Dutch knowledge' (*Rangaku*, from 'Oranda', the Japanese name for Holland). A Japanese screen made about 1625 shows a world map derived from Plancius's map of 1592, while a Blaeu world map of 1648 was soon in the possession of the shogun. Curiosity developed, and some Japanese scholars began to visit Nagasaki to learn more about the West. Arashiyama Hoan, for example, studied western medicine there and published a textbook on the subject in 1683. A section from the Dutch translation of Hübner's geography was published in Japanese in 1772. A group of Japanese physicians translated an anatomy textbook from Dutch and published it in 1774. Following his visit to Nagasaki, the scholar Otsuki Gentaku published an introduction to western knowledge in 1788. Only around the year 1800 did the specialists in Rangaku discover that Dutch was not necessarily the most useful western language to be learning.[55]

Like the Europeans, the Chinese and Japanese dealt with exotic knowledge by translating it into their own categories and finding a place for it in their own systems of classification. It is with the problems of classifying knowledge that the following chapter will be concerned.

[55] Inno (1994), fig. 11.22, 434.

5

Classifying Knowledge: Curricula, Libraries and Encyclopaedias

> The categories of human thought are never fixed in any one definite form; they are made, unmade and remade incessantly: they change with places and times.
>
> Durkheim

One of the most important elements in the elaboration of knowledge described in the last chapter was its classification. It is time to look at this topic in more detail, whether at attempts to fit new knowledge into traditional frameworks or at the opposite theme of the ways in which the frameworks changed over the long term in the course of attempts to accommodate novelties. As Durkheim pointed out, systems of classification 'are made, unmade and remade incessantly'.[1]

The anthropology of knowledge

Where the last chapter offered a geography of early modern knowledge, this chapter will sketch what might be called its 'anthropology', since from Durkheim onwards anthropologists have developed a tradition of taking other people's categories or classifications seriously and of investigating their social contexts. The tradition includes such classic studies as Marcel Granet's *Chinese Thought* (1934) and *The Savage Mind* (1962) by Claude Lévi-Strauss. Granet, for example, described Chinese categories such as Yin and Yang as examples of concrete or 'prelogical' thought. Lévi-Strauss rejected the idea of the pre-logical but he too stressed the concrete categories of so-called primitive peoples such as the American Indians, who make a distinction

[1] Durkheim (1912), 28; cf. Worsley (1956).

akin to our contrast between 'nature' and 'culture' via the categories of the 'raw' and the 'cooked'.[2]

Western category systems of tbe early modern period are so different from our own as to require an anthropological approach, as Michel Foucault realized in the 1960s. We have inherited some of the terminology, words like 'magic' or 'philosophy', for example, but these terms have changed their meaning as the intellectual system has changed. To avoid being deceived by these 'false friends', we need to defamiliarize ourselves with European categories, to learn to regard them as no less strange or constructed than those of (say) the Chinese. Foucault made this point with the aid of a fable borrowed from Jorge Luis Borges about the categories of animal to be found in a Chinese encyclopaedia – animals belonging to the emperor, those drawn with a fine camel-hair brush, those which from far off look like flies, and so on. The fable vividly illustrates the apparent arbitrariness of any system of categories when it is viewed from outside.[3]

In the last generation, a number of cultural historians, many of them working on the early modern period, bave turned to the study of systems of classification.[4] Early modern Europe was itself a period of great interest in taxonomy on the part of scholars such as the Swiss Conrad Gesner in his natural history of animals (1551), and Ulisse Aldrovandi of Bologna. The Swedish botanist Carolus Linnaeus may have been the greatest and the most systematic of the intellectual taxonomists, but he was not alone in his interests.[5] It is the taxonomy of knowledge itself, however, which is the main theme of this chapter, the taxonomy of taxonomies, concentrating on academic knowledge but attempting to place it in the context of alternative knowledges.

Varieties of knowledge

In early modern Europe, knowledge was classified by different groups in a number of ways. This section will discuss a few of the most common distinctions, bearing in mind the fact that the categories changed over time, and also that they were often contested, implicitly or explicitly, with different individuals or groups drawing their distinctions in different places. The distinction between more or less certain knowledge will be discussed in chapter 9 below.

[2] Granet (1934); Lévi-Strauss (1962, 1964).
[3] Foucault (1966), 54–5; cf. Elkanah (1981), Crick (1982); Zhang (1998), 19–24.
[4] Kelley and Popkin (1991); Daston (1992); Zedelmaier (1992); Kusukawa (1996); Kelley (1997).
[5] Foucault (1966); Olmi (1992); Koerner (1996).

One recurrent distinction was between theoretical and practical knowledge, the knowledge of the philosophers and the knowledge of the empirics, or as some said, 'science' (*scientia*) and 'art' (*ars*). A vivid example of the employment of these categories in a practical context comes from the building of Milan cathedral around the year 1400. In the course of its construction a dispute developed between the French architect and the local master masons. A meeting of the masons argued that 'the science of geometry should not have a place in these matters since science is one thing and art another'. To this argument the architect in charge of the enterprise replied that 'art without science' (in other words, practice without theory) 'is worthless' (*ars sine scientia nihil est*).[6]

Another recurrent distinction was the one between public and 'private' knowledge (not so much in the sense of 'personal' knowledge as in the sense of information restricted to a particular elite group). In this sense, private knowledge included the secrets of state (*arcana imperii*), discussed in the following chapter, as well as the secrets of nature (*arcana naturae*), the study of which was sometimes known as the 'occult philosophy'. Alchemical secrets, for example, were transmitted, sometimes in cipher, via informal networks of friends and colleagues or within secret societies. Technical secrets were shared within guilds of craftsmen, but outsiders were excluded. The link between 'mysteries' and *métiers* was more than an etymological one.[7]

The question of what kinds of knowledge ought to be made public was a controversial one, answered in different ways in different generations and in different parts of Europe. The Reformation was among other things a debate over religious knowledge in which Luther and others argued that it should be shared with the laity. In Italy, England and elsewhere, reformers of the law argued in a similar manner that laws should be translated into the vernacular so as to free ordinary people from 'the tyranny of lawyers'.[8] Some learned societies were more or less secret societies, while others, like the Royal Society of London, were concerned to make knowledge public. Over the long term, the rise of the ideal of public knowledge is visible in the early modern period, linked with the rise of the printing-press.[9]

A similar distinction was made between legitimate and forbidden knowledge, the *arcana Dei*, knowledge which should be kept secret not only from the general public but from humanity. The extent to which

[6] Ackerman (1949).
[7] Principe (1992); Eamon (1994).
[8] Hill (1972), 269–76; Dooley (1999), 83.
[9] Yates (1979); Stolleis (1980); Eamon (1994).

intellectual curiosity was legitimate rather than a 'vanity' or a sin was a matter of debate. The reformer Jean Calvin, for example, followed St Augustine in condemning curiosity, but in the seventeenth century, as we have already seen (26), the word 'curious' was often used as a term of approval to refer to scholars, especially if they were gentlemen.[10]

The distinction between higher and lower knowledge (*scientia superior* and *inferior*) made by the Dominican Giovanni Maria Tolosani in the 1540s is a reminder of the importance of hierarchy in the intellectual organization of knowledge in this period.[11] Male knowledge, including knowledge of the public sphere, was regarded, by males at least, as superior to female knowledge, more or less limited to piety and the domestic realm.

The distinction between 'liberal' and 'useful' knowledge was au old one which continued to be drawn in the early modern period, although the relative evaluation of the two kinds of knowledge was in the process of reversal, at least in some circles. 'Liberal' knowledge, such as knowledge of the Greek and Latin classics, was high in status in 1450 or even 1550, while merely 'useful' knowledge, of trade for instance, or processes of production, was low in status, just like the tradesmen and craftsmen who possessed it. Following a medieval classification which was still in use at this time, craftsmen were viewed by the upper classes as practitioners of the seven 'mechanical arts', traditionally specified as cloth-making, shipbuilding, navigation, agriculture, hunting, healing and acting.[12]

For example, in his autobiography, the English mathematician John Wallis remembered that in the early seventeenth century, his subject was generally regarded not as 'academical studies, but rather mechanical', associated with 'merchants, seamen, carpenters, surveyors'. The assumption of the superiority of liberal to useful knowledge makes a vivid example of the intellectual consequences of the dominance of the old regime by what Veblen called a 'leisure class'. However, this superiority was undermined during the period, as we shall see.

Specialized knowledge was often contrasted with general or even universal knowledge. The ideal of the 'universal man' was taken seriously in some circles in fifteenth-century Italy, witness Matteo Palmieri's *Civil Life*, according to which 'a man is able to learn many things and make himself universal [*farsi universale*] in many excellent arts.' The Florentine poet and scholar Angelo Poliziano was a supporter of the ideal, as is shown by his little treatise on universal

[10] Blumenberg (1966); Ginzburg (1976); Kenny (1998).
[11] Feldhay (1995), 207.
[12] Kristeller (1951–2), 175; Rossi (1962).

knowledge, the *Panepistemon*. So was the humanist Giovanni Pico della Mirandola, as may be seen from the list of 900 theses which this bold young scholar proposed to defend in public debate in Rome in 1487. Pico was described by a character in Erasmus's dialogue the *Ciceronian* (1528) as an all-sided man (*ingenium ad omnia factum*).

To know everything, or at least to know something about everything, remained an ideal throughout our period, described as 'general learning', *polymathia* or *pansophia*, a key word in the writings of the Czech educational reformer Jan Amos Comenius and his followers. As the Cambtidge don Isaac Barrow put it in his treatise *Of Industry*, 'he can hardly be a good scholar, who is not a general one.' General knowledge was made necessary by the 'connection of things, and dependence of notions', so that 'one part of learning doth confer light to another.' The ideal of generality was exemplified by a few remarkable individuals such as the French magistrate Nicolas de Peiresc, whose interests included law, history, mathematics and Egyptology; the Swedish academic Olaus Rudbeck, active in the fields of anatomy, botany and medicine as well as history; the German Jesuit Athanasius Kircher, who wrote (among other things) on magnetism, mathematics, mining, music and philology; and Daniel Morhof, whose book on the *Polyhistor* (1688) encouraged the use of that term to describe the ideal of general knowledge.[13]

All the same, this ideal was gradually abandoned. The religious writer Richard Baxter already noted with regret the growing fragmentation of knowledge in his *Holy Commonwealth* (1659). 'We parcel arts and sciences into fragments, according to the straitness of our capacities, and are not so pansophical as *uno intuitu* to see the whole.' The article on 'Gens de lettres' in the *Encyclopédie* was more resigned, declaring that 'Universal knowledge is no longer within the reach of man' (*la science universelle n'est plus à la portée de l'homme*). All that could be done was to try to avoid narrow specialism by encouraging a 'philosophical spirit'.

'Book-learning', as it was sometimes called, was distinguished on occasion, even by members of the clerisy, from the knowledge of things. Comenius, for example, emphasized the importance of studying things rather than words, and a similar distinction already underlay the humanist criticism of the wordiness and the hair-splitting of scholastic philosophers, the 'jargon of the schools'.[14] Quantitative knowledge was distinguished from qualitative knowledge and was taken increasingly seriously. As Galileo famously declared, the book

[13] Schmidt-Biggemann (1983), xiii–xiv, 141–54; Waquet (1993b); Serjeantson (1999).
[14] Burke (1995b).

of nature is written in the language of mathematics. From the middle of the seventeenth century onwards, information useful to the state was increasingly arranged in the form of 'statistics' (below, 135).

Central to this chapter, however, is academic knowledge and its various fields. 'Field' is a revealing metaphor for knowledge, which goes back a long way in western culture, at least as far as Cicero. In the article in the *Encyclopédie* already quoted, the *gens de lettres* are recommended to enter different 'fields', even if they cannot cultivate them all (above, 85). The term employed, *terrain*, calls up an image of scholar-peasants defending their intellectual turf against the encroachments of their disciplinary neighbours. The 'territorial imperative' was – and remains – important in the intellectual world as well as in the realms of politics and economics. The subject of this chapter might equally well be described as a historical geography of early modern academe and its various 'domains', or as Linnaeus would say, its 'kingdoms' (*regna*).[15]

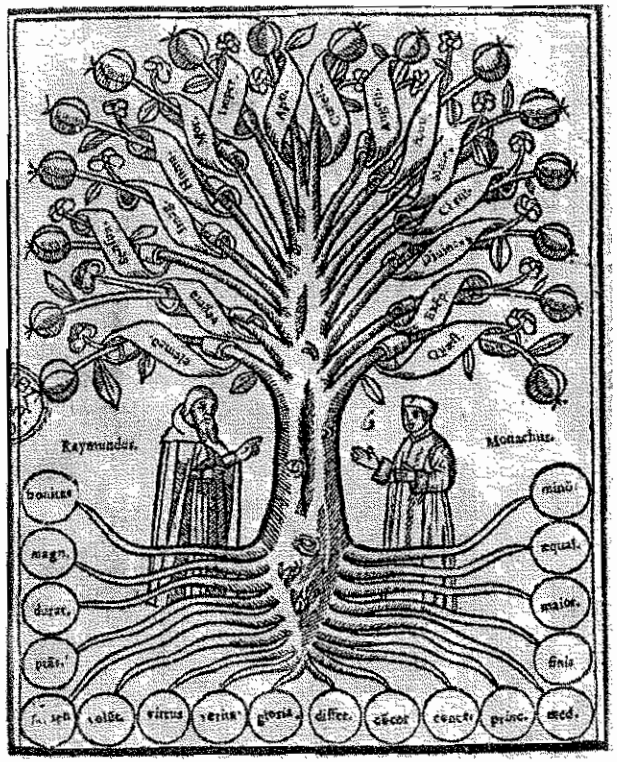
Another key metaphor of the sixteenth century, as of the Middle Ages, for imagining the knowledge system was that of a tree and its branches. Besides trees of knowledge such as Ramon Lull's *Arbor Scientiae* (figure 5), written *c.*1300 but reprinted several times in the early modern period, there were trees of logic (the so-called 'Tree of Porphyry'), trees of consanguinity, trees of grammar, trees of love, trees of battles, and even a tree of Jesuits (on the analogy of the Tree of Jesse, with Ignatius at the root).[16] What we might call an 'organogram' of the French government was described in 1579 as 'the tree of French estates and offices' (figure 6), while in 1612, the German lawyer Ludwig Gilhausen published a treatise called *Arbor Judiciaria* ('The Tree of Judgments').

Thinking in terms of a tree suggested a distinction between dominant and subordinate, trunk and branches. Lull and Gilhausen followed the metaphor down into the roots and up into the twigs, flowers and fruits. The tree image illustrates a central phenomenon in cultural history, the naturalization of the conventional or the presentation of culture as if it were nature, invention as if it were discovery. This means denying that social groups are responsible for classifications, thus supporting cultural reproduction and resisting attempts at innovation.

In place of the 'tree', a more abstract term was coming into use in the seventeenth century to describe the organization of knowledge. This term (associated with the ancient Stoic philosophers) was 'system',

[15] Salmond (1982); Becher (1989).

[16] Rossi (1960), 47, 51–61; Ladner (1979); Tega (1984); Serrai (1988–92), vol. 2, 120–31.

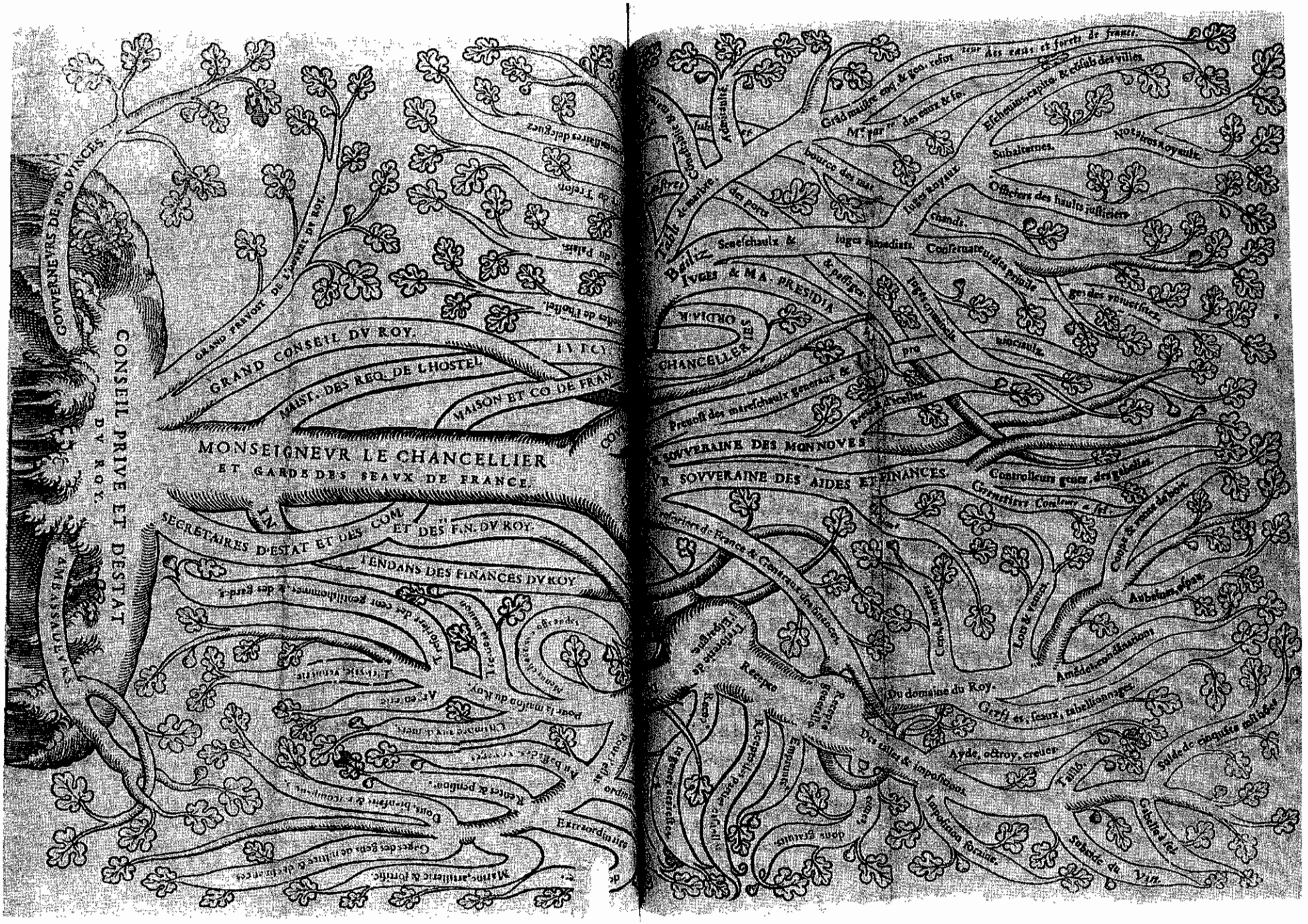


5 *Tree of Knowledge*, title-page of R. Lull, *Arbor Scientiae* (1515: rpr. 1635): copy in Cambridge University Library (P*.3.52)

applied either to specific disciplines or to the whole of knowledge, as in the case of the 'system of systems' offered by Bartholomaeus Keckermann and Johann Heinrich Alsted.[17] Three hundred and fifty years before Foucault, in 1612, Alsted used the metaphor of 'archaeology' to describe the analysis of the principles underlying the system of disciplines. To examine the ways in which the classification of academic knowledge entered into everyday practice in European universities, it may be useful to examine in turn three subsystems, a kind of intellectual tripod composed of curricula, libraries and encyclopaedias.

It should not be assumed that any of the three systems were unproblematic reflections of general mental categories or ideas about

[17] Gilbert (1960), 214–20; Zedelmaier (1992), 125.



6 Tree of French offices, from Charles de Figon, *Discours des Estats* (Paris 1579): Cambridge University Library (Pryme D.1, folding plate)

the organization of knowledge. It is certainly possible to offer internalist or local explanations of developments in each area. The curriculum, for instance, is sometimes affected by the micropolitics of universities: a new chair may be founded as the result of a successful campaign. Alternatively the curriculum may change in response to what are perceived as pedagogic needs, as was the case in eighteenth-century Aberdeen, where logic was moved out of first-year courses on the grounds that concrete knowledge (as Comenius had argued), should come before abstractions.[18]

Again, the organization of libraries was obviously subject to both financial and architectural constraints.[19] Encyclopaedias were products sold on the open market and subject to its pressures, a point which will be discussed in more detail below (172). However, where the three systems overlap, the fundamental categories are likely to express the assumptions of the university population if not the population in general, or as the French historian Lucien Febvre used to say, their 'intellectual equipment' (*outillage mental*).

Discipline and teaching

The curriculum is a metaphor from classical athletics. Like the 'course', it is the route around which the students had to run. It was an order or system of 'disciplines'. In ancient Rome the arts and the law were already described – by Cicero and Varro, for example – as *disciplinae*, a word derived from *discere*, 'to learn'. In the early modern period, the word was used in an academic context by the Spanish humanist Luis Vives, for example.[20] The term was not a neutral one. In the classical world, discipline was associated with athletics, with the army, and with the philosophy of the Stoics which emphasized self-control. In the Middle Ages, discipline was associated with monasteries, with penance and with scourging. In the sixteenth century, Calvinists in particular spoke of Church discipline, while some secular writers, notably Machiavelli, referred to military discipline, as in Roman times. These associations are relevant to discussions of knowledge because the sixteenth century saw a movement of 'disciplining' – *Disziplinierung*, as the Germans say – in schools and universities as well as in churches.

Speaking about 'disciplines' in the plural runs the risk of projecting the disciplinary conflicts of a later epoch onto the early modern period. Scientific disciplines in particular have been described as an

[18] Wood (1993).
[19] Zedelmaier (1992), 112ff.
[20] Kelley (1997), ix.

'invention' of the late eighteenth and early nineteenth centuries.[21] Anachronism is a constant danger. However, there is also an opposite danger, that of distinguishing too sharply – as in the case of the 'professionalization' debate – between early and late modern times. What was new around the year 1800 was not so much the idea of a discipline as its institutionalization in the form of academic 'departments' (a term first used in English in 1832, according to the *Oxford English Dictionary*). Even these departments were not so much a new invention as the elaboration of what the medieval university called 'faculties', a flexible term which referred at once to an ability, a branch of knowledge and a corporate group.

It would be easy to take the language of 'faculties' too literally and so to exaggerate the importance of the frontiers between subjects in early modern academe. A few talented men were willing and able to teach a variety of subjects, and the academic system allowed them to do so. The 'chemist' Andreas Libavius taught history and poetry at Jena, while the 'political scientist' Herman Conring taught medicine at Helmstedt. The Dutch natural philosopher Herman Boerhaave was a pluralist who occupied chairs in medicine, botany and chemistry at the same time at the university of Leiden. The problem of 'autonomy', another revealing metaphor which confirms Elias's analogies between university departments and nation-states (above, 33) had not yet arisen, at least not in acute form. Mathematics and astronomy, for example, have been described as 'semi-liberated' subjects at Oxford and Cambridge. In principle they remained part of philosophy yet in practice they possessed a certain measure of independence.[22]

The organization of curricula

In 1450, the curriculum of the European universities, a network which extended from Coimbra to Cracow, was remarkably uniform, thus allowing students to move with relative ease from one institution to another (a practice known as the *peregrinatio academica*).[23] The first degree was the BA, and the arts of which the student became a bachelor were the seven 'liberal arts', divided into two parts, the more elementary *trivium*, concerned with language (grammar, logic and rhetoric), and the more advanced *quadrivium*, concerned with numbers (arithmetic, geometry, astronomy and music). In practice there was also a place for the 'three philosophies', ethics, metaphysics

[21] Stichweh (1991); cf. Lenoir (1997).
[22] Feingold (1984), 17.
[23] Costello (1958); Brockliss (1996).

and what was known as 'natural philosophy', the last of these subjects being studied with special reference to Aristotle's *Physics* and his treatise *On the Soul*.[24]

The first degree might be followed by a course in one of the three higher faculties, theology, law and medicine, a ternary scheme of a kind not uncommon in the Middle Ages, when society was divided into those who prayed, fought and ploughed, and the other world into heaven, hell and purgatory. Law meant the so-called 'two laws', civil and canon law. It was generally considered to have a higher status than medicine but lower than theology, known as the 'queen of the sciences'. The 'higher' faculties were considered more 'noble', another term which reveals the projection of the social hierarchy onto the world of the intellect. As we shall see, this medieval system was extended rather than reconstructed in early modern Europe, the basic ten elements (3+4+3) retaining their place but gradually coming to share it with an increasing number of newcomers such as history and chemistry.

Despite some obvious parallels evoked in chapter 3, the system differed in crucial respects from its equivalent in the world of Islam. In the Muslim system, there was a fundamental distinction between the 'foreign sciences' (essentially arithmetic and natural philosophy) and the 'Islamic sciences', which included not only the study of the Quran and the sayings of the prophet (*hadith*), but also Muslim law (*fiqh*), theology, poetry and the Arabic language. In Christendom, despite the high status of theology, a distinction between Christian and non-Christian disciplines was not built into the system. In similar fashion, the Christians used the word *scientia* for religious and secular knowledge alike, while Muslims distinguished religious knowledge (*'ilm*) from secular studies (*'ulum*, 'knowledges' in the plural, or *ma'rifa*).[25]

The order of libraries

The 'natural' appearance of the traditional system of disciplines was reinforced by the second leg of the tripod, the arrangement of books in libraries. It was only to be expected that the 'order of books' (*ordo librorum*), as Gesner called it, would reproduce the order of the university curriculum.[26] It also supported this system of classification, as it still does, by making it material, physical and spatial. Surviving libraries allow us to study the 'archaeology of knowledge' in the literal sense of Foucault's famous phrase, examining the physical remains of

[24] Grant (1996), 42–9.
[25] Rosenthal (1970).
[26] Bouza (1988); Chartier (1992); Zedelmaier (1992), 112.

old classification systems. The catalogues of public and private libraries, and the organization of bibliographies (which were presented in the form of imaginary libraries, often using the title *Bibliotheca*), often followed the same order, with a few permutations and modifications.[27] The catalogue of the Bodleian Library, for example, published in 1605, divided books into four main groups – arts, theology, law and medicine, with a general index of authors and special indexes of commentators on Aristotle and the Bible.

The first printed bibliography (1545), an impressive scholarly achievement which took years of travel as well as study to compile, was the work of Conrad Gesner, who was as interested in classifying books as he was in classifying animals. It listed some 10,000 books by 3,000 authors. A second volume, the *Pandects* (1548), was concerned with subject classification or, as Gesner put it, 'general and particular arrangements' (*ordines universales et particulares*). The volume was divided into twenty-one sections. It began with the *trivium*, followed by poetry, the *quadrivium*, astrology; divination and magic; geography; history; mechanical arts; natural philosophy; metaphysics; moral philosophy; 'economic' philosophy; politics; and finally the three higher faculties, law, medicine and theology.[28]

Comparisons have the advantage of reminding us that this manner of ordering books was not the only one possible. In China, for example, the dominant classification of books from the seventh to the nineteenth centuries, to be found in the Emperor Qianlong's *Four Treasuries* and elsewhere, was a remarkably simple one, composed of no more than four groups: classics, history, philosophy and literature.[29] An Islamic jurist, Ibn Jama'a, recommended books to be arranged in a hierarchical order rather different from the Christian one. 'If there is a Quran among them, it should occupy the place of precedence . . . then books of *hadith*, then interpretation of the Quran, then interpretation of *hadith*, then theology, then *fiqh*. If two books pertain to the same branch of knowledge, then the foremost should be the one containing the most quotations from the Quran and *hadith*.'[30]

The arrangement of encyclopaedias

The third leg of the tripod was the encyclopaedia.[31] The Greek term *encyclopaedia*, literally 'circle of learning', originally referred to the

[27] Besterman (1935); Pollard and Ehrman (1965); Serrai (1988–92); McKitterick (1992).
[28] Serrai (1990; 1988–92, vol. 2, 211–571); Zedelmaier (1992), 3–153.
[29] Drège (1991); Guy (1987).
[30] Chamberlain (1994), 161.
[31] Wells (1966); Dierse (1977); Kafker (1981); Eybl et al. (1995).

educational curriculum. The term came to be applied to certain books because they were organized in the same way as the system of education, whether in order to assist students in institutions of higher education or to offer a substitute for these institutions, a do-it-yourself course. It should not surprise us to find that in that age when the ideal of universal knowledge still appeared to be within reach, encyclopaedias were sometimes compiled by university teachers including Giorgio Valla, who taught at Pavia and in Venice, and Johann Heinrich Alsted, who taught at Herborn in Germany.

Encyclopaedias and their categories may be viewed as expressions or embodiments of a view of knowledge and indeed a view of the world (after all, from the Middle Ages onwards, the world was often described as a book).[32] Hence it is surely significant that medieval encyclopaedias continued to be used in the early modern period and were even reprinted on occasion. The *Speculum* or 'Mirror' of Vincent of Beauvais, for instance, was reprinted in Venice in 1590 and again in Douai in 1624. On the latter occasion, adapting the metaphor in the title to the age of print, the book was entitled 'the library of the world', *Bibliotheca Mundi*.

Vincent's encyclopaedia was divided into four parts, dealing in turn with the worlds of nature, doctrine, morality and history. Sixteenth-century encyclopaedias were also organized thematically, the main categories often corresponding to the ten disciplines of the medieval university. Gregor Reisch's encyclopaedia, for instance, first published in 1502 and much reprinted in the sixteenth century, was divided into twelve books summarizing the contents of the *trivium*, the *quadrivium* and natural and moral philosophy. On the other hand, Giorgio Valla, like a good humanist, combined the *trivium* with poetry, ethics and history in his encyclopaedia (1501).[33]

At this point it may be illuminating to return to the organization of Chinese encyclopaedias, as they appear in printed texts of the Ming and Qing dynasties rather than in the vivid imagination of Borges (above, 82). A typical arrangement was as follows: celestial phenomena; geography; emperors; human nature and conduct; government; rites; music; law; officialdom; ranks of nobility; military affairs; domestic economy; property; clothing; vehicles; tools; food; utensils; crafts; chess; Daoism; Buddhism; spirits; medicine; natural history. The contrast between the complexity of this system and the simple classification of Chinese libraries is worth noting.[34]

[32] Curtius (1948), 302–47; Gellrich (1985).
[33] Dierse (1977), 11ff; Schmidt-Biggemann (1983), 34–5.
[34] Teng and Biggerstaff (1936), 110.

Commonplaces

So far we have considered the intellectual organization of knowledge at what might be called the macrolevel. There is also something to say about the microlevel. In his *Organon* (literally 'instrument'), Aristotle had expounded a system of ten general categories (substance, quantity, quality, relation, place, time, position, condition, action and passion). These categories were widely known and used (indeed we still use them today, even if we no longer think of them as a closed system). In his treatise on logic, the fifteenth-century Dutch humanist Rudolf Agricola elaborated the categories into twenty-four topics which would allow arguments to be found more rapidly. Topics could be used as 'pigeonholes' (*niduli*), as Erasmus called them.[35]

Building on Agricola, Luther's friend and colleague Philipp Melanchthon published a highly successful textbook of theology known as the *Commonplaces* (1521), dividing his subject into its specific 'places' (*loci*) or 'heads' (*capita*), or as we would say, using the same metaphors, 'topics' and 'headings' such as God, creation, faith, hope, charity, sin, grace, sacraments and so on. For their part, Catholics could turn to the treatise on *Theological Topics* (1563) by the Spanish Dominican Melchor Cano. In similar fashion the Spanish Jesuit Francisco Labata's *Instrument of Preachers* (1614) provided an alphabetical list of moral or theological commonplaces such as the virtues, the seven deadly sins and the four last things (death, judgement, hell and heaven). Attempts were made to produce similar handbooks for other disciplines such as law and natural philosophy. Opposites such as industry and idleness were often juxtaposed, the dramatic contrast aiding the acquisition of knowledge discussed in more detail in chapter 8 (below, 181).[36]

These discipline-specific commonplaces, together with more general ones, were brought together in the Swiss physician Theodor Zwinger's ambitious encyclopaedia of topics, the *Theatre of Human Life* (1565) as he called it, based on the manuscripts – presumably commonplace books – bequeathed to him by another Swiss scholar, Conrad Lycosthenes but rearranged by Zwinger himself. The second edition, published in 1586–7, had expanded to four volumes. In the following century, the Protestant Zwinger's work was revised and enlarged and given a different religious tinge by the Flemish Catholic Laurentius Beyerlinck, in a book with the same title published in eight volumes in Leuven in 1656. That the tradition of commonplaces

[35] Schmidt-Biggemann (1983), 8–15.
[36] Gilbert (1960), 125–8; Schmidt-Biggemann (1983), 19–21; Moss (1996), 119–30.

was still active in the eighteenth century is clear from an inspection of Chambers's *Cyclopedia*.[37]

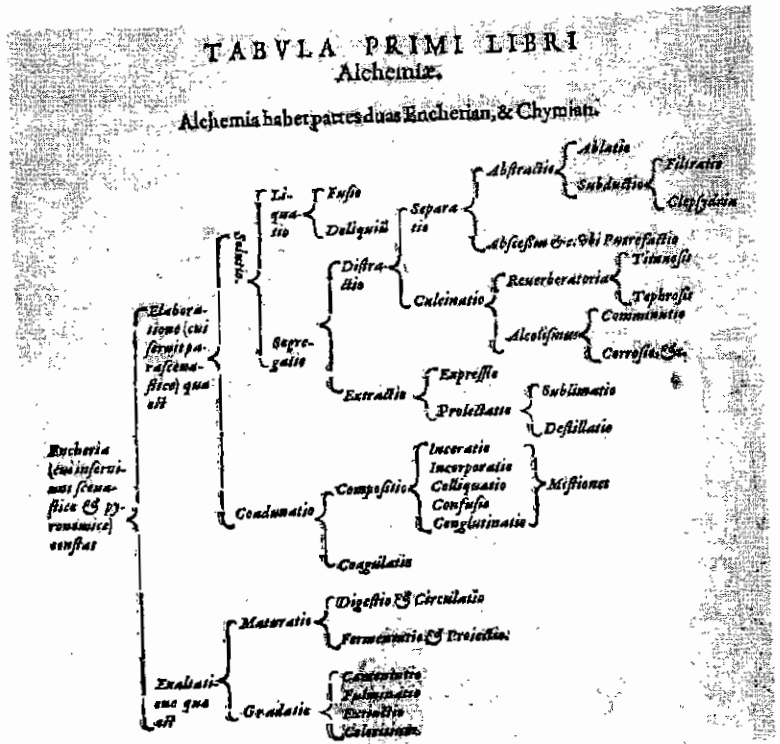
THE REORDERING OF THE SYSTEM

It is clear that the legs of the tripod supported one another, thus assisting cultural reproduction by making the categories appear to be natural, and alternatives unnatural or even absurd. The survival of traditional ideas of knowledge may be illustrated by juxtaposing two books discussing the conflicts for precedence between university faculties, one of them written by the Florentine humanist Coluccio Salutati at the beginning of the fifteenth century and the other by Immanuel Kant nearly 300 years later. Both focus on the conflicts between theology, law and medicine because these 'higher' disciplines retained their dominance throughout the early modern period. All the same, important changes did occur within the system of academic knowledge between the Renaissance and the Enlightenment, tendencies to 'remapping knowledge' as well as 'reshaping institutions'.[38]

The balance between continuity (or reproduction) and change gradually shifted in favour of the latter. At the level of theory, the shift is revealed by the number of schemes for reforming the classification of knowledge. Some of these schemes were put foward by famous philosophers such as Bacon, Descartes, Locke and Leibniz. Leibniz, for example, was interested in the reform of both libraries and encyclopaedias.[39] Other schemes were the work of men whom posterity has taken less seriously, professional 'systematizers' such as Ramus, Keckermann, Alsted and Kircher.

The French academic Petrus Ramus attacked the classifications used and recommended by Aristotle and Cicero, claiming that the latter was confused and had jumbled the arts. Ramus redrew the frontier between logic and rhetoric. In his own system, binary oppositions presented in tabular form played a major role.[40] These 'dichotomies' were adopted by his followers in encyclopaedias such as Zwinger's *Theatre* and also in textbooks. For example, Andreas Libavius – despite his opposition to Ramus in other respects – presented chemistry in this way (figure 7), while in the 1580s Thomas Frey (Freigius) and Abraham Fraunce offered Ramist analyses of the law, the civil law in

[37] Schmidt-Biggemann (1983), 59–66; Yeo (1991, 1996); Blair (1992); Goyet (1996), 441–3; Blair (1997), 46–8.
[38] Lemaine et al. (1976); Giard (1991).
[39] Flint (1904); Rossi (1960); Schulte-Albert (1971).
[40] Ong (1958); Gilbert (1960), 129–44.

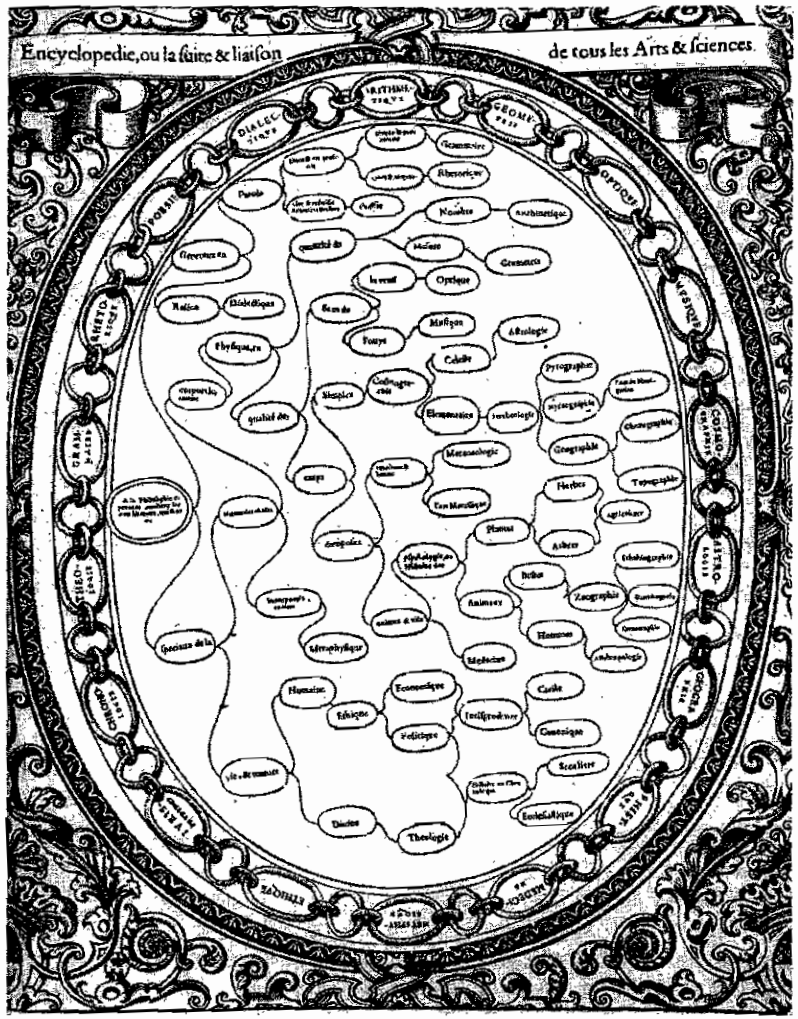


7 TABULA PRIMI LIBRI, IN ANDREAS LIBAVIUS, ALCHEMIA (FRANKFURT, 1597), SIG. B2, VERSO: COPY IN CAMBRIDGE UNIVERSITY LIBRARY (L.4.14)

the first case and the common law in the second. Even a description of Tuscany published in 1605 by the Englishman Robert Dallington included an 'analysis of the discourse' along these lines.

A more fluid or flexible classification of 'all the arts and sciences' was presented by the Frenchman Christofle de Savigny in the form of an oval diagram (figure 8). Around the edge runs a chain of eighteen disciplines in which the trivium, quadrivium and the three higher faculties have been joined by poetry, optics, geography, cosmography, physics, metaphysics, ethics and chronology. In the centre float seventy-five more ovals, attached by strings like so many balloons, including subdivisions of the same eighteen disciplines. The diagram offers a more flexible way of showing interdisciplinary links ('la suite et liaison' as Savigny puts it), than the dichotomies of Ramus.

Ramus was not welcomed by everyone. His critique of Aristotle, for example, seemed to some contemporaries to be a kind of *lèse-majesté*,



8 C. SAVIGNY, *TABLEAUX ACCOMPLIS*, 1587: PARIS, BIBLIOTHÈQUE NATIONALE

a point dramatized by Christopher Marlowe in his play *The Massacre at Paris*, when the Duke of Guise, about to kill Ramus as a heretic, asks him: 'Was it not thou that scoff'dst the Organon / And said it was a heap of vanities?' Despite these reservations, some of Ramus's criticisms were widely accepted and attempts were made to incorporate them in eclectic solutions to the problem of classifying knowledge. Alsted, for example, tried to combine Aristotle with Ramus and also with Ramon Lull, whose tree of knowledge has already been mentioned. Kircher's *Great Art of Knowledge* was another attempt at a new synthesis, once again making use of Lull. Leibniz too discussed the work of Lull as well as that of Alsted.[41]

Francis Bacon's solution to the problem was an unusually bold one, appropriate to a man who announced his intention of replacing Aristotle by calling one of his books the *New Organon*. Bacon made the three faculties of the mind – memory, reason and imagination – the basis of his scheme, allocating history to the category 'memory', for instance, philosophy to 'reason', and poetry to 'imagination'.[42] An examination of the curriculum, the library and the encyclopaedia in the seventeenth and eighteenth centuries suggests that Bacon's reclassification was the most successful of the various attempts made at this time.

THE CURRICULUM REORGANIZED

The reorganization of curricula appears to follow certain patterns. There is a recurrent tendency towards differentiation, specialization, and even what might be called 'balkanization'.[43] New disciplines gain their autonomy only to fragment, like new nations in the later twentieth century. In his history of the French Academy of Sciences (1709), its secretary, Bernard de Fontenelle, compared the state of physics in 1650 to that of 'a great but dismembered kingdom' (*un grand royaume démembré*), in which provinces such as astronomy, optics and chemistry had become 'virtually independent'. We have returned to the problem of territoriality (above, 86).

The reorganization of the curriculum took different forms in different universities, but a few general trends are visible. In some places, such as the universities of Bologna or Rome, change was gradual, the balance between *trivium* and *quadrivium* gradually shifting to the advantage of the latter.[44] In many universities an alternative system to the *trivium* and the *quadrivium* invaded or infiltrated the curriculum. This was the system of the *studia humanitatis* consisting of five subjects: grammar and rhetoric (as in the *trivium*), plus poetry, history and ethics. Sometimes the new subjects entered quietly, but on occasion, as in the case of poetry at the University of Leipzig around 1500, bitter conflicts occurred.

[41] Rossi (1960), 179–84, 239; Schmidt-Biggemann (1983), 100–39.
[42] Kusukawa (1996), esp. 51–2.
[43] Lemaine et al. (1976), 1–23.
[44] Reiss (1997), 135–54.

The rise of history in particular was assisted by its links with law and with politics (in the sense of a career rather than a discipline). For example, by the eighteenth century, if not before, the study of international history was considered good training for diplomats at Paris. It was taught at the political academy founded in Paris by the foreign minister Torcy in 1712 and in Strasbourg in the 1750s. The foundation of the Regius chairs in History at Oxford and Cambridge in the early eighteenth century had similar origins.[45]

Geography, also known as cosmography, was another discipline which was becoming more prominent in the university in the early modern period, as well as in Jesuit colleges.[46] In Heidelberg in the 1520s, lectures on geography were given by Sebastian Münster, later the author of a famous treatise on cosmography (1544). In Oxford, they were given by Richard Hakluyt in the 1570s, before he became famous as an editor of travel books. The need for more knowledge of geography in an age of exploration and empire was obvious enough and as we have seen (above, 61), cosmography was taught to navigators at the House of Trade in Seville. The fact that ancient Greeks and Romans such as Ptolemy and Strabo had taken the subject seriously also helped to make geography respectable. So did the link between geography and astronomy, the terrestrial globe and the celestial. Geography was sometimes taught by the professor of astronomy, suggesting that the new subject entered the university more easily because it was clinging to the coat-tails of an established discipline. All the same, the fact that Philipp Cluverius was appointed to a paid research post in geography at the University of Leiden in 1616 may be a sign of the difficulty of fitting geography into the curriculum as well as of the university's concern with research, a concern unusual in the period.[47]

'Natural philosophy' gradually gained its independence from the quadrivium, only to split into virtually independent subjects such as physics, natural history, botany and chemistry. The first chair founded in natural history, for instance, was at Rome in 1513, followed by Ferrara and Pisa. Leiden had a chair of botany by 1593, Oxford by 1669 and Cambridge by 1724. Chemistry arrived a little later, in Cambridge in 1702, for example, in Uppsala in 1750 and in Lund in 1758. In the cases of botany and chemistry, the new subjects represent the conferring of a certain measure of academic respectability on certain traditional forms of alternative knowledge, that of the 'cunning folk' and the alchemists. The new university subjects of surgery and

[45] Hammerstein (1972), 216ff; Voss (1979).
[46] Dainville (1940); Brockliss (1987), 156.
[47] Baker (1935); Broc (1975, 1980); Cormack (1997), 14–15, 27–30; Jacob (1999).

pharmacy also represent some degree of recognition of alternative knowledges, for in seventeenth-century France apprentices in these 'arts' were allowed to attend lectures in some university faculties.[48]

What might be described as the 'coat-tails principle' was in operation here too, for both botany and chemistry gained a foothold in the university thanks to their association with the long-established faculty of medicine as 'ancillary' subjects, literally 'handmaids' to the master discipline, thanks to the healing power of certain herbs and chemical preparations. For example, Cesare Cesalpino did his botanical work while professor of medicine at Pisa, and Rembert Dodoens taught botany while occupying a chair in medicine at Leiden. A chair in medical chemistry was founded at the university of Marburg in 1609. Georg Stahl lectured on chemistry at the university of Halle although his appointment was in medicine, while Boerhaave's combination of medicine with botany and chemistry has already been mentioned.[49]

It is even possible that an association with medicine was of aid to another new discipline, politics. The images of the 'body politic', the 'physician of the state', 'political anatomy' and so on were more than mere metaphors, especially before 1700. When Conring lectured on medicine and politics in the university of Helmstedt in the middle of the seventeenth century, this combination of subjects may not have seemed as odd at the time as it does today. After all, the alchemist Johann Joachim Becher, who had been trained in medicine, claimed the right to speak on politics because the motto of both subjects was 'the welfare of the people is the supreme law' (*salus populi suprema lex*).[50]

In the case of politics and economics, however, it was the established discipline of philosophy which helped their entry to the academic curriculum. Keckermann reformed the curriculum at the gymnasium at Danzig by adding third-year courses on ethics, politics and 'economics' (*disciplina oeconomica*), in the ancient Greek sense of household management. At Halle, at the end of the seventeenth century, Christian Thomasius taught politics and economics as what he called 'practical philosophy' (*philosophia practica*).[51]

The rise of politics and, more slowly, of political economy was also assisted by the needs of the centralizing state. Politics was coming to be considered less of an 'art', to be learned by practice, and more of a science (*scientia, Wissenschaft*), which could be systematized and taught in an academic manner. Conring, for example, used the phrase *scientia politica*. A fashionable term in German-speaking lands from the late seventeenth century onwards was *Polizeywissenschaft*,

[48] Brockliss (1987), 393–4; Mandosio (1993).
[49] Hannaway (1975); Meinel (1988).
[50] Stolleis (1983); Seifert (1980, 1983); Smith (1994), 69.
[51] Hammerstein (1972), 62ff.

otherwise known as *Statsgelartheit* or *Staatswissenschaft*. The subject was taught outside universities, at special colleges for officials, before chairs in it were founded at the universities of Halle and Frankfurt-on-Oder in 1727.

As for 'political economy', it developed out of household management, the state being regarded as an enormous household. The phrase was apparently coined by the French Protestant playwright Antoine de Montchestien in his *Traité de l'économie politique* (1615). It was only in the eighteenth century, however, that we can observe the entry of the new discipline into the academic system, thus recognizing and theorizing the practical knowledge of merchants, bankers and speculators on the stock exchange. It was appropriate that Carl Ludovici, the author of an important encyclopaedia of commerce, should have held a chair in 'knowledge of the world' (*Weltweisheit*) at the university of Leipzig from 1733 onwards (that a chair could be founded with such a title gives the impression that the university was open to innovation at that point).

The entry of economics into the academic environment was not always simple or smooth. Adam Smith, who was employed at the university of Glasgow as a professor of moral philosophy, was unable to write the *Wealth of Nations* until he had resigned from his chair to become a travelling tutor to an aristocrat, although it is true that he had been able to try out his ideas on 'the general principles of law and government' in an informal manner in a so-called 'private' class at the university in 1762–4.

Smith might have found the academic environment more favourable to his ideas had he lived in the German-speaking world or in Naples. In Halle and Frankfurt-on-Oder, for instance, chairs in what was known as *Cameralia Oeconomica* were founded in 1727, followed by Rinteln (1730), Vienna (1751), Göttingen (1755), Prague (1763) and Leipzig (1764). In Naples, a chair of 'political economy' – the first in Europe with this name – was created in 1754 for Antonio Genovesi, while in Moscow University, founded a year later, economics (known as *kameralija* or *kameral'nykh nauk*) was taught virtually from the start.[52] By this time, the new discipline was well enough established to lend a helping hand to chemistry: it was in the faculty of *Kameralistik* that chairs of chemistry were located in German and Swedish universities. It had also begun to fragment into specialities such as forestry (*Forstwissenschaft*), which fortified its claims to scientific status by employing the latest quantitative methods.[53]

[52] Meier (1966), 214; Larrère (1992); Stichweh (1991), 4.
[53] Meinel (1988); Lowood (1990).

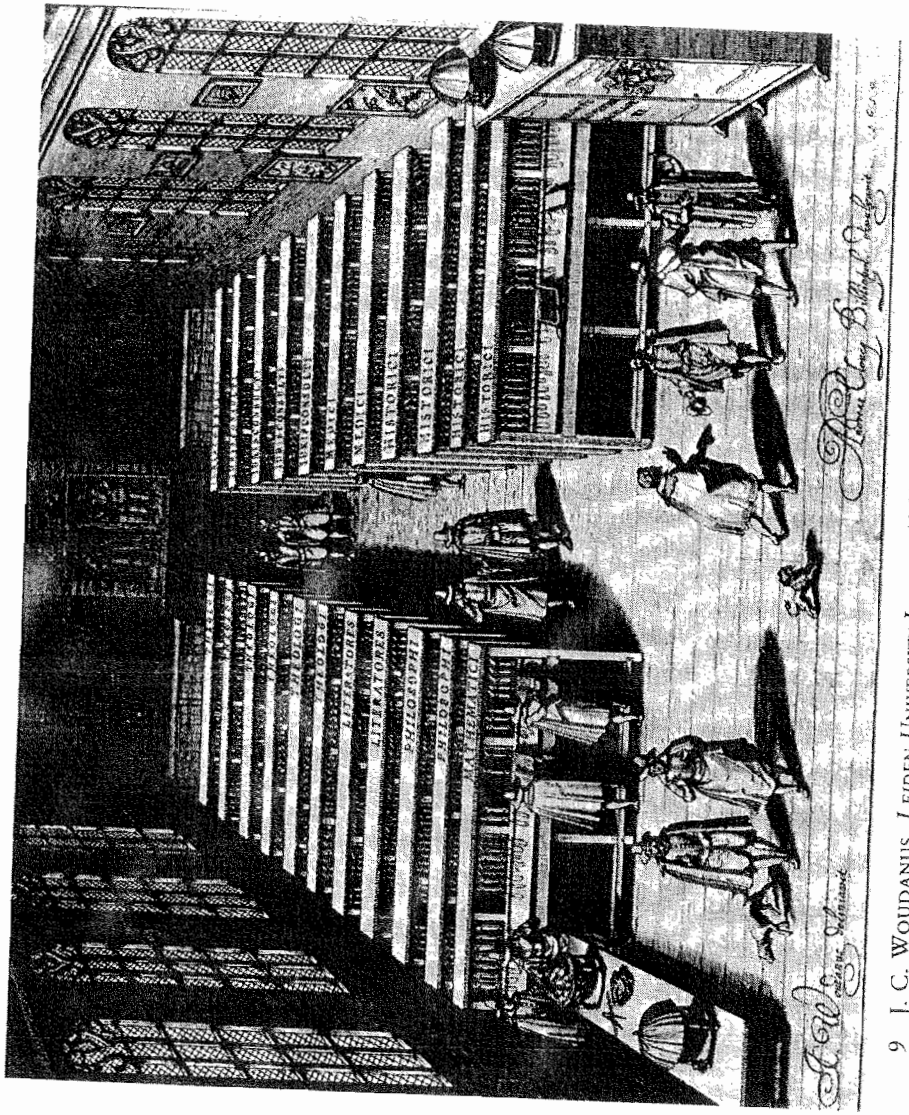
Libraries rearranged

In libraries too there was a concern with reclassification, partly as a result of changes in the organization of universities, but also as a result of the multiplication of books which followed the invention of printing, an outpouring of books which alarmed some scholars. An Italian writer, Antonfrancesco Doni, was already complaining in 1550 that there were 'so many books that we do not even have time to read the titles'. Comenius referred to the 'vast quantities of books' (*granditas librorum*), and a French scholar of the later seventeenth century, Basnage, to the 'flood'.[54] Rather than an order of books, what some contemporaries perceived was a 'disorder of books' which needed to be brought under control. Even Gesner, who coined the phrase *ordo librorum*, also complained of 'that confused and irritating multitude of books' (*confusa et noxia illa librorum multitudo*).[55]

In this domain the intellectual frontier was necessarily more open than in the case of curricula, since books were material objects which had to be placed somewhere and might not fit any traditional category. Books on politics, for example, proliferated in the period, as is clear from subject bibliographies such as *De studio politico ordinando* (1621), by the German academic Christoph Colerus, or the *Bibliographia politica* (1633), by the French scholar-librarian Gabriel Naudé. Bibliographies, a form of reference book which became increasingly common in the period (below, 187) have been described as 'libraries without walls' which could travel all over Europe.[56]

Catalogues were indeed less resistant to novelty than were curricula. Gesner's general bibliography of 1548, for instance, already found a place for politics alongside subjects such as economic philosophy, geography, magic and the mechanical arts. His imaginary library became the basis of catalogues of actual libraries, such as the imperial library at Vienna at the time when the humanist Hugo Blotius was librarian. A new and complex system was proposed by the Spanish scholar Francisco de Aráoz in a treatise on *How to Arrange a Library* (1631). Aráoz divided books into fifteen 'predicaments' or categories. Five of these categories were religious: theology, biblical studies, ecclesiastical history, religious poetry and the works of the fathers of the Church. Ten were secular; dictionaries, books of commonplaces, rhetoric, secular history, secular poetry, mathematics, natural philosophy, moral philosophy, politics and law.

[54] Lieshout (1994), 134.
[55] Zedelmaier (1992), 19n.
[56] Stegmann (1988); Chartier (1992).



9 J. C. Woudanus, *Leiden University Library* (1610), engraved by W. Swanenburgh: Leiden University Library

A simpler solution to the problem of classification is recorded in an engraving of the interior of Leiden university library in 1610 (figure 9), showing books arranged in seven categories: the traditional faculties of theology, law and medicine together with mathematics, philosophy, literature and history. The catalogue of the same library, published in 1595, uses the same seven categories, while the 1674 catalogue added an eighth, 'oriental books' (by this time the university had become well known for its contribution to oriental studies).

Another simple solution was offered by Gabriel Naudé. In his *Advice on Building up a Library* (1627), which devoted its seventh chapter to the question of classification, Naudé declared that a pile of books was no more a library than a crowd of soldiers was an army, and criticized the famous Ambrosiana library in Milan for its lack of subject classification, its books 'heaped in confusion' (*peslemelez*). He also criticized 'capricious' schemes of classification on the grounds that the point of the scheme was simply to find books 'without labour, without trouble and without confusion'. For this reason he recommended following the order of the faculties of theology, medicine and law, together with 'history, philosophy, mathematics, humanities and others'.[57]

These solutions were pragmatic ones, shuffling the pack of disciplines but leaving more fundamental problems in suspense. Reformulating Plato, one might say that to introduce order into the realm of books, either librarian-philosophers or philosopher-librarians are required, combining the talents of John Dewey the pragmatist philosopher with those of Melvil Dewey, the originator of the famous Decimal System of Classification.[58] In the late seventeenth century, this ideal was briefly realized in the person of Leibniz, who was librarian of the duke's library at Wolfenbüttel. Thanks to this stimulus Leibniz, who wrote in a letter of 1679 that a library should be the equivalent of an encyclopaedia (*il faut qu'une Bibliothèque soit une Encyclopédie*), produced a 'Plan for Arranging a Library' (*Idea bibliothecae ordinandae*). This plan divided knowledge into nine parts, of which three corresponded to the traditional higher faculties of theology, law and medicine, joined by philosophy, mathematics, physics, philology, history and miscellaneous. In similar fashion the *Acta Eruditorum* of Leipzig, a journal which regularly reviewed new books, indexed them under seven categories: theology (including ecclesiastical history), law, medicine (including physics), mathematics,

[57] Blum (1963); Stenzel (1993); Revel (1996); Nelles (1997).
[58] Petrucci (1995), 350–1.

history (including geography), philosophy (including philology) and 'miscellaneous'.[59]

The category 'miscellaneous' deserves more attention than it has usually received. Indeed, it might be argued that a history of the different items which have been placed in this category over the centuries would make an illuminating contribution to intellectual history, focusing on whatever resisted successive modes of classification. Samuel Quiccheberg, the author of a guide to arranging collections (below, 109) used 'philology' as his miscellaneous category, including in it war and architecture. The French bibliographer La Croix used 'Mélanges' as one of his seven categories, including in it memoirs, recreational reading, paradise, purgatory, hell and the end of the world. Alsted included in his *Encyclopaedia* (1630), a large miscellaneous section (*farragines*) including history and the art of memory.

Methodizing museums

Problems of classification were even more acute in the case of museums than in that of libraries, since there was no medieval tradition for owners or curators of museums to follow or adapt. Museums or 'cabinets of curiosities' proliferated in the sixteenth, seventeenth and eighteenth centuries. Some of them were famous all over Europe: not only the cabinets of princes (Rudolf II in Prague, for example, or Louis XIV in Paris), but also of private individuals such as the cleric Manfredo Settala in Milan, the professor Ulisse Aldrovandi in Bologna, the apothecary Basilius Besler in Nuremberg, the physicians Pierre Borel in Castres and Ole Worm in Copenhagen or the virtuoso Hans Sloane in London (below, 110). No fewer than 723 collections are known to us from eighteenth-century Paris alone. Around the year 1700, medals were the most popular item, but the eighteenth century saw the rise of a competitor, shells, suggesting a shift from an amateur interest in classical erudition to an interest in natural philosophy.[60]

To reconstruct the organization of these collections, we have to rely on the evidence of images, while recognizing that the artist's intentions may have been to produce an allegorical rather than a realistic portrayal.[61] Seventeenth-century pictures are likely to give today's viewers an impression not only of abundance but also of heterogeneity. In the contemporary engraving of Worm's museum,

[59] Schulte-Albert (1971); Palumbo (1993a, 1993b).
[60] Pomian (1987), 121.
[61] Pomian (1987), 49–53.

for instance (figure 10), our attention is drawn by the statue of a man flanked by a jacket, boots and spurs, but also by the stuffed fish hanging from the ceiling (together with a small bear), and the deer's antlers displayed on a wall together with drinking-horns. The catalogue reveals an even wider range of objects, including an Egyptian mummy, an ancient Roman brooch, money from Java, manuscripts from Ethiopia and Japan and tobacco pipes from Brazil, as well as many Nordic antiquities – spears from Greenland, a bow from Lapland, skis from Finland and an ancient shield from Norway.

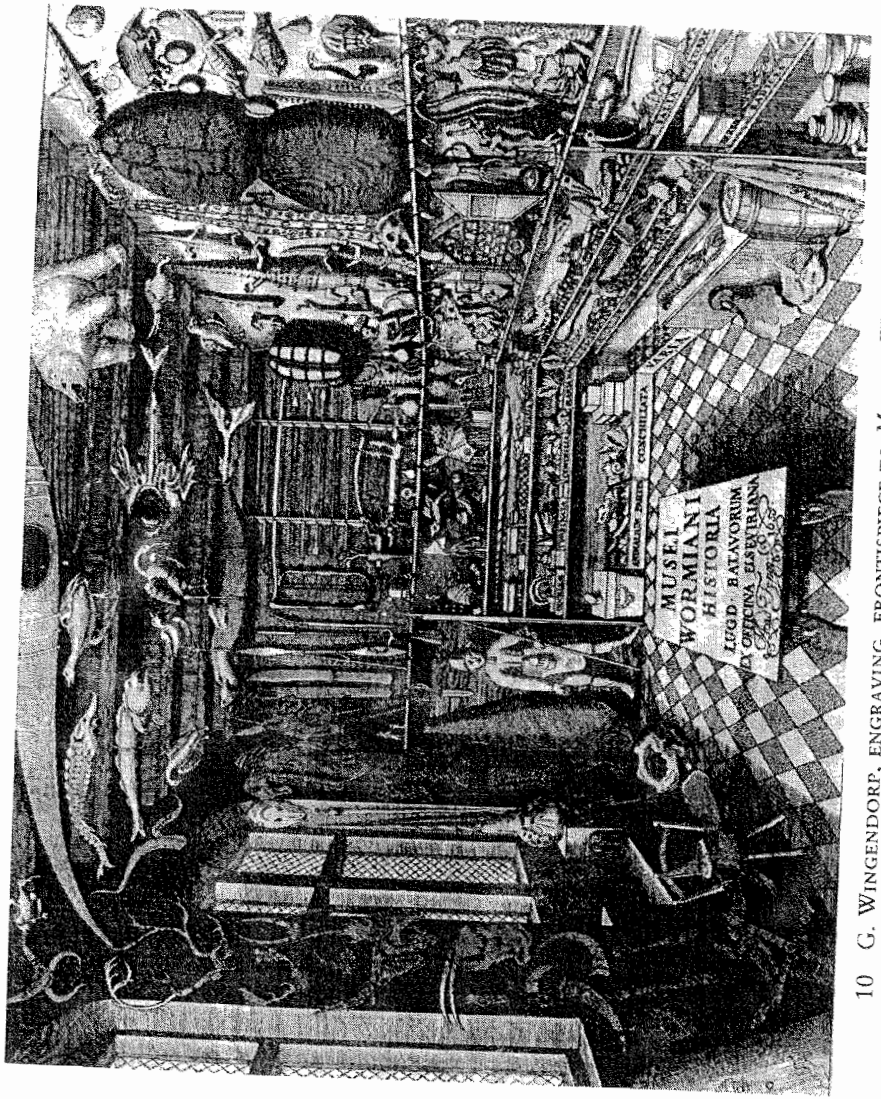
Looked at more carefully, however, the apparently heterogeneous display reveals the existence of a desire to classify. Worm's museum includes boxes labelled 'Metal', 'Stone', 'Wood', 'Shells', 'Herbs', 'Roots' and so on. The drinking-horns are displayed together with the deer's antlers because they are made from the same material. The description of the collection published by Worm's son is divided into four books, dealing respectively with stones and metals; plants; animals; and artifacts (*artificiosa*). In other words, the contents of the museum, whether natural objects or artifacts, are classified not by place or period but by the substances out of which they were made. Manfredo Settala of Milan adopted the same classification by raw material, thus encouraging the impression that the museum was a microcosm, a universe in miniature.

Again, Aldrovandi tried to impose order on his collection by dividing it into sixty-six chests (*cassette*), subdivided into no fewer than 7,000 compartments. An 'Index' in two large volumes assisted the task of finding a specific object. Catalogues of some collections, including those of Settala and Worm, were published in the seventeenth century and reveal the logic behind the arrangements.[62]

Similar problems of order arose in the case of collections of images. Aldrovandi, for example, commissioned painters to record the appearance of animals and birds. Another famous example is the 'paper museum' (*museo cartaceo*) of the Roman virtuoso Cassiano del Pozzo, featuring images of classical antiquity and much more. A third, in print this time, is the series of volumes *Antiquity Explained* (1719–) published by the Benedictine scholar Bernard de Montfaucon, with 1,120 plates illustrating different aspects of the ancient world – gods, cults, daily life, war, tombs and so on.[63]

The importance of the ordering of objects is also revealed by texts such as Samuel Quiccheberg's *Inscriptions* (1565), Jacques Oisel's *Treasury of Ancient Coins* (1677), and John Evelyn's *Discourse of*

[62] Olmi (1992), 195ff, 201ff, 274n, 285.
[63] Olmi (1992); Haskell (1993), 131–5; Cropper and Dempsey (1996), 110–13.



10 G. Wingendorp, engraving, frontispiece to *Museum Wormianum* (1655); Cambridge University Library (M.13.24)

Medals (1693). Quiccheberg, for example, recommended a division of museums into five categories, of which one was 'nature'. Oisel divided classical coins into ten classes, concerned respectively with emperors, provinces, gods, virtues, war, games, apotheoses, public buildings, priests and miscellaneous. Evelyn devoted some pages of his treatise, addressed to would-be collectors, to 'the method of ranging, marshalling and placing' medals, noting for example that the 20,000 medals in the cabinet of the king of France were 'ranked according to the dates'. Evelyn's concern with what he called 'methodizing' is reminiscent of Ramus and also of Gabriel Naudé, whose discussion of the ordering of books Evelyn translated into English.

No wonder then that the apparently irresistible rise of museums in this period has been explained not only as an indicator of the expansion of curiosity but as an attempt to manage a 'crisis of knowledge' following the flood of new objects into Europe from the New World and elsewhere – alligators, armadillos, feathered head-dresses, newly discovered Egyptian mummies, Chinese porcelain – objects which resisted attempts to fit them into traditional categories.[64]

Encyclopaedias alphabetized

In the case of encyclopaedias, the impetus to change was provided once again by the invention of printing. The rise of the printing industry had two important consequences in this domain. In the first place, it obviously made encyclopaedias more readily and more widely available. In the second place, it made them even more necessary than they had been before the invention of the press. To be more precise, one of their functions became increasingly necessary, that of guiding readers through the ever-growing forest – not to say jungle – of printed knowledge.

Compilers of encyclopaedias gradually became bolder in their modifications of the traditional category-system. Pierre Grégoire's *Syntaxes* (1575–6), a bold attempt at an epitome of 'all the sciences and arts', devoted separate sections to mechanical arts, including a separate discussion of painting as well as of the traditional topics of cloth-making, war, navigation, medicine, agriculture, hunting and architecture. Bacon's classification seems to have been especially influential. Naudé's discussion of the formation of a library, for example, adopted a Baconian framework. The Italian bishop Antonio Zara

[64] Findlen (1994), 3, 50; cf. Lugli (1983); Impey and Macgregor (1985); Pomian (1987).

put into practice what Bacon was preaching with his system of thirty-six subjects arranged in the three master categories of memory, intellect and imagination. Ephraim Chambers divided knowledge into the products of the senses, reason and imagination.[65] D'Alembert discussed the ideas of Bacon in his prelimary discourse to the *Encyclopédie*.

However, a still more profound change in the organization of encyclopaedias began to be visible from the early seventeenth century onwards: alphabetical order. Alphabetical order had been known in the Middle Ages. What was new in the seventeenth century was that this method of ordering knowledge was becoming the primary rather than a subordinate system of classification. Today the system may seem obvious, even 'natural', but it appears to have been adopted, originally at least, out of a sense of defeat by the forces of intellectual entropy at a time when new knowledge was coming into the system too fast to be digested or methodized. Its gradual spread will be discussed in more detail in chapter 8 below.

The advancement of learning

A number of changes in conceptions of knowledge have been noted in the course of this chapter, among them the increasing concern with figures. The use of figures or 'statistics' was associated with the new ideal of impersonal or impartial knowledge, of what would later be called 'objectivity' (above, 26). Two other changes in the course of the early modern period also deserve to be emphasized.

In the first place, a shift took place in the relative importance of liberal and useful knowledge, the latter being stressed by Descartes, Bacon and Leibniz as well as by Bacon's many followers such as John Durie, Samuel Hartlib, Robert Boyle, Joseph Glanvill and Hans Sloane. The *Essay toward Promoting All Necessary and Useful Knowledge*, published in 1697 by Thomas Bray, was typical of its time. Although the rhetorical claim to usefulness was traditional, the emphasis on the uses of practical knowledge was an innovation. Reversing the dictum of the French architect in Milan in 1400 (above, 83), the Baconians might well have said in 1700 that 'theory is worthless without practice', *scientia sine arte nihil est*.

By the eighteenth century, useful knowledge had become respectable. Under its new constitution of 1699, the French Academy of Sciences placed more emphasis on engineering and other forms of applied science, an emphasis which culminated in its multi-volume

[65] Yeo (1991).

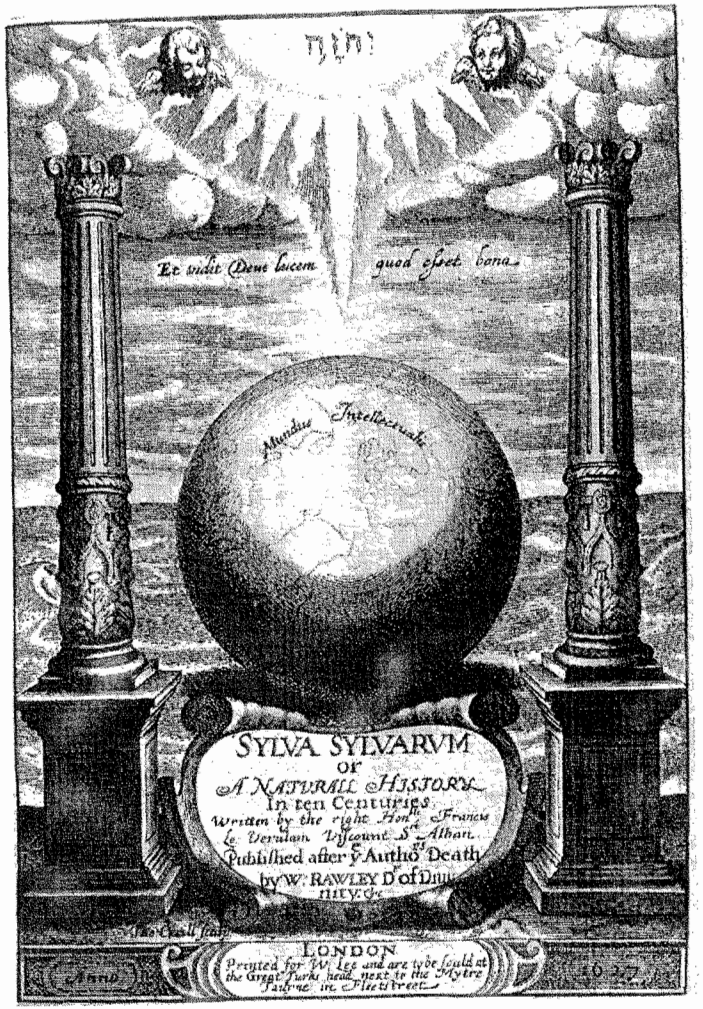
Description of Crafts and Trades (1761–88).[66] A biographer of the alchemist-economist Johann Joachim Becher described him in its title as 'the model of a useful scholar' (*Das Muster eines Nützlich-Gelehrten*). The *Gentleman's Magazine* remarked in May 1731 that 'Our knowledge should be in the first place, that which is most useful, then that which is most fashionable and becoming a Gentleman.' In the same year, in Dublin, a society was founded 'for the Improvement of Husbandry', its purpose being 'to bring practical and useful knowledge out of libraries into the light of day'. Agricultural societies were founded all over Europe to spread knowledge which would be useful to farmers. The Erfurt Academy of Useful Sciences, founded in 1754, had similar aims, like societies founded in Philadelphia (1758), Virginia (1772) and New York (1784). Diderot and the French scholars associated with the *Encyclopédie* had similar views.

In Russia, the western knowledge which Tsar Peter the Great was so keen to introduce was exemplified by the schools which he founded to teach mathematics and navigation as well as by the fact that the first secular book to be printed in Russia was Leonty Magnitsky's *Arithmetic* (1703). For this kind of practical knowledge a new Russian word was coined, *nauka*. It is this word, usually translated into English as 'sciences', which was used to describe the new Academy of Sciences in St Petersburg. The original associations of the term *nauka* were not academic at all but military, naval, technological and economic.

Looking back, it is tempting to describe the first half of the seventeenth century as a brief 'age of curiosity'. It was the time that the words 'curious', *curiosus* or *curieux* came to be used much more frequently. The religious criticisms of 'curiosity' had at last been virtually banished from the secular sphere, while the secular criticisms of 'useless' knowledge were not yet vocal. In the second place, there was a shift in conceptions of knowledge, to borrow the famous phrase of Alexandre Koyré, 'from the closed world to the infinite universe', a new vision of knowledge as cumulative. Novelty lost its pejorative associations and became a recommendation, as in the titles of such books as Kepler's *New Astronomy* and Galileo's *Discourse Concerning Two New Sciences*.[67]

The best-known expression of this vision of progress is Francis Bacon's, in the book appropriately entitled *The Advancement of Learning* (1605). On the title-page and in the text of more than one of his books (figure 11), Bacon made use of a striking image which

[66] Briggs (1991), 40, 65.
[67] Thorndike (1951); Rossi (1962), 68–102.



11A, 11B ENGRAVINGS, FRONTISPIECES, F. BACON, *INSTAURATIO MAGNA* (1620): PARIS, BIBLIOTHÈQUE DE LA SORBONNE PHOTO JEAN-LOUP CHARMET (FONDS V. COUSIN, 5525 RÉS.); AND *SYLVA SYLVARUM* (1627): CAMBRIDGE UNIVERSITY LIBRARY (LE 24.25)

symbolizes his desire to change the system. It is the image of the 'intellectual world' (*mundus intellectualis*) illustrated by an engraving of a globe or alternatively, a ship sailing beyond the Pillars of Hercules in search of new territories. 'It would disgrace us', he wrote in his *Refutation of Philosophies*, 'now that the wide spaces of the material globe, the lands and seas, have been broached and explored, if the limits of the intellectual globe should be set by the narrow discoveries of the ancients.' The English Baconian Joseph Glanvill adopted the motto of the emperor Charles V, PLUS ULTRA ('beyond', that is, beyond the Pillars of Hercules) as the title of one of his books, and Leibniz too wrote the phrase at the head of a manuscript on which he was working in the 1670s, concerned with the advancement of learning.

Bacon's ambition was clearly that of an intellectual Columbus who would 'redraw the map of learning'. For a concrete example of the advancement of knowledge, we may turn to maps themselves. Atlases, like encyclopaedias, tended to become larger and larger in successive editions. Ortelius asked his readers to send in information which might improve his atlas, and some readers responded.[68] The idea of the advancement or 'improvement' of knowledge recurs again and again in England, linking the millenarian enthusiasms of the 1650s to the more limited hopes of the 1660s and beyond, expressed in Joseph Glanvill's *Plus Ultra* (another allusion to the Pillars of Hercules) and in John Locke's *Essay Concerning Human Understanding* (1690). Another vivid example comes from a short treatise on the function of the 'library-keeper' published by John Durie in 1650, in which he argues that a university librarian ought to be bound to give an annual 'account' of 'his profit in his trade', in other words the increase in acquisitions, described as 'the stock of learning'.[69] In the eighteenth century, the ideal of intellectual exploration was sometimes summed up by a quotation from Horace, taken out of its original context and turned into the slogan 'Dare to know' (*sapere aude*).[70]

The modern academic ideal might be viewed as the routinization of these seventeenth- and eighteenth-century aspirations. Intellectual innovation, rather than the transmission of tradition, is considered one of the major functions of institutions of higher education, so that candidates for higher degrees are normally expected to have made a 'contribution to knowledge', and there is pressure on academics – despite the counter-pressures described in chapter 3 above – to colonize new intellectual territories rather than to continue to cultivate old ones.

[68] Jacob (1992), 88, 112.
[69] Webster (1975), 100–245.
[70] Venturi (1959).

Conclusion

The *Encyclopédie* offers an excellent view of what d'Alembert (following Bacon) called the 'map' of learning at the end of our period.[71] Successive editions of the book – and its rivals – reveal an increasingly acute awareness of the progress of knowledge. All the same, the classification of knowledge propounded by d'Alembert in his 'preliminary discourse' and presented in tabular form by Diderot is balanced between tradition and innovation. Looking back from our own time, this scheme looks traditional, especially the idea of the tree of knowledge and its branches, the distinction between the liberal and the mechanical arts and the discussion of the *trivium* of grammar, logic and rhetoric.

Viewed from 1500, on the other hand, a number of innovations would have stood out. The tree of knowledge had been trimmed.[72] Mathematics was promoted to the first place and discussed before the *trivium*. Theology was subordinated to philosophy, subverting the traditional hierarchy (and shocking the reviewer of the book in the *Journal des Savants*). As the engravings as well as the text reveal, the mechanical arts were taken even more seriously than in the encyclopaedias of Alsted and Zara, illustrating the increasing rapprochement between academic and non-academic knowledges.

Finally, the arrangement of the articles was alphabetical, although it was countered up to a point by the elaborate system of cross-references. Independently of the practical reasons for which it was adopted, the use of alphabetical order both reflected and encouraged a shift from a hierarchical and organic view of the world to one which was individualistic and egalitarian. In this respect we might speak of 'the content of the form', reinforcing the editors' ambition to subvert the social hierarchy in some respects at least. For the *Encyclopédie* was a political as well as an intellectual project. The politics of knowledge will be examined in more detail in the following chapter.

[71] Dieckmann (1961); Gandt (1994); Malherbe (1994), especially 29–31.
[72] Darnton (1984).