaking.<sup>43</sup>

In Europe there was little development until the Middle Ages because, for hundreds of years in the Dark Ages, the scholars, mostly monastic writers, chiefly confined their efforts to copying the writings of their predecessors, in the process causing more and more corruption of the original, particularly in illustrations.

The subject of herbals cannot be dissociated from that of materia medica, with the result that a disinterested botanical science is not possible, for plants were mainly collected for their medical properties. The herbals in which these properties were discussed, together with various means of identification of each herb, also contained other drugs derived from the mineral and animal kingdoms but the plants were so predominant that they gave the tone (and their name) to these collections. The history of herbals is difficult to extricate since many works have interpolations in them. Thus, a Latin herbal including Arabic elements might influence another Arabic compilation etc. Bearing this restriction in mind I have considered each of the herbalistic traditions separately, as Greek, Arabic, Sanskrit and Sino-Japanese, and Latin (i.e. West European) with a section devoted to the English herbal tradition. Obviously these traditions are only partially independent, as is very evident throughout, for there are whole series of links connecting them at different chronological levels.

The Latin tradition in Western Europe began to rise again as the Arabic tradition began to wane in the East, i.e. in the thirteenth and fourteenth centuries, and this tradition persisted until the official pharmacopoeias came into existence in the sixteenth and seventeenth centuries, taking over the medical function of the herbal, and the science of botany arose in the seventeenth and eighteenth centuries taking over the function of providing adequate descriptions of plants in 'floras'.

The 'Macer Floribus de Virtutibus herbarum' of Odo of Meung, written at the end of the eleventh century is a convenient starting point. This work was a poem,

describing in 2,269 hexameters the virtues of 77 roots and herbs. At the beginning of the twelfth century the Salernitan School was at the height of its botanical fame. From here came the 'Regimen sanitatis' - a poem which enjoyed great popularity. Nicholas of Salerno, a master there, produced an antidotary called 'Antidotarium parvum' to distinguish it from the Byzantine antidotary which was called 'magnum'. This contained 150 recipes for the preparation of drugs, most very complicated, together with indications of application and action. Mattheaus Platearius, also of Salerno, produced the first commentary on this and also a treatise on simples 'De simplici medicina', often called 'Circa Instans', from its opening words. Like the Antidotarium Parvum of Nicholas it remained popular until the sixteenth century. It listed drugs in alphabetical (Latin) order, together with their names in Greek, Italian and French and then, for each drug, gave a description, action, mode of application, signs of purity, falsifications and distinctions of the various kinds. Of the 273 chapters, 229 treat of medicinal plants. It marked great progress over Dioscorides and other herbals and gradually, in the thirteenth and fourteenth centuries superceded the Herbarium of 'Apuleius'<sup>14</sup> and became one of the prototypes of our Western pharmacopoeias. Giles of Carbeil, also a Salernitan, wrote many medical poems including an antidotary, at the end of the twelfth century.<sup>44</sup>

In the thirteenth century, one of the earliest medical writers of Germany was Hildegard of Bingen, a woman, who was one of the most original personalities of late Medieval times. Her medical knowledge can be traced back to Roman sources through the unbroken Benedictine tradition. She also knew the popular remedies, mostly herbal in nature, of her own people. The folk lore origin of her learning is evident in her vernacular German naming of about a thousand plants and animals. At about the same time the first Scandinavian herbal was written by a Danish physician, Henrik Harpestraeng. Towards the middle of the century Nicholas Myrepsos, a Byzantine physician, compiled a collection of pharmaceutical recipes known as the Dynameron (Δυναμῆρον). This was derived primarily from the Antidotarium parvum of Nicholas of Salerno but is far more elaborate. Instead of 150 recipes it has 2656, classified into 48 groups according to their medical properties. Considerable Arabic influence is revealed in words such as musk, ambergris and camphor. It introduces the use of mercurine ointments for itch and other skin troubles. An abridged text of the Dynameron was translated into Latin by Nicholas of Reggio and

recombined with the Salernitan antidotary into a single alphabetical work, the whole containing 1065 recipes. The full Latin text was not available until 1549 but remained the standard pharmacopoeia in Paris until the seventeenth century. Jean of Saint Amand wrote a commentary on the antidotary of Nicholas of Salerno, 'Expositio sive additio super antidotarium Nicolai' which shared the popularity of the antidotary itself. The commentary is a treatise on general therapeutics centred on the action of drugs, in three main parts dealing with dosages, evacuation and restauration. He also wrote a medical compendium called 'Revocatorum memoriae'. At the end of the thirteenth century Simon of Genoa devoted thirty years to writing a materia medica entitled 'Synonyma medicinae' or 'Clavius sanationis' which contained 6000 articles and was regarded as indispensable until the middle of the sixteenth century and is still useful today in studying medieval terminology. His main sources were, in chronological order:- Celsus, Dioscorides, Pliny, Galen, Oribasios, al-Razi, Ali-ibn-Abbas, Ibn Sina, Nicholas of Salerno and Ibn Sarabi.<sup>45</sup>

In the following century, the fourteenth, the pharmacist had a rich array of books at his disposal; not only the classics like Dioscorides' 'De Materia Medica', the Grabadin of Mesuë the Younger, the Antidotarium parvum of Nicholas of Salerno and special parts in every medical encyclopaedia but also they might have had extracts from more recent publications such as the 'Clavius Sanationes' of Simon of Genoa, the 'Pandectae' of Matthaëus Sylvaticus<sup>Su</sup>, the 'Dispensarium ad aromatorios' of Nicolo de Reggio. The Greek druggists had the Greek text of Dioscorides and the Byzantine medical encyclopaedias together with the Dynameron of Nicholas of Myrepsos. The Arabic druggists had Dioscorides and their own encyclopaedias, chiefly the Kitab-al-hawi of al-Razi, the Kitab al-maliki of Ali ibn Abbas and the Qanun of Ibn Sina and finally the Jami' fi-l-adwiya al-mufrada of Ibn al-Baitar. The Chinese had a whole series of pên ts'ao reaching back for centuries and in addition there were pharmaceutical chapters in the medical treatises and encyclopaedias.

Perhaps the most important work of the fourteenth century was the 'Pandectae' of Mattheus Sylvaticus who worked in Salerno where he kept a botanical garden. The Pandectae takes the form of a dictionary of simples and is in effect a reference book on diseases and their remedies. It contains 724 chapters and is roughly alphabetical, giving names in Greek, Arabic and Latin. Some of the observations

included are his own, but most are taken from his predecessors. Another herbalist of this period, John of Milano, compiled an illustrated herbal for Phillippe de Valois before his accession to the throne of France as Philippe VI in 1328. The earliest Polish herbal was the 'Practica' written by Roger of Salerno. Tommaso del Garbo wrote a most interesting treatise 'De reductione medica-mentorurum ad actium' which deals with the way medicines should be made up - in the correct proportions etc. and Giacomo De Dondi, an Italian wrote the 'Aggregatio medicamentorum', a large collection of medical recipes based on Arabic and Greek sources. In the second half of the century the Silesian doctor, Thomas of Sorepta, not only compiled a herbal but also a herbarium (in the modern sense) of dried plants, the earliest known example of such a collection. The herbal, 'Muhi competit', consisted of four parts, dealing with conservation of health, the qualities and degrees of simples, compound drugs and therapeutic methods, derived partly from his own experience.<sup>46</sup>

The advent of the fifteenth century saw the coming of an increase in internal medicine due to improvement in well-read medical texts. More reliable translations became available; notably Hippocratic and Galenic works were translated into Latin direct from the original Greek. As a result of colonies being founded in the New World, new drugs such as ipecacuanha, cinchona and tobacco became available. Advances also occurred in the understanding of the natural history of infectious diseases. There were relatively few herbals of noteworthiness in this century though various medieval manuscript herbals, drawing largely from Pliny and Dioscorides were put into print. A notable one was the 'Das Puch der Natur' of Konrad von Medenberg which was brought out in 1475 and included the first known woodcuts of botanical drawing.<sup>47</sup>

One of the first printed works to which the term herbal can be applied was the pseudo-Apuleius treatise 'Herbarium' which was printed in 1481 about a thousand years after it was written. Shortly after, three works were published in Mainz in Germany, one of the earliest centres of typography. The first 'Latin Herbarius' 1484 was an anonymous compilation from medieval and certain classical and Arabic authors. It gave an alphabetical list of herbs native to Germany, together with descriptions, aimed at describing cheap and easily obtained remedies in the case of illness or accident. The German Herbarius or 'Herbarus Zu Teutsch' was based on the Hippocratic doctrine of the four humours, a theory maintained by Aristotle and Galen

and which held for more than two thousand years. This involved the blending of the four humours within the body, any imbalance causing illness and eventually death. The herbs are associated with these properties and are given in order that the balance of the four humours and hence the health of the body may be restored. The book, published in 1495 contained descriptions of herbs from various parts of Europe. The 'Hortus (Ortus) Sanitatis' 1491 was also printed at Mainz. In part it is a modified Latin translation of the 'German Herbarius' but is expanded, both in the sections on herbs and by the addition of notes on animals, birds, fishes and stones. It was written by Jacob Medenbach.<sup>48</sup>

The great German writers of herbals in the sixteenth century exercised a profound influence on the observation side of the science of botany, even though plants were only described if they had medical applications. Brunfels, Boch, Fuchs and Cordus became known as the 'German Fathers of Botany' and all lived during the first half of the sixteenth century. In effect a new era in the history of the herbal began with the 'Herbarium vivae eicones' of Otto Brunfels (1496-1534) published by Schott of Strasburg in 1530. However Hans Weiditz, the artist, deserves a lot of the credit for drawing the plants as they really are in nature rather than copying them from previous drawings. In fact the 283 illustrations are incomparably better than the text which contains many errors. Brunfels' botanical knowledge came mainly from Italian authors and he tried to find the plants described by them and Dioscorides in the Strasburg district with the result that many differences and discrepancies arose. He failed to understand plant geography even though 1800 years earlier Theophrastos pointed out that each area has its own type of plants. Under his influence a younger contemporary, Jerome Boch (Heironymus Tragus as he described himself (1498-1551)) compiled a herbal, 'New Kreütter Büch' printed in Strasburg by Wendel Rihel in 1539. The text was in German and showed much first-hand observation. He attempted to classify the 800 species of plants named into three groups : herbs and odiferous plants; clovers or grasses and ; trees or shrubs. He insisted on the distinction between individual species. The first edition was not illustrated but in the editions after 1546 there were many wood cuts, some founded on those of Brunfels and Fuchs but others drawn and engraved by David Kandel. Boch's claim to remembrance therefore lies in his descriptions. He noted the mode of occurrence and localities of plants and was approaching the modern writing style. He rejected

superstitious ideas such as the 'two-headed eagle' revealed when taking a transverse section of a fern rhizome, pointing out that it is nothing more than the plant's system of vessels in section. Leonhart Fuchs (1501-66) first practiced as a physician in Munich, became Professor of Medicine at Ingolstadt in 1526 then in 1535 at Tübingen. He had a widespread reputation for his treating of the plague of 1529 and his services were in great demand all over Europe. In spite of his activity he produced a Latin Herbal in 1542 from the press of Isingen of Basle under the title 'De Historia Stirpium'. It was the most beautiful of all early herbals and contained 400 native German and 100 foreign plants all clearly and accurately described giving names, shapes, sites, temperaments and therapeutic nature. It was followed in 1543 by a German edition 'Neue Kreüterbüch'. Both versions were written in alphabetical order with no attempt at grouping them but were illustrated by first-rate woodcuts. His herbal therefore surpassed that of Brunfels in illustrations and exceeds it in the number of species described but he did have the use of Boch's and Gesner's works which were published before his. The majority of illustrations i.e. wood engravings in Dodoens' 'Crüjdeboeck' 1554, Turner's 'New Herball' 1551-68, Lyte's 'Nievve Herball' 1578, Jean Bauhin's 'Historia Plantarum Universalis' 1650-1 and Schinz's 'Anleitung' 1774 are copied from Fuchs or even printed from his actual wood blocks.<sup>49.50</sup>

In the sixteenth century in Italy a number of treatises on drugs were written which had no official standing. The most important of these was a commentary on the works of Dioscorides by Peridria A. Mattioli of Sienna (1501-77) entitled 'Comentarii in sex libros Pedacii Dioscoridis' published in 1544. It went through many editions, the earlier ones having only small illustrations but later editions being produced with large-scale figures. Mattioli described all the plants he knew including some new ones from the Tyrol district. Some material had been passed on to him by others and he recognises this in the introduction where he acknowledges the help of Busbecq who obtained two versions of Dioscorides for him and Luca Ghini. Another herbal 'De Plantis Aegypti' 1592, a very specialised study by Prospero Alpino contained the first mention of coffee.<sup>51.52.</sup>

In 1554 Rembert Dodoens who was very interested in the medical aspect of botany wrote a herbal, illustrated by some of Fuchs' woodblocks which he borrowed, titled Crüjdeboeck which was written in Flemish and printed by Plantin. It was soon

translated into French by Charles de L'Ecluse as the 'Stirpium Historiae Pemptades Sex Sive Libri' illustrated with 1305 figures, mostly borrowed from other authors. Dodoens described the plants both by their external characteristics and also by alphabetical order of their names. Jules Charles de L'Ecluse himself wrote 'Rariorum aliquot stirpium per Hispanias observatorum Historia' which was published in 1576 by Plantin using the same wood-blocks for the illustrations that Dodoens had used. De L'Ecluse was a versatile linguist and as well as translating the Flemish herbal of Dodoens into French, he combined his own Spanish and Hungarian Floras with his herbal as 'Rariorum plantarum historia' 1601. This described and illustrated some 1585 plants, described as trees or shrubs, bulbs producing odorous, non-odorous and mal-odorous flowers, poisonous, narcotic and acrid and lactiferous plants, umbellifers, ferns, graminaceous and leguminous plants. He was the first to distinguish between edible and poisonous mushrooms and to cultivate the potato. Mathias l'Obel (1538-1616) whose name is remembered in the name of the tree, Lobelia, assisted by Pierre Pena, wrote a herbal 'Stirpium adversaria nova' published in Latin in 1570, 1. This contained the first attempt to distinguish mono-cotyledons from dicotyledons. These three de l'Obel, de L'Ecluse and Dodoens, were great friends and freely interchanged material, thus confusing the situation for historians. Jacob Dietrich (or Tabernaemontanus) combined his activities in the medical profession with the writing of a herbal 'Neuw Kreüterbüch' 1588 which contained 3000 plants. His woodcuts were acquired by John Norton and in 1597 were used to illustrate the first edition of Gerard's 'Herball'. The 'Neuw Kreüterbüch' was published in Latin as 'Eicones plantarium' in 1590.<sup>53</sup>

Meanwhile in Switzerland Konrad Gesner, who lived there, wrote on medicine, mineralogy, zoology and botany. He collected a large amount of material for a herbal but it was not published until the eighteenth century when it was printed by C.J. Trew. Among the correspondents of Gesner were two brothers who also lived in Switzerland. The first of these, Jean Bauhin was a pupil of Fuchs. He wrote two great works, both published posthumously, the 'Historia plantarum prodonus' 1619 and the 'Historia universalis plantarum' 1650-61 which was divided into forty books and was a vast compilation on everything written on plants since antiquity. His younger brother Gaspard planned to make one systematic botanical work, having made

friends with the best botanists all over Europe. He had a herbarium of more than four thousand plants. The main part of his chief work was never published, though his son brought out one instalment many years after his death. The best work published is the 'Pinax theatri botanici' of 1623 which contained a complete concordance of the names of plants, dealing with about sixty thousand species in all.<sup>54</sup>

There was little activity in France during the sixteenth century even though the school at Montpellier was the best in existence for the teaching of botany and medicine. However Jean Ruel made a Latin translation of Dioscorides in 1536 'De Natura Stirpium', and Jean and Gaspard Bauhin and the printer Christophe Plantin were all French by extraction.<sup>55</sup>

One of the results of expansion to the Western World was the introduction of native materia medica into the medical practices of Europe. This is easily seen as being prevalent by examination of sixteenth and seventeenth century herbals such as those of Carlos Clusius, Gaspard Bauhin, Monardes, Hernandez, Gerard and Parkinson etc. With the exploits of Cortez news of the culture of the Aztecs drifted back to Europe. After the fall of Tenochitlan in 1521 Cortez described a street of 'herb sellers where there are all manner of roots and medicinal plants that are found in the land. There are houses, as it were, of apothecaries where they sell medicines made from these herbs both for drinking and for use as ointment or salves'. The only herbal written by the Aztecs themselves which has reached us is a Mexican herbal known as the 'Bordianus Manuscript' which was compiled in 1552 in the College of Santa Cruz at Tlaltelco, Mexico City, by two Aztecs who were educated there. It was initially written in Aztec but quickly translated into Latin. The text is illustrated with 1204 herbs and trees, all of which are beautifully coloured. The Latinised version of this contained formalised illustrations resembling European ones, suggesting that the Aztecs were following the traditions of their Spanish masters rather than an indigenous style of writing and drawing. The herbal gives the name, description, use and application of herbs.<sup>56</sup> The writings of Hernandez and Monardes deal almost entirely with the material medica of Mexico. The Hernandez volume was written in the second half of the sixteenth century and while not published until a hundred and fifty years later it was one of the finest herbals of that century. Another Spanish writer, Nicholas Monardes in 'Dos Libros' published in two parts in 1569 and 1570 gives some of the earliest discoveries by the Spaniards of the New World plants, including tobacco and balsam. It was translated into Latin by Charles de l'Ecluse and then into Flemish, Italian, English and French,

the English translation being by John Franton in 1577. The Spaniards had a great respect for the pharmacopoeias of the 'Indians' of Mexico and, under Mexican names, adopted many herbs into their own materia medica.<sup>57</sup>

In the nineteenth century in America, 'botanics' reappeared seeking popular patronage by stressing the superiority of the indigenous plant remedies over the mineral medication of the regular members of the medical profession, an ironic accusation since many of the 'regulars' were zealous collectors of plant drugs. These 'Botanics' were in reality herbals, and a large number were published by the so-called 'botanists' who were really herb-doctors. The best known of these was Elisha Smith's 'Botanic Physician' 1830 which gives the names, scientific nomenclature, habitat, techniques of collection and preparation, properties and uses of more than 300 plants.<sup>58</sup>

As has been seen, there was little original drawing in herbals until the sixteenth century when the writers, starting with Otto Brunfels, began employing artists to draw plants accurately for them. This significantly occurred when woodcuts were just beginning to be used for the illustration of books. Before this time illustrations had simply been copies of copies etc., so that all the drawings became highly stylised, not only ceasing to resemble the plants they depicted but also; in some cases, incorporated mythological motions such as the "Narcissus" in Jacob Medenbach's 'Hortus Sanitatis' of 1491 which has a human figure instead of the plant's sex organs emerging from each perianth. The great German herbals of Brunfels, Boch and Fuchs in the sixteenth century, therefore exercised a profound influence on the observation side of botany because of the precise illustrations, even though the plants were only described if they had medical applications. With the advent of the seventeenth century there was seen a need to classify plants more accurately especially when they were not being described for their medical virtues. There had been an increasing tendency to attempt classification with the herbals though, and this was probably the forerunner of the Linnean system of classification. One notable branch of the Latin tradition of herbals, that of the British has yet to be described. It closely paralleled the developments in the rest of Europe but tended to be about half a century in arrears in development.<sup>59.60.</sup>

As far as can be determined books on herbs were studied as early as the eighth century A.D. in England, but studies may have been done earlier, in Roman times. The oldest we possess are of the tenth century being Saxon translations of the pseudo-Apuleius 'Herbarium' on simples of which an Anglo-Saxon Codex dating from A.D. 1000 is in the British Museum, and a few minor works. A few Anglo-Saxon herbals were written, including the 'Leech Book of Bald' and the 'Lacnunga'. There was a large gap between the Anglo Saxon herbals and the early printed herbals. Only one original treatise appeared in the middle ages, written by Bartholomaeus Anglicus in the middle of the thirteenth century. This work, 'De proprietatibus rerum' describes herbs, in alphabetical order, and their medical properties including allusions to classical writers although the descriptions were original. This cannot be regarded as a herbal though, for the section on herbs only forms a very small part of it. This work was first printed in 1470 on Wynkyn de Worde's press and went through twenty-five editions before the end of the fifteenth century. However the first printed herbal (in the strict sense of the word) was an anonymous compilation, without illustrations which was printed by Banckes in 1525 and thus gets the name 'Banckes' Herball'. It probably derived from an unknown medieval manuscript though it may be original. It was very popular for the medicinal descriptions of plants. Where the plants had no such properties they were described by means of poetry. In 1555 appeared 'Askham's Herball' which is derived directly from Banckes' Herball. Other books modelled on it in the sixteenth century were Herbals by Copland, Kynge and Robert Wyer.<sup>61</sup>

The most famous of the early English printed herbals was the 'Grete Herball' printed by Peter Treveris in 1526 and again in 1529. It was, in the main a translation of a French herbal 'Le grand Herhier' which was itself a translation of the 'Circa Instans' of Matthaeus Platearius of Salerno which was written in the twelfth century. The 'Grete Herball' was arranged alphabetically and contained degraded copies of the plant figures which appeared in the Herbarius Zu Teutsch. Again, it emphasises the importances of the four Hippocratic humours and is very medieval in character for it attributes remarkable properties to such products of the ocean as coral and pearls. Some medicines recommended remain in use, though not necessarily in medicine e.g. liquorice, herbane, opium, olive oil, cuttlefish bone

and borax.<sup>62</sup>

William Turner wrote several works including 'Libellus de re herbarus novus' in 1535; and 'The names of herbs in Greke, Latin, Englishe, Duche and Frenche wyth the commune names that Herbaries and Apothecaries use' 1538. His main work though was his 'Herball' published in three parts, the first in London in 1551, the second together with the first in Cologne 1562 and all three parts published in 1568, also in Cologne. It was the only original work written by an Englishman on this subject in the sixteenth century. It is arranged alphabetically and describes 238 of our native plants, treating them as simples. England itself contributed little to the art of plant illustration, most illustrations being borrowed from Flemish or German sources. Turner's herbal was no exception for although some illustrations were by the author, most came from Fuchs' herbals 'De Historia Stirpium' (1542) and 'Neue Kreüterbüch' 1543. These woodcut illustrations are a very attractive feature but the herbal gains much of its charm from its vivid descriptions of the plants and their uses. It contains a lot of folk-lore not mentioned in any other herbal and Turner is one of the few herbalists who cautioned against excessive use of a herb. Besides descriptions of herbs it also includes articles on dates, rice, olives, citron pomegranates and lentils.<sup>63.64.</sup>

In 1578 Lyte made an English translation from de l'Ecluse's French version of Dodoen's 'Crüydeboeck' (1554) and called it 'A Nievve Herball'. Most of the illustrations are ultimately from Fuchs though some derive from Dodoens. It was dedicated to Elizabeth I.<sup>65</sup>

John Gerard has one of the best reputations among English herbalists, a situation he does not deserve. 'The Herball' 1597 was vertically a translation of the 'Pemptades' of Dodoens. Gerard however, is criticised because he came into the possession of an unfinished translation by a man named Priest, completed it, claimed that Priest's translation had perished and used it without acknowledgement in his own herbal. Although the bulk of the work is from Dodoens' Latin Herbal, it is the additions of Gerard which give the book its charm. It contains 1800 woodcut illustrations of which the majority were acquired by Norton the printer from among the blocks used by Tabernaemontanus in his 'Neu Kreüterbüch'. The work was full of mistakes and the printer gave it to de l'Obel to correct. In the Old Saxon herbals there was a belief that herbs used in amulets were particularly effective and this

survives even in Gerard's herbal. It also contains much contemporary folk-lore though he deliberately avoids herbs pertaining to witchcraft. He is noted for his usage of Old English names for plants e.g. 'Live for Ever' for a certain type of cudweed and 'Devil's-bit' for wild scabious. He also maintained the legend of the barnacle geese growing from shells on bits of driftwood in the sea, an adaption of the idea of the barnacle goose tree and even though Albertus Magnus had disproved it in the thirteenth century (otherwise known as Albert the Great) by watching barnacle geese hatch from eggs, many botanists still believed the legend.<sup>66.67.</sup>

In 1632 Johnson revised 'Gerard's Herball' and illustrated it with a set of 2766 blocks previously used in botanical works printed by Plantin.<sup>68.</sup>

John Parkinson (1567-1650) was the last of the great British herbalists. He wrote two herbals, 'Paradisi in Sole Paradisus Terrestris' in 1629 and as a sequel, a much larger work, 'Theatrum Botanicum' 1640. The first one is better known and is basically a gardening book, though it describes many fragrant herbs that may be grown in the garden. The 'Theatrum Botanicum' is the largest herbal in English and describes about 3800 plants which he divides into 'classes' or 'tribes'. It incorporates most of Bauhin's 'Pinax' and part of Matthias de l'Obel's unfinished work, 'Plantorum seu stirpium icones'. Even this work contains folk-lore for it supports the use of amulets and includes the unicorn. Later well-known writers such as Robert Morison and John Ray were botanists in the modern sense and cannot be classified as herbalists. Of course there are many herbals written after this time in this and every country, right into the twentieth century and there is no doubt that there is a demand for them as is illustrated by the number of herbalist shops in Edinburgh.<sup>69.70.</sup>

Before considering the development of the official pharmacopoeias there are three topics which have been mentioned in passing with regard to herbals, which need further elaboration. The first of these is the subject of theriacs (panaceas or mythridates - named after Emperor Mythridates), which are remedies reputed to cure all diseases. In former times many drugs were habitually used, given in very complicated prescriptions. The first of these known is that made up by Mythridates VI Eupator of Pontis (120-63 B.C.) to whom Krateuas was physician. After this, most herbalists had their own, often made up of a multitude of ingredients. Andromachos

of Crete, physician to Nero (54-68 A.D.) was notorious for his modification to the mythridate which was recorded in a poem dedicated to Nero and had sixty ingredients. It was supposed to cure all poisons and most other ailments and, of the sixty ingredients, viper flesh was the most important. Up to the end of the eighteenth century it was a custom in some cities to produce annually a 'Theriaca Andromachi', the word theriac surviving in our 'treacle'. In the Renaissance period theriacs were prepared under ceremonial conditions. In English literature the first mention is in 1124 and references are frequent in Chaucer and Milton. When Claude Bernard was an apprentice apothecary in 1830 he was warned not to throw away any spoilt prescription as it could always be used in a theriac. One eighteenth century example had more than 140 ingredients in it and for centuries physicians wrote long and complicated prescriptions on the principle of the blunderbuss. Polypharmacy, the prescribing of complex mixtures of drugs is a vice from which medicine has now freed itself. The number of drugs given by scientific physicians is fewer than it was, firstly because it was found that many drugs were useless or even dangerous and secondly, since attention had been drawn to the active principles of drugs rather than crude natural drugs it has been seen that many drugs being given were merely duplicates of each other, and often the administration of the active principle itself is more effective and reliable.<sup>71.72.</sup>

Amulets have been mentioned in a number of places e.g. in connection with John Parkinson. These are anything worn as a charm against evil, disease, witchcraft etc. With reference to diseases many people wore herbs as a protection against infectious diseases and most herbals obligingly supplied suggestions as to what herbs should be worn.<sup>73.</sup>

Herbaria have also been mentioned and though no medicinal herbaria have come down to us because of their extreme perishability (consisting of dried plants) it is possible that many botanists and herbalists had such collections since in the middle of the thirteenth century Villard de Honnecourt described how to preserve the colouring in dried flowers. The earliest herbarium of which we know is that of the Silesian doctor Thomas of Sarepta in the fourteenth century. One of the most notable is that of Gaspard Bauhin which contained more than 4000 plants.<sup>74</sup>

The pharmacopoeia did not show any resemblance to the modern style until the

end of the fifteenth century. The first pharmacopoeia in the modern sense was published in Florence in 1498 as the 'Nuova Receptario Composito' (The New Compound Dispensatory) the first edition of the 'Receptario Fiorentino' (The Florentine Dispensatory) which was made the official and obligatory guide for all the apothecaries in the province.<sup>75</sup>

The next to be written was that of the city of Nuremburg 'Dispensatorium Pharmacorum' compiled by Valerius Cordus and published in 1546. He was not a pharmacist but whenever he was visiting a city he collected recipes, as well as selecting from the works of respected authors. The physicians of Nuremburg were delighted with the idea of standard formulae and other cities and Municipalities quickly followed suit, Mantua 1559, Lyons 1561, Augsburg 1564, Cologne 1565, Bologna 1574, Bergamo and Rome 1580, Venice 1618.<sup>76</sup>

It was not however until 1585 that the Royal College of Physicians in London debated the possibility of a uniform pharmacopoeia for the use of apothecaries in the London area. In 1589 the decision was made to proceed and twenty four physicians were named for the writing under the various headings included, such as Syr<sup>up</sup>icks, Dococotions, Oils, Waters, Liniments, unguents, plasters, conserves, salts, chemicals and metals. It is interesting that no apothecaries were considered suitable to assist, but experienced pharmacists were consulted about methods of preparation and dosages. By 1594, eight scrutineers of the draft text had been chosen but there was a long delay before a fresh examination was ordered in 1614. By September 1617 the manuscript was ready for the press. Among those active in the final stages of its preparation was Sir Theodore Turquet de Mayerne (1573-1655), court physician to the Early Stuarts, who was responsible for the inclusion of certain chemical remedies which had been recommended by Paracelsus among others.<sup>77</sup>

Before the publishing of local pharmacopoeias the apothecaries would have kept on their shelves any number of different texts, probably including Ibn Sina's 'On Simples' and Nicholas of Salerno's 'Antidotarium'. The compilers of the London pharmacopoeia had to follow the best practice of physicians and apothecaries and so the majority of the compounds came from the formularies already established or from classical authors, among them being Galen, Ibn Sina, Matthiolus, Nicholas of Salerno, Nicholas Myrepsos and Mesuë.<sup>78</sup>

On 26th April 1618 a Royal Proclamation was issued commanding all apothecaries

of the realm to follow the 'Dispensatory' compiled by the Royal College of Physicians and on 7th May 'Pharmacopoeia Londinensis' appeared in Latin as an 'incomplete work'. It was withdrawn shortly afterwards because the king's proclamation was not in force throughout the country. It was reprinted and reappeared on 7th December 1618 and it was this issue that became known as the 'First London Pharmacopoeia' because it was the first official edition that it was obligatory to follow. Other reasons for withdrawing the May edition are suggested as because it was 'full of errors' and also there was too much pruning of commonly accepted formulae. The December edition contained more pages and many more simple and compound preparations. The 'Dedicatory Epistle' commanded strict obedience to it. The new 'chemistry' was not overlooked though its place was auxiliary. The work contained 1028 simples and 932 compound preparations. Roots, herbs, leaves and seeds account for more than half the preparations which were set out under the headings of waters, syrups, powders, electuaries etc. The variety of materia medica named, animal, vegetable and mineral, ~~in~~ particularly the compound preparations, was enormous; a knowledge that few people outside a drug manufacturing house would have nowadays. "Distillation" played a large part in preparing many simples, notably the waters and of the Aqua Vitae. The word distillation is often used however in the context that evaporation is now used.<sup>79.80.</sup>

The animal materia medica and excrementa which had long been employed continued in use in official pharmacopoeias for a hundred and fifty years after 1618. For instance materia medica of the eighteenth century included dessicated animal glands, many of which have no pharmacological properties although some, such as the thyriod do. Liver, pancreas and pituitary (and a few others) are still processed for the principles they contain, the last two respectively insulin and oxytoxic injections, detailed in the British Pharmacopoeia. The composite preparations were typical, many with 10-30 ingredients, with the extreme 'Great Antidote of Matthiolus against poisons and the plague' which had more than 130 items in it.<sup>81</sup>

The London Pharmacopoeia of 1618 and its successors were drawn upon by other European countries, notably the Netherlands, in the compiling of their national pharmacopoeias and dispensatories. Not only this but there were actual issues in the Netherlands of six British pharmacopoeias of various sorts.<sup>82</sup>

London Pharmacopoeias successively followed the first one at about thirty year intervals. The second appeared in 1650 and in this, salts of mercury were added for

the treatment of skin complaints. The third edition in 1677 was called the 'Pharmacopoeia Collegii Regulis Londini' and was dedicated to Charles II. The fourth edition of 1721 included more chemicals and botanical descriptions of plants used by Sir Hans Sloane (1660-1753). It is also interesting because an attempt was made to omit many superstitious and disgusting recipes that had been accepted for more than a century. The fifth edition, of 1746 had revisions and eliminations of obsolescent preparations and scorned the idea of the four qualities or attributes of warming, cooling, drying and wetting and the associated Hippocratic humours.<sup>83</sup>

There was a growing tendency among better physicians to get away from elaborate formulae and to strive towards simpler prescribing, preferably of only accurately understood drugs through the knowledge of their mechanism. S.F. Gray in the 'Supplement to the Pharmacopoeia' (Lond. 1818) compared this edition with the sixth of 1768 saying that whereas the 1746 edition had excelled in Galenic pharmacy the 1788 edition excelled in chemical pharmacy because certain of Bergmann's names for the salts of chemicals were adopted. It was in 1788 that the 'grand compositions' began to disappear after Herbenden's caustic essay on mythridates and theriacia. At the same time a number of new drugs such as aconite, arnicia, conium and calumbria were adopted and introduced. In the seventh edition of 1809, a number of preparations from the Edinburgh and Dublin pharmacopoeias were included and the change was made to the chemical nomenclature of Lavoisier, as the science of chemistry had forced itself on the compilers. The ordinary 'sceptical chymist' could no longer afford space or time in his elaboratory to produce the chemicals now prescribed and hence the need for large scale manufacture arose. To meet the cheap prices demanded the manufacturers were forced to go into production outside the major cities where costs, i.e. rent, labour and power sources, were comparatively low.<sup>84</sup>

The 1809 edition had a corrected version published in 1815 largely due to the objections of a London chemist, Richard Phillips. In this and the 1824, eighth edition, apothecaries were again commanded to follow exactly, the Troy measures stipulated and to make no others except by special direction of a learned physician.<sup>85</sup>

The ninth edition, 1836 deserves special mention because many recently discovered alkaloids appeared for the first time. It included aconita, morphia, quinia,

strychnia and also the halogens, iodine and bromine and potent drugs such as hydrocyanic acid and ergot. It also gave an indication of methods for detecting impurities in 120 of the chemicals described, a practice which was increasingly followed. The tenth and last edition for which the college alone was responsible appeared in 1851.<sup>86</sup>

After the initial success of the Pharmacopoeia Londinensis the provincial cities of Edinburgh and Dublin also produced their own pharmacopoeias.

The first pharmacopoeia issued by the Royal College of Physicians of Edinburgh appeared in 1699 under the title of 'Pharmacopoeia Collegii Regii Medicorum Edinburgensium' during the presidency of Sir Robert Sibbald. It was small and similar to the London Pharmacopoeia on which it may have been modelled and contained simples - herbs and animal materials, compound preparations and many chemical medicines. The college tried, with success, to produce revised editions every ten or twelve years and had reached the sixth edition by 1774 when many changes were made to bring it more into line with medical thought of the time. Due to the influence of Sir John Pringle much outmoded materia medica was cut out and although the opposition to such a change was great, many of human and animal ingredients were omitted. It is interesting that in the 1783, seventh edition 'Digitalis' (foxglove) which had been dropped from earlier editions was readmitted shortly after publication in 1775 of William Withering's 'Account of the Foxglove and some of its medical uses', about which he wrote to many of his Scottish medical friends. Another feature of this edition is that all quantities were given for the first time by weights, whether solids or liquids, a system which the French had been practising in the weighing of liquids for pharmaceutical preparations. This system did not hold for long though, for in the last edition, the Imperial system of weights and measures in conjunction with the apothecaries' system was adopted. As with the London Pharmacopoeia of 1836, the Edinburgh compilers in the 1839 edition, the first in the English language, began to indicate how purity of a chemical could be ascertained. The fifteenth and last edition appeared in 1841 and continued in use until it was superseded by the new British Pharmacopoeia in 1864.<sup>87.88.</sup>

The Edinburgh Pharmacopoeia had wide influence in the United States of America, the first use of it being in the compilation of the Lititz pharmacopoeia in 1778 by Brown of Philadelphia and, almost without change, the Edinburgh Pharmacopoeia then

current was adopted when the 'Pharmacopoeia of the Massachusetts Medical Society' was issued in Boston in 1808. The Edinburgh pharmacopoeia had wide influence also in England, Ireland and many countries in Europe.<sup>89</sup>

Both the Edinburgh and London Pharmacopoeia had circulated in Ireland as had many formularies and dispensatories and in 1793 and 1805 the Royal College of Physicians of Dublin produced editions of its own pharmacopoeia for the use of its members. On the 24th March 1806 the president and four censors authorised the first general issue of the 'Pharmacopoeia Collegii Medicorum Regis et Reginae in Hibernia' which was written in Latin, dated 1807 and dedicated to George III. The College described it as a catalogue of drugs or simple medicines they thought necessary for the prescription and use of surgeons and physicians. They described vessels and utensils, which were to be made of glass or at least not contain copper or lead, as well as weights and measures and as in other official pharmacopoeias admonished apothecaries to follow it. The current London and Edinburgh pharmacopoeias were taken into account and the latest chemical nomenclature was followed though no dosages were suggested. A new edition was published in 1826 and the third and last edition in 1850, which was dedicated to Queen Victoria and remained official until replaced in 1864 by the British Pharmacopoeia.<sup>90.91.</sup>

In England the publication of the London Pharmacopoeia in Latin stimulated medical writers to translate it into English and issue their own dispensatories. One of the earliest of these was the famous unauthorised translation of the 1618 Pharmacopoeia Londinensis by Nicholas Culpeper (1616-54) which was published in 1649 entitled 'A Physicall Directory or A translation of the Dispensatory made by the Colledge of Physitians in London'. This was pseudo-scientific in character, for Culpeper added many comments to the translation and of course this made it very popular to the credulous but unpopular with orthodox practitioners. It marked a return to the belief in the influence of heavenly bodies upon herbs, which was characteristic of the seventeenth century herbals written alongside the pharmacopoeias. Culpeper was a notable exponent of this idea among the poor people in East London, who seemed to have boundless faith in it. He was one of the last people to set up publicly as an astrologer and herb doctor and although he was a staunch Roundhead and fought at least once, he continued in practice throughout the war and acquired great

popularity in East London. His publication brought the fury of the College of Physicians to bear on him but this only had the effect of producing an enormous sale of his book.<sup>92.93.</sup>

In his introduction he writes on the use of the book and this, together with the succeeding extract serves to illustrate what type of publication it was.

"Instructions for the right use of the book.

And herein let me premise a word or two; the Herbs, Plants etc. are now in the book appropriated to their proper planets. Therefore,

First, consider what planet causeth the disease; that thou mayest find in my aforesaid Judgement of Diseases.

Secondly, consider what part of the body is affected by the disease, and whether it lies in the flesh, or blood, or bones, or ventricles.

Thirdly, consider by what planet the affected part of the body is governed that my Judgement of Diseases will inform you also.

Fourthly, you may oppose diseases by the Herbs of the planet, opposite to the planet that causes them: as diseases of Jupiter by Herbs of Mercury; diseases of Mars by Herbs of Venus and the contrary.

Fifthly. There is a way to cure diseases sometimes by Sympathy, and so every planet cures his own disease; as the Sun and Moon by their Herbs cure the Eyes, Saturn the Spleen, Jupiter the Liver, Mars the Gall and diseases of cholera and Venus diseases in the instruments of Generation'

Nicholas Culpeper."<sup>94</sup>

Typical extract from Culpeper's Complete Herbal and English Physician Enlarged (1831 edition) :- "Dandelion, vulgarly called piss-a-beds.

Descripts) It is well known to have many long and deep gashed leaves lying on the ground about the head of the roots; the ends of each gash or jay, on both sides looking downwards towards the roots: the middle rib being white, which being broken, yields abundance of bitter milk, but the root much more; from among the leaves, which always abide green, arise many slender, weak, naked foot-stalks, every one of them bearing at the top one large yellow flower, consisting of many rows of yellow leaves, broad at the points; and nicked in with deep spots of yellow in the middle, which growing ripe, the green husk, wherein the flowers stood turns itself down to

the stalk, and the head of down becomes as round as a ball; with long seed underneath bearing a part of the down on the head of everyone, which together is blown away with the wind or may be at once blown away with one's mouth. The root growing downwards exceedingly deep, which being broke off within the ground, will yet shoot forth again, and will hardly be destroyed where it hath once taken deep root in the ground.

Place) It grows frequently in all meadows and pasture grounds.

Time) It flowers in one place or another almost all the year long.

Government and Virtues) It is under the dominion of Jupiter. It is of an opening and cleansing quality and therefore very effectual for the obstructions of the liver, gall and spleen, and the diseases that arise from them, as the jaundice and hypochondriac, it opens the passages of the urine both in the young and old; powerfully cleanses imposthumes and inward ulcers in the urinary passage and by its drying and temperate quality doth afterwards heal them; for which purpose the decoction of the roots or leaves in white wine, or the leaves chopped as pot-herbs, with a few Alisanders and boiled in their broth are very effectual. And whoever is drawing towards a consumption or an evil disposition of the whole body; called Cachesica, by the use hereof for some time together, shall find a wonderful help. It helps also to procure rest and sleep to bodies distempered by the heat of ague fits or otherwise : The distilled water is effectual to drink in pestilential fevers, and to wash the sores. You see here what virtues this common herb hath, and that is the reason the French and Dutch so often eat them in Spring; and now if you look a little farther, you may see plainly without a pair of spectacles; that foreign physicians are not so selfish as ours are, but more communicative of the virtues of plants to people."<sup>95</sup>

Besides this he also wrote several medical works but his name will always be associated with his herbal. He wrote it to combine the ideas of astrology with those of the herbalist, something which few authors had done. He wrote a lot of nonsense about plants e.g. his ideas on the congealing of sap in plants during the winter, thus stopping growth and thinning out again as the sun 'declines' from the Tropic of Cancer. It seems that he knew he was talking nonsense but because he found it remunerative he continued to do it. Together with Peter Coles he published 'The

English Physician Enlarged' in 1653 which contained 334 medicinal plants illustrated by 176 woodcuts and had 369 'new' herbal remedies. It became known as Culpeper's British herbal' and went through five editions before 1698.<sup>96</sup> Less popular than Culpeper's numerous writings, but far more attractive are Coles' own two books 'Adam in Eden' 1657 and 'The Art of Simpling' 1656. In the latter he attacks Culpeper. This work is the only herbal which devotes a chapter, 'Plants as have operation upon the bodies of Bruit Beasts', to herbs useful to animals and which is full of curious folk-lore, e.g. that the swallow uses celandine and that an ass eats asplenium when it feels melancholy. It also contains a chapter on plants used in and against witchcraft.<sup>97</sup>

William Salmon (1644-1713) produced a work, published in 1676 'New London Dispensatory' which ran to eight editions by 1716, and in 1694 appeared the 'Pharmacopoeia Bateana', a translation from George Bate's 'Dispensatory'.<sup>98</sup>

The eighteenth century brought a crop of similar Dispensatories. John Quincy's of 1721 was one of the most popular, whereas Dr. Henry Pemberton's of 1746 was more erudite. Gray's 'Supplement to the Pharmacopoeia' 1818 was a very useful work in practical pharmacy. Many similar but less important works were published. The most important Scottish formularies were the 'New Dispensatory' of Dr. Lewis 1748, a translation into English of the Edinburgh Pharmacopoeia and the 'Edinburgh New Dispensatory' by Andrew Duncan junior in 1803.<sup>99</sup>

Edinburgh like many other cities had its own 'Pharmacopoeia pauperum' for the use of the poor, the first edition of which was published in 1746, five years after the Edinburgh Royal Infirmary opened in December 1741.<sup>100</sup>

The medical Act of 1858, Section 54 obliged the General Medical Council to publish, 'a book containing a list of key medicines and compounds and the manner of preparing them, together with true weights and measures by which they are to be prepared and mixed ..... to be called 'The British Pharmacopoeia' ..... to be altered, amended and republished as they (the Council) should deem necessary'. By the Medical Council Act of 1862 the British Pharmacopoeia would supersede the pharmacopoeias of London, Edinburgh and Dublin and in 1864 it was made official, with the publication of the first edition which had been prepared for the General Medical Council by a commission of experts. New editions quickly followed, the second edition in 1867

with an addendum in 1874, the third in 1885 with a further addendum in 1890, the fourth in 1898 with an 'Indian and Colonial Addendum' in 1900, for it was frequently used as the standard work in the Empire and, later, the Commonwealth countries. The fifth edition appeared in 1914 and contained about 140 crude vegetable drugs of which roughly a third were known and in general use before Galen's time, a third were added in the Middle Ages and after the discovery of America and the remainder added in the eighteenth and nineteenth centuries.<sup>101.102.</sup>

For example, acacia, aniseed, castor oil, coriander, juniper, myrrh, poppy and turpentine are all mentioned in the Egyptian medical papyri. The Egyptians also used some mineral remedies still employed such as alum, copper salts, sodium carbonate and bicarbonate, and possibly some arsenical compounds. Assyrian medical tablets refer to most of the Egyptian drugs as well as to others such as almond oil and liquorice. Early Indian medicine had a very extensive materia medica and cannabis indica (hashish or Indian hemp), candamonis, colognth, cassia and datura were all introduced from India. It is possible that mercury preparations were also of Indian origin. The medical folk-lore of the Greeks comes to us chiefly from Dioscorides who mentioned about 500 plants, some of which are still used and others now unidentifiable. Besides the Egyptian, Assyrian and Indian drugs mentioned above, these included aloes, ammoniacum, chomomile, cinnamon, cloves, dill, hyoxyamus, linseed, liquorice, male fern, mustard, pomegranate, rhubarb, rosemary, scammony, sesame, squill, staresacre, tragacanth and valerian. The Arabs derived their pharmacopoeias direct from the Greeks but also added many new drugs still included in the 1914 British Pharmacopoeia such as belladonna, caraway, cubebs, dandelion, nutmeg and senna. Drugs introduced from America include cinchona and ipecacuanha from Peru, arachis (ground-nut) oil, cascura, sugrada, capsium, catechu, copaiba, guaiac and jalap. Of the many additions made in the eighteenth and nineteenth centuries few were important but they include podophyllum from America and digitalis and in 1812, a drastic purgative from India - croton oil.<sup>103</sup>

A new phase in the preparation of the British Pharmacopoeia began in 1928 when a Selection Committee under the General Medical Council appointed a Pharmacopoeia commission of six members to be responsible for the preparation of the next edition which appeared in 1932. It was also recommended that a revision be made every ten

years. There were seven addenda between the 1932 and 1948 editions, the latter delayed because of the war. The seventh edition, 1948 was very laboriously rewritten using 'approved names' of drugs approved by the World Health Organisation and the United States Pharmacopoeia Revision Committee. A very notable addition in the seventh edition was that of penicillin.<sup>104</sup>

The sixth to the ninth editions successively eliminated crude vegetable drugs and added more synthetic ones and less than fifty vegetable drugs now remain. Those eliminated include :- ammoniacum, asapetida, cajuput, cannabis indica, cassia, catechu, colocynth, copaiba, croton oil, cubebs, guaiac, jalap, juniper, mustard, myrrh, scammony, serpentaria, spearmint, squill, stavesacre, valerian, clove, creosote, fennel, lavender oil, nut-meg and quassia.<sup>105</sup>

Despite all simplification and elimination, officially used drugs in materia medica and pharmacology are still divided into about fifty classes. From the historical aspect two very interesting classes of remedies are the vegetable bitters and the volatile or essential oils. The vegetable bitters are used to act on taste nerves as appetisers, causing saliva and gastric juice flow. The volatile oils are complex mixtures obtained from plants by distillation - like cinnamon, ginger and peppermint which are used to give a pleasant taste to medicines. There is an enormous increase in the use of organic compounds in the fields of anaesthetics and antiseptics as well as in general medicine and the face of pharmacopoeia has changed completely in a relatively short period.<sup>106</sup>

After the seventh edition was published the General Medical Council, by the 1950 Medical Act, recommended that the interval between editions be reduced to five years because of rapid pharmaceutical and pharmacological progress, and also recommended that a precise date should be stated for when a new pharmacopoeia was to come into force.<sup>107</sup>

The eighth edition in 1953 gives tables of drugs and preparations in English with the abbreviated Latin title retained as a synonym. Capsules of the flexible and hard types, described as 'a medicament enclosed in a shell' constituted a new group. An addendum was published in 1955 and the ninth edition in 1958 contains about 160 new monographs with about 100 previous ones deleted. Drugs for sedation, and radioactive chemicals for oral administration had a much more prominent position. An

addendum appeared in 1960 and the tenth edition in 1963 with further addenda in 1964 and 1966. The eleventh edition appeared in 1968, coming into force on 3rd March, 1969 with an addendum in 1969 coming into force on 1st June, 1970.<sup>108.109.</sup>

The eleventh edition of 1968 contains 1149 monographs, 150 more than the previous edition. The new ones cover a wide range of topics, notably synthetic drugs, antibiotics and biological materials together with preparations such as capsules, injections and tablets. An interesting side note is that the official name of the drug 'Acetylsalicylic Acid' has been changed to Aspirin.<sup>110</sup>

Under the 'Medicines Act' of 1968 responsibility for the production of the British Pharmacopoeia has now been transferred from the General Medical Council to the Health Ministry and to the Medicines Commission established under the act.<sup>111</sup>

The British Pharmacopoeia is an official work on the preparation of standard drugs which are in current use, and must necessarily only contain substances, the reliability of which is in no doubt. But new drugs which have passed laboratory tests must be tried out, so in 1903 the Council of the Pharmaceutical Society of Great Britain decided there was a need for a work of reference which would indicate not only official drugs but also drugs which have not become official and some drugs which are still used though excluded from the current British Pharmacopoeia. As a result the first 'British Pharmaceutical Codex' was produced in 1907, drugs not in the British Pharmacopoeia being labelled B.P.C. Its aim was stated as being to make available, in one volume, accurate information "respecting all drugs and medicines in common use throughout the Empire, including also the principle substances and preparations which are official in the Pharmacopoeias of France, Germany and the U.S.A.;" as well as those described in the British Pharmacopoeia. Further editions were published in 1911, 1923, 1934, 1949, 1954, 1959, 1963 and 1968. At the request of the British Pharmacopoeia Commission, the Council of the Pharmaceutical Society agreed in 1959 to publish the Codex to coincide with the British Pharmacopoeias i.e. every five years; similarly with the British National Formulary.<sup>112. 113.</sup>

'A Companion to the British Pharmacopoeia' was published in 1864 by Peter Squires, aiming at comparing the strengths of dosages in the new British Pharmacopoeia with those in the old Edinburgh, Dublin and London and also U.S.A. pharmacopoeias, giving special attention to weights and measures because he thought the

General Medical Council's instructions would lead to confusion.<sup>114</sup>

The 'British National Formulary' is compiled by the British Medical Association and the Pharmaceutical Society of Great Britain and is aimed to be helpful in connection with the National Health Service. The basis adopted is to give a range of preparations and standard formulae in general use. The first edition appeared in 1949 and the latest, the eighth in 1968. Publication is now designed to coincide with that of the British Pharmacopoeia and British Pharmaceutical Codex.<sup>115</sup>

'The Extra Pharmacopoeia' (Martindale) was first issued in 1883 by a pharmacist William Martindale (1840-1902) in conjunction with Dr. W.W. Westcott. Its function was to provide medical men and pharmacists with practical and up-to-date information on new therapeutic methods to supplement those on the British Pharmacopoeia. It has now run through twenty-five editions and is published by the Pharmaceutical Society of Great Britain.<sup>116</sup>

Hospitals in the eighteenth and nineteenth centuries were taken up by the idea of having their own pharmacopoeia since this would enable them to have a bulk stock made up of the most-used drugs for easy and ready use. As early as 1730 St. Bartholomew's had its own printed pharmacopoeia; St. George's in 1768, Guy's 1803, King's College 1835, and in the nineteenth century scores of provincial hospitals issued their own printed pharmacopoeias. The Royal Infirmary in Edinburgh had its third edition by 1758 and the 'Infirmary Pharmacopoeia' continued until relatively recent times. Other notable ones were those of Glasgow Royal Infirmary and Rotunda (Dublin) and Belfast.<sup>117</sup>

The 'British Homoeopathic Pharmacopoeia' had its first edition in 1870 which was modelled as far as possible on the British Pharmacopoeia of 1867. Homoeopathic medicine had been revived by Dr. C.F.S. Hahnemann of Saxony and was taken up by the British Homoeopathic Society. It believed that if a soluble drug was put through repeated dilution with vigorous shaking then the remedy developed greater powers of cure without the undesirable side effects of higher doses. Further editions appeared in 1876 and 1882; when it ceased publication.<sup>118</sup>

The Pharmaceutical Society first produced the 'British Veterinary Codex' in 1956 and other editions and supplements have been published since. The British Medical Association in 1949 first published the 'Dental Practitioner's Formulary'

with regular editions since.<sup>119</sup>

Most countries now possess national pharmacopoeias - Argentina, Austria, Belgium, Brazil, Denmark, Egypt, Finland, France, Germany, Greece, Hungary, Netherlands, Norway, Paraguay, Poland, Portugal, Rumania, Spain, Sweden, Switzerland, Turkey, U.S.S.R., U.K., U.S.A., Venezuala and Yugoslavia all have them. The one in longest continued existence is the Danish Pharmacopoeia which was established in 1722.<sup>120</sup>

As long ago as 1874 it was suggested that there should be world uniformity in standards for potent drugs. The idea received support at the 1902 international conference and an agreement was ratified in 1906. No progress was made with it until a second conference was held in 1925 when a further agreement was made and ratified in 1926. The first volume 'Pharmacopoeia Internationalis' was finally published in 1951 by the World Health Organisation, part of the United Nations. It is aimed at eliminating or minimising differences in natural pharmacopoeial standards. The first edition contained over two hundred drugs and many others have been added in subsequent supplements.<sup>121.122.</sup>

The evolution of the herbal and pharmacopoeia has been a relatively slow development. From earliest times man found a use for herbs as medical remedies. Because animal and mineral remedies were also useful they were included in the herbals. Early descriptions of the use of remedies were usually just a list containing a description of the substance and where it can be obtained, the preparation, use and dosage. A number of writers of these 'drug-lists' e.g. Nicandros of Colophon and Andromachos put the descriptions in verse form in order to avoid alterations in them during copying. After the first century A.D. it became common practice to undertake some sort of organisation of the lists, whether by putting in alphabetical order or classifying in similar groups. After the time of Galen, drawings in European works became highly stylised and did not regain their individuality and accuracy until the sixteenth century. One of the most dominant features of many herbals was the belief in the Hippocratic humours, the four elements and principles:- Blood associated with fire which is hot and dry; yellow bile, air, hot and wet; phlegm, water, cold and wet; black bile, earth, cold and dry. Treatment involved restoring the balance between opposite pairs of principles i.e. hot-dry and cold-wet, by the application

of the appropriate drug.<sup>123</sup> Some herbalists e.g. Culpeper, had an equally strong belief in the effect of the celestial bodies upon specific organs and diseases and thus astrology was also incorporated in the tradition. If a person had a disease which was supposedly under the influence of a particular planet then treatment would be by administration of the drug which was under the influence of a planet with opposite characteristics. Many herbals were written however without these ideas but with the belief that a specific herb had a specific effect on the body and therefore on a specific disease. Although herbals were primarily designed to include herbal remedies, chemical remedies became increasingly common in herbals and this trend has continued into the modern pharmacopoeias where the majority of drugs are purely chemical in nature.

The different traditions all played an essential part in the history of the herbal and pharmacological development, and representative drugs of all the main traditions still appear in the national pharmacopoeias today. However our pharmacopoeias are very much more indebted to the Greek, Latin and Arabic traditions than to the Sanskrit and Chinese traditions with which there has been much less contact. The Chinese and Sanskrit traditions have continued in existence, paralleling the developments of Western Europe and although there are many links, these are relatively minor in nature and our knowledge of their tradition is relatively insignificant and calls for a great deal of research. The Graeco-Roman tradition following on from those of Babylonia and Egypt, forms the basis of European development. When Western Europe was in the Dark Ages, Islam maintained and continued the tradition until the Renaissance when the rest of Europe again became scientifically minded and took over from there.

The change from the widespread use of herbals to the general use of official pharmacopoeias was a slow one and for about three centuries they coexisted, although the emphasis was continually shifting towards the pharmacopoeia which unlike the herbals only describe the drugs and their preparation and not their effects. At the same time the herbal was giving way to the botanical floras in which plants were described for their own sake, although the production of herbals on a minor scale has continued until the present day. How much medicine and botany are indebted to each other is very debatable. The two disciplines basically diverged from the

seventeenth century onwards with the appearance of pure botanists but up until that time most herbalists were physicians who had been led to study botany on account of its connections with the art of healing. With the advent of the pharmacopoeias however the necessity for this gradually diminished thus causing a break in the connections between the two sciences.

The pharmacopoeia now is of vital importance to every branch of the medical profession in every country but it is well to remember the enormous debt that it owes for its establishment to the herbal writers of the last three millenia.

---

Bibliography.

1. Encyclopaedia Britannica.
2. Chamber's Encyclopaedia.
3. Journal of Hellenic Studies 47. 1929 pl-62 C. Singer 'The Herbal in Antiquity'.
4. A. Arber. Herbals, their origin and evolution.
5. Sigerist. A History of Medicine.
6. Encyclopaedia Britannica.
7. Journal of Hellenic Studies, ibid.
8. G. Sartan. A History of Science. Vol. 1.
9. Encyclopaedio Britannica.
10. W.P.D. Wightman. The Emergence of Scientific Medicine (1971)
11. R. Taton. A General History of the Sciences.
12. G. Sartan. A History of Science. Vol. 1.
13. Sigerist, ibid.
14. Journal of Hellenic Studies, ibid.
15. ibid.
16. ibid.
17. G. Sartan. Introduction to the History of Science.
18. ibid.
19. ibid.
20. Journal of Hellenic Studies, ibid.
21. G. Sartan. Introduction to the History of Science.
22. Journal of Hellenic Studies, ibid.
23. ibid.
24. ibid.
25. G. Sartan. Introduction to the History of Science.
26. Journal of Hellenic Studies, ibid.
27. A. Arber, ibid.
28. R. Taton, ibid.
29. G. Sartan. Introduction to the History of Science.
30. ibid.
31. ibid.
32. ibid.

33. Alkindi Medical Formulary or Aqrabadhin (Levey).
34. G. Sarton. Introduction to the History of Science.
35. ibid.
36. ibid.
37. ibid.
38. ibid.
39. ibid.
40. ibid.
41. ibid.
42. ibid.
43. ibid.
44. ibid.
45. ibid.
46. ibid.
47. Encyclopaedia Britannica.
48. A. Arber ibid.
49. ibid.
50. Singer and Underwood A short History of Medicine.
51. ibid.
52. A. Arber ibid.
53. ibid.
54. ibid.
55. ibid.
56. Bulletin of the Institute of the History of Medicine Vol. 3. P483f. E.W. Emmar  
'The Bordianus Manuscript'.
57. A. Arber, ibid.
58. Bulletin of the Institute of the History of Medicine Vol. 30 P7-31 A. Berman.
59. Grene. The Death of Adam.
60. Singer and Underwood. ibid.
61. Rohde The Old English Herbals.
62. ibid.
63. ibid.
64. A. Arber. ibid.

65. *ibid.*
66. *ibid.*
67. Rohde *ibid.*
68. Arber *ibid.*
69. Arber *ibid.*
70. Rohde *ibid.*
71. Singer and Underwood, *ibid.*
72. *Journal of Hellenic Studies*, *ibid.*
73. Rohde, *ibid.*
74. G. Sarton. *Introduction to the History of Science.*
75. Matthews. *History of Pharmacy in Britain.*
76. *ibid.*
77. Singer and Underwood, *ibid.*
78. Matthews, *ibid.*
79. *ibid.*
80. Singer and Underwood, *ibid.*
81. Matthews, *ibid.*
82. *ibid.*
83. *ibid.*
84. *ibid.*
85. *ibid.*
86. *ibid.*
87. *ibid.*
88. Singer and Underwood, *ibid.*
89. Matthews, *ibid.*
90. *ibid.*
91. Singer and Underwood, *ibid.*
92. Rohde, *ibid.*
93. Matthews, *ibid.*
94. *Culpeper's Complete Herbal and English Physician Enlarged (1831 edition).*
95. *ibid.*
96. R. Taton, *ibid.*

97. Rohde, *ibid.*
  98. Matthews, *ibid.*
  99. *ibid.*
  100. *ibid.*
  101. Singer and Underwood, *ibid.*
  102. Matthews, *ibid.*
  103. Singer and Underwood, *ibid.*
  104. Singer and Underwood, *ibid.*
  105. *ibid.*
  106. *ibid.*
  107. *ibid.*
  108. *ibid.*
  109. The British Pharmacopoeia. 1968.
  110. *ibid.*
  11. *ibid.*
  112. Singer and Underwood, *ibid.*
  113. Matthews, *ibid.*
  114. *ibid.*
  115. *ibid.*
  116. *ibid.*
  117. *ibid.*
  118. *ibid.*
  119. *ibid.*
  120. Encyclopaedia Britannica.
  121. *ibid.*
  122. Matthews, *ibid.*
  123. J.D. Bernal Science in History, Volume 1.
-