

## I

## Introduction: botany, medicine and horticulture

There are many books on the history of biology, or of botany as a separate science, but it is not easy to distil from them certain relevant ideas which I believe to be important in understanding the shape of modern botanical science. Indeed, I have been forced to the conclusion that much of the written account of the history of biology is liable to be misinterpreted by many readers. Since I was myself until recently guilty of such misinterpretation, I feel that it would be useful to clarify the matter here, before we start on the particular history of the Cambridge School of Botany and the Cambridge Botanic Garden.

It is common knowledge that the science of botany developed from a study of plants as useful to cure diseases, and that the oldest surviving Botanic Gardens, at Padua and Pisa in Italy, were founded in the middle of the sixteenth century as 'herb gardens' whose primary purpose was to grow the medicinal plants important to the medical science of the time. The foundation of such gardens in connection with universities and centres where there were flourishing medical schools proceeded quite rapidly in the late sixteenth and early seventeenth centuries, and the first British Botanic Garden was founded in 1621 in the University of Oxford. The background to seventeenth- and eighteenth-century botany can be found in the many 'Herbals' or illustrated books devoted to the identification and description of medically useful plants, a tradition which occupied the late medieval and Renaissance periods in Europe, and stamped the Linnaean botany which succeeded it with an individual shape which persists in the botanical taxonomy of the present day. This medical background to botany is well described by Arber (1912); its effect in shaping the modern classification of the flowering plants I have myself discussed (Walters 1961).

Whilst the origins of botany in medicine are well described and documented, there is surprisingly little discussion in the standard works of the reasons why botany developed in this way. It is, of course, true that a chronological sequence of events in history may be known and relatively undisputed, whilst the interpretation of the

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same history can remain obscure and controversial. The difficulty enshrined in the aphorism '*post hoc, ergo propter hoc*' is obvious enough, in history as in experimental science. Yet a medical origin for European botany is not self-evidently necessary, and the sequence of events does demand some explanation. In particular, it seems reasonable to ask why agriculture and horticulture, both ancient and very important 'sciences' dealing with plants, contributed little or nothing to modern botany (or indeed to biology as a whole) until relatively recent times. Bound up with this question are two larger questions, which take the enquiry further back in history. One concerns the origins of biology as a recognisable, separate science, and its relation to botany and zoology. The other has even wider ramifications, and concerns the difference between observational and experimental science.

Let us examine a little more closely the relation between biology and medicine. As we see it now, in terms of twentieth-century science, medicine might look like a peculiar sort of applied biology. Man is an animal, and animals, directly or indirectly, are dependent on plants for their food. Indeed, there is no logical reason why today we should not go to a Department of Applied Biology to seek 'medical' advice. But this is not the structure we have, and the reason is embedded in history. To understand the shape of science in any modern university we must go back to the beginnings of universities in Europe in the twelfth and thirteenth centuries. As Green (1969) explains in his very readable survey of the history of British universities, in the twelfth century 'monastic and cathedral schools were already in existence but . . . the monasteries . . . were no longer the centres of culture they had once been . . . Those who wanted to study and to teach gathered together in groups independent of the monastic and cathedral schools and, living as often as not in a strange city, found it necessary to create an organisation, a guild, a *universitas societas magistrorum discipulorumque*, to safeguard their position in the community, to defend their privileges and to order their own lives. It was in this way that universities came into existence and teaching became institutionalised.' Green continues: 'the rapid growth of the medieval universities testified to the social and intellectual need which they were meeting. They brought into existence an entirely new class of educated men, academics and intellectuals . . . If in the first instance the universities trained a clerical caste which dominated the culture and government of western Europe, ultimately they helped also to instruct the laymen, lawyers and doctors in particular, who were to challenge ecclesiastical control.'

Against this background we can imagine a medieval university scholar with an interest in what we would now call 'natural his-

tory'. The formal courses of study open to him were in theology, law and medicine. Only in medicine could he pursue his interest, and even there only, effectively, in botany. Thus botany grew as an answer to the question: what are all these different plants growing wild, and which of them are useful to cure diseases and injuries? It is significant that zoology did *not* grow in answer to a parallel question. Medicine, in fact, asked a very different question about animals, which could be put as follows: how closely does man resemble the other animals, and is there, then, a hierarchy of animals, with Man at its head, a hierarchy which culminates in Man? This is the familiar Aristotelian '*scala naturae*', a very potent force in zoological thought which has no traditional counterpart in botany.

It is for these reasons misleading to think of 'biology' as having originated from medicine. Certainly both botany and zoology had such origins, but they were separate, and the origin of botany as a science is very much older than zoology. This is very clearly illustrated by the history of the two Cambridge Chairs; as we shall see, the first Professor of Botany was appointed in 1725, whilst the university had to wait until 1869 for the zoological chair, which was eventually founded in that year as the 'Chair of Zoology and Comparative Anatomy'. Over-simplifying greatly, one could sum up the difference by saying that, in the late medieval university, you could, if you were a naturalist, study something recognisably the science of botany, but any 'zoological' study would be more or less indistinguishable from medicine, and would be dominated by human anatomy and physiology.

We are now equipped to give a tentative answer to the question about the exclusively medical origins of botany. Theoretically, an applied science of botany could have arisen from man's total experience of using plants, not simply from their known or presumed medicinal uses. Indeed, if we study the languages and cultures of primitive tribes, we find quite elaborate systems of botanical naming and classification ('folk taxonomies') which *do* cover the total value of the plant world to man – food, poison, shelter, religious ceremony, etc – and not simply medicine. Why did medicine dominate?

The answer seems to lie in the class structure of medieval society. The Church, law and medicine were the three great professions for which the medieval university trained its students. To that extent the ancient universities were more akin to modern polytechnics, training men to fit the available careers in the society of the time, than to the 'liberal University' of the eighteenth century which pursued learning for its own sake. [It is, perhaps, the strength of Oxbridge that it retains the tradition of vocational training side by

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side with the liberal, academic tradition: the tension between the two is particularly fruitful in the natural sciences.]

With these considerations in mind, it is extraordinarily interesting to turn to Theophrastus, botanical pupil of Aristotle, and see what plant science contained, as known to the ancient Greeks in the fourth century B.C. The *Enquiry into Plants* (trans. Hort 1916) consists of nine books of 'applied botany', covering all wild and garden plants and their use by man. The surprise is that only a part of *one* of these nine books, the last in fact, is devoted to the medicinal value of plants. The Aristotelian School was quite free from medical bias and dominance, and any botanical science directly descended from Theophrastus without distortion would have incorporated experimental agriculture and horticulture in its tradition without question. Medical dominance, visible in the writings of Dioscorides in the first century A.D., far from 'stimulating' the development of botany, might be thought on this analysis to have captured and stultified it. In particular, it favoured what we might now call botanical taxonomy and discouraged other, equally legitimate, forms of enquiry. We shall see some of the interesting implications of this as they are worked out in the history of Cambridge botany.

How does this fundamental difference between the medical origins of botany and zoology relate to the difference between 'observational' and 'experimental' science? Here we have one of the most interesting, and at the same time most complex, of issues which are relevant to our present thesis. Our starting-point is the demand from medicine that the botanist (or 'herbalist') should accurately describe and identify *all* plants, so that their medicinal properties can be assessed. Because medicine had (and still has) a privileged status in society as a whole and in the institutions of higher learning in particular, it was always respectable for naturalists to herborise and know their plants in the field. No such continuous tradition is present in field zoology. Indeed there is no term 'to zoologise', equivalent to the term 'to botanise'. The sixth Professor of Botany in Cambridge, Charles Cardale Babington, published in 1843 a *Manual of British Botany* which is, purely and simply, a Flora of the British Isles, a technical work describing and identifying all higher plants found in Britain. Such a narrow interpretation could not operate in university Zoology. As we have seen, there *was* in fact no Professor of Zoology in Cambridge when Babington published his *Manual*, and the subject was still a part of Comparative Anatomy. A zoology born of comparative anatomy and linked to, even dominated by, studies of human anatomy and physiology, was much more naturally inclined to consider together form and function, observation and experiment, than was the traditional observational botany.

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There is another aspect of the difference between the two traditions which has had a great effect on the way botanists and zoologists think and write today. This is the Aristotelian '*scala naturae*', an evolutionary picture which fixed a zoological hierarchy with man as the highest animal at the head. No corresponding idea is fixed in pre-Darwinian botany, and botanists even today are free to be sceptical of both the broad pictures of the course of organic evolution and of the more rigid Darwinian orthodoxies which attempt to explain them. Both these themes – the rise of experimental science, and the impact of Darwinism – find their place in the closing chapters of the book.





Figure 1 *Geranium sanguineum* and the Devil's Dyke where John Ray first recorded it in 1660.

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## Ray and the herborising tradition

A history of Cambridge botany must necessarily be selective, especially when it deals with those more distant periods for which it is partly an accident of historical research which figures seem of special importance. There can, however, be no doubt about the contribution of one man in establishing the continuous botanical tradition which survives and even flourishes to the present day. That man is John Ray, son of an Essex blacksmith, who was admitted a Sizar in Catherine Hall (now St Catherine's College) in 1644 at the age of 17 years, and transferred to Trinity College in 1646, where he was elected a Fellow in 1649. There he held a selection of teaching and administrative posts until the year 1662, when, like many of his colleagues, he refused assent to the Act of Uniformity and was forced to resign his College appointments and leave the university.

The excellent, scholarly biography of John Ray written by Charles Raven in 1942 (2nd edn 1950) and the detailed bibliography by Keynes (1951) provide abundant material from which to assess the character and scientific ability of this very remarkable man. It would be inappropriate in a limited space to attempt even a condensed general account of his achievements, but there are several aspects of Ray's life and work which are highly relevant to the special contribution he made to botany, and Cambridge botany in particular, and which we should at least briefly mention.

To understand Ray's contribution, we need to see the background of culture and factual knowledge available to him. The explanation in the Preface to the 'Cambridge Catalogue' – his Cambridgeshire Flora, published in 1660, which we describe below – as to how he came to write the book is really so good that we should let it speak for itself (original in Latin; trans. Ewen & Prime 1975).

I became inspired with a passion for Botany, and I conceived a burning desire to become proficient in that study, from which I promised myself much innocent pleasure to soothe my solitude. I searched through the University, looking everywhere for someone to

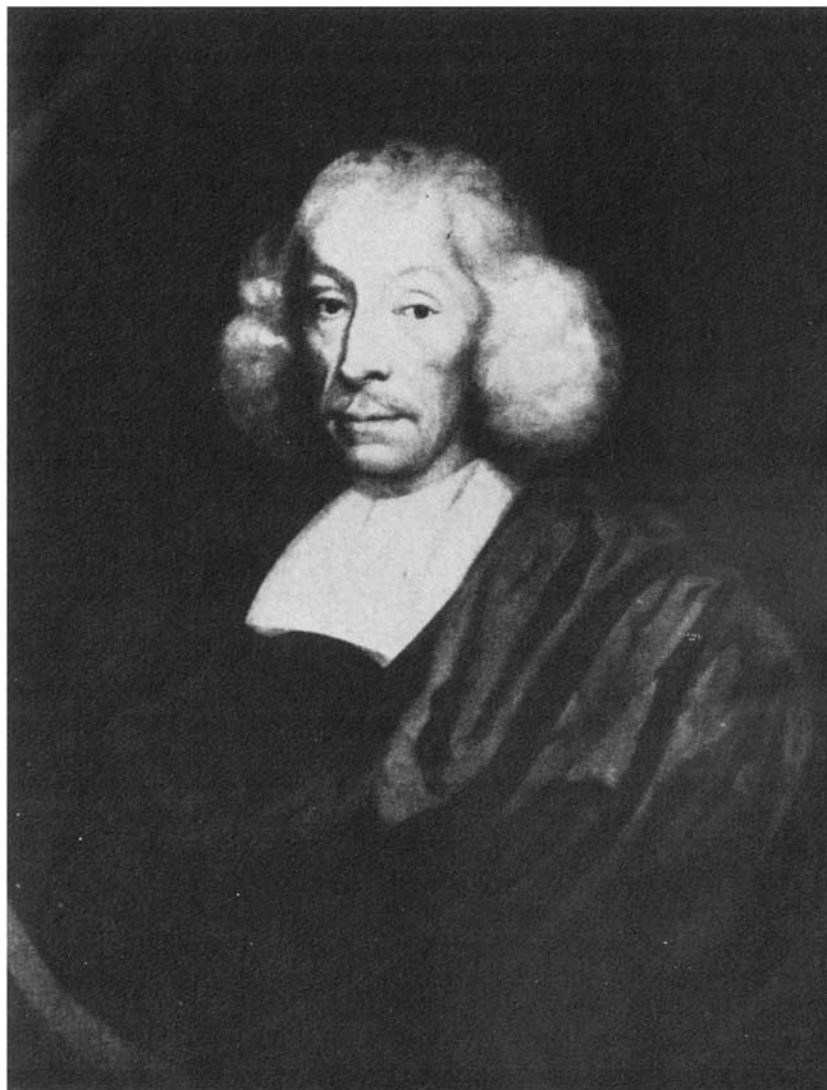


Figure 2 John Ray: an engraving by G. Vertue, 1713, from a portrait by W. Faithorne.

act as my teacher and my guide, who would instruct me and, so to speak, initiate me, so that I would be able to enjoy the benefit of his advice whenever I needed it. But, to my astonishment, among so many masters of learning and luminaries of letters I found not a single person who was deeply versed in Botany, and only one or two who had even a slight acquaintance with the subject. . . . What was I to do in this situation? Should I allow the flame of my enthusiasm to be

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quenched or diverted to some other field of study? I decided that this must not happen . . . Why should not I, endowed with ample leisure, if not with great ability, try to remedy this deficiency so far as my power permitted, and advance the study of Phytology, which had been passed over and neglected by other men?

So far as the University was concerned, it is clear that Ray could get little help. Indeed, it becomes apparent when one inspects the copious bibliography (*Explicatis*) attached to the 'Cambridge Catalogue' that Ray found relatively little help from any previous botanical work published in England. There were in fact only four important English botanical authors available to him – two from the previous century and two from nearer his own time. The first of these chronologically was a Cambridge man, William Turner, often called 'the Father of British Botany', who studied medicine at Pembroke College, Cambridge and published in 1551 the first part of his *New Herball*. Ray obviously found this book useful, and commends Turner as 'a man of sound learning and judgment'. In the words of John Gilmour (1944), Turner's *New Herball* provided for the British medical profession 'for the first time . . . a volume in their own tongue which gave them some reasonably accurate information on the plants available for their work'.

Ray had far less respect for the other famous botanical writer in sixteenth-century England, John Gerard, whose *Herbal* dates from 1597. According to Raven (1950, p.74), 'the charm and interest of the book are apt to blind its readers to its defects, the attachment of plates to the wrong descriptions, the reckless multiplication of species, the credulity and errors, the false claims and statements, and the blunders due to ignorance of Latin'. Ray realised these defects in the original work, and used the *Herbal* in the much improved edition made by Thomas Johnson in 1633, speaking appreciatively of Johnson's worth as a botanist.

The difference between Gerard and Johnson, both practising medicine in London, is most obvious in their attitude to wild plants. To Gerard, the successful surgeon, the many plants he knew and cultivated in his London garden were of interest only for their medicinal value. Johnson, on the other hand, combined his profession as an apothecary with a real enjoyment of field botany, and might be said, together with his London friends, to have created the tradition of herborising which Ray so successfully continued. Johnson's *Iter* and *Descriptio*, published in 1629 and 1632, are choice botanical classics now available in translation (ed. Gilmour 1972).

Before we leave Gerard, we should record a curious piece of evidence, preserved in the Lansdowne manuscripts in the British Museum, about the earliest attempt to found a Garden in



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Cambridge. This is a letter, drafted by Gerard in 1588 for Lord Burghley, then Chancellor of the University ‘to signe for ye University of Cambridge for planting of gardens’. It commends Gerard himself to the University as a suitable person to look after their Botanic Garden ‘by reason of his travaile into farre countries his great practise and long experience’. There is no evidence that the University ever received such a letter, and the effort came to nothing.

The most modern work available to Ray in English was by John Parkinson, whose *Theatrum Botanicum* was published in 1640. It is, according to Raven (1947), ‘an old man’s book, diffuse and often ungrammatical in its long and ill-penned sentences’, but nevertheless a work revealing ‘the authentic passion for a garden and the quiet wisdom of a gardener, than which there are a few things more precious’. His earlier work with the punning title *Paradisi in sole Paradisus terrestris* (The Park on earth of the Park in sun), published in 1629, has a good claim to be the first English gardening book: it represents an important and already separate tradition of plant lore which increasingly diverged from the medically-dominated academic botany, as we shall see in later chapters.

With this background, we can now look at the nature of Ray’s contribution to English botany in the ‘Cambridge Catalogue’. It is a small volume entitled *Catalogus plantarum circa Cantabrigiam nascentium*, published in Cambridge by John Field, University Printer. The text is in Latin throughout, except where Ray gives a Cambridgeshire locality, when the sentence or phrase is given in italics in English. These English phrases have delighted generations of Cambridge botanists, to whom until recently they were the only immediately comprehensible parts of the text. Now we have the very useful translation by Ewen & Prime (1975) which makes Ray’s Flora accessible to all.

Ray’s purpose in writing the book is clear from the quotation already given from his Preface. He was anxious to do something to promote a proper study of Botany in the University, and had found from his own experience that herborising with friends was an excellent way of combining scientific study with a healthy outdoor pursuit. He hoped that what he had learned would help others coming after him ‘so that they, perhaps less patient of labour than myself, would not be deterred by the endless succession of difficulties, and falter in their studies’.

Bound up with this very laudable aim to share his enthusiasm with others of like interest, there was undoubtedly also a very real desire on Ray’s part to rescue botany from a neglect which was the more serious because other branches of ‘natural philosophy . . . were flourishing and making progress in our midst’. The Royal

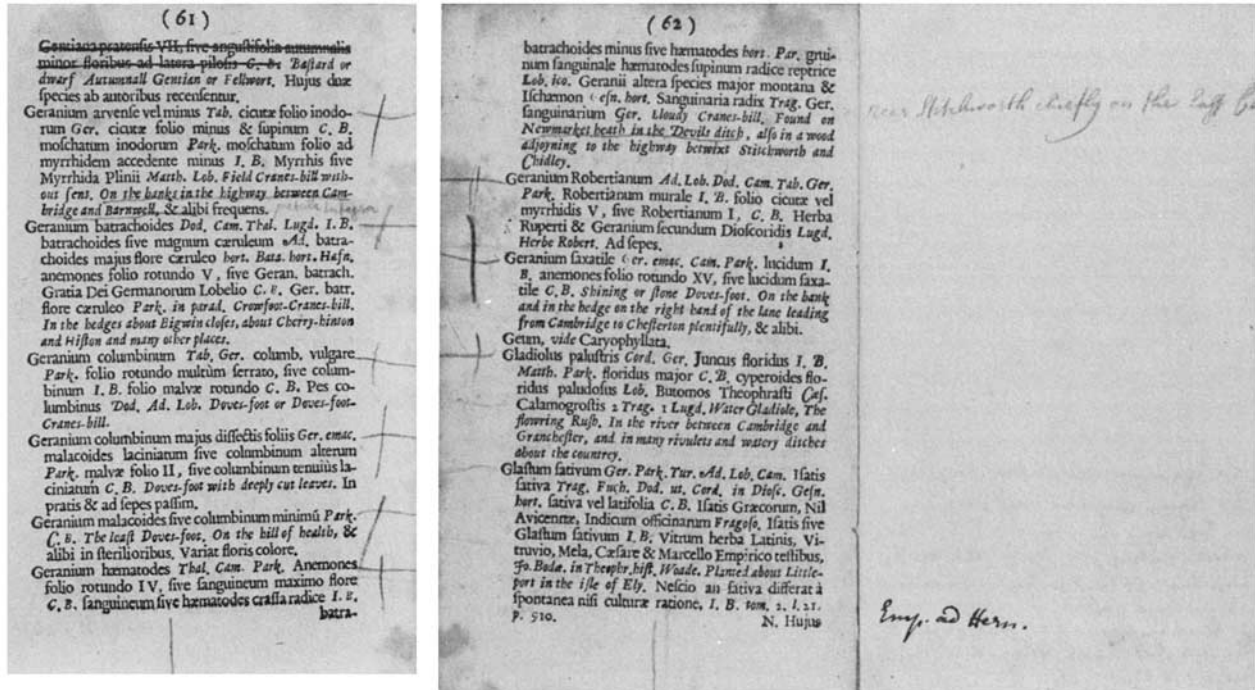


Figure 3 Pages from John Martyn's interleaved and annotated copy of Ray's *Catalogus*, with the reference to *Geranium sanguineum*.

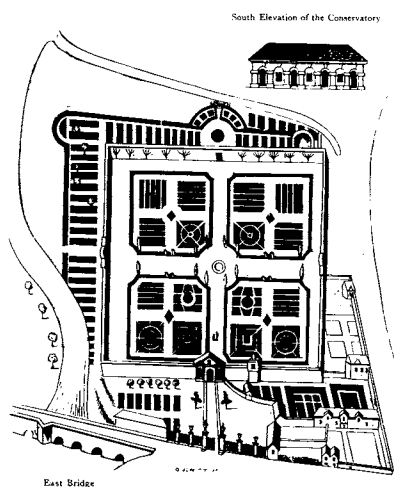


Figure 4 Loggan's Plan of the Oxford Botanic Garden in 1675.

Society was founded in 1662, and Ray was to see in his own lifetime a remarkable burst of what we would now call 'natural science'. Ray himself was elected a Fellow of the Royal Society in 1667, and Isaac Newton began his career as a young student at Trinity during Ray's time there as a Fellow. Part of the neglect which concerned Ray was due to the absence of any formal teaching of botany – or any other science if medicine be excepted – in the University. During Ray's time at Trinity there were in fact only seven Professors in Cambridge: two of Divinity, and one each of Arabic, Greek, Hebrew, Civil Law and Medicine.

Oxford, by contrast, was well provided for; the Botanic Garden there was founded in 1621, the earliest in Britain, and Robert Morison was appointed Professor of Botany in 1669. There is no evidence that Ray visited the Oxford Botanic Garden before 1669, but in May of that year he was there, and, according to Raven (1950, p. 150) 'impressed by the work of Jacob Bobart junior and William Browne of Magdalen College, . . . at the Botanic Garden, of which Bobart had just succeeded his father as custodian'. Apparently the young Bobart told Ray on this occasion that the progeny he had raised from seed of 'a Cowslip' contained both