The history of the teaching of biological subjects including nature study in English schools since 1660

Hudspith, W.H.

W. H. HUDSPITH

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PREFACE

The literature dealing with historical researches into the different grades and types of schooling that have existed in this country is voluminous; voluminous, too, are the books about the history of Science and of the sciences. In considering the more specialised field of science teaching in the schools Foster Watson's 'The Beginnings of the Teaching of Modern Subjects in England' and D. M. Turner's 'History of Science Teaching in England' are general works but there have been published in the last decade, a number of short articles, as well as one or two theses, which deal with certain aspects of biological subject teaching in schools during the period under review. In particular, Miss Bremner's articles in the 'School Science Review' on Botany, Zoology and Physiology teaching in the Nineteenth Century, E. S. Brown's article in the same journal about Zoology teaching in the century from 1851, and B. S. Cane's article in the 'British Journal of Educational Studies' concerning secondary school work in the scientific and technical subjects have proved valuable. Miss R. M. McDonald has covered Grammar school biology teaching from 1850 in her thesis and the researches of G. W. Thomas and E. L. Greenberg have also been helpful in discussing biological work in the Dissenting Academies and the

Private Schools respectively. (See Bibliography)

This account deals with a larger slice of English schoolteaching history against a changing historical background and an attempt has been made throughout to discuss and to correlate the nomenclature which has been applied to the Sciences and to portions of them during the last three centuries. It is in this light that the material is first considered in the Introduction.

INTRODUCTION

This work mentions freely words that have been in use for some time to describe and limit small portions of science, partitioning that discipline into more or less manageable slices, which reveals how vast the collections of scientific material have become. 'Natural Science', for instance, deals with a number of subjects of which 'Biology' is now one. 'Biology' is a relatively modern word covering a group of subjects that are zoological or botanical in content. Thus such sciences as Embryology, Parasitology, Bacteriology and Mycology contain more specific biological data and each has its own terminology and its own particular boundaries, although these parts of Zoology and Botany do overlap, in subject-matter, within the parent disciplines. Such subdivisions of a science are therefore not mutually exclusive and, although a specialist or expert in any one of them might not lay claim to expertise in another, he would find common ground with his fellow scientists in that particular thought-process which is called 'scientific reasoning' and which is only applied common-sense. All of the sciences have grown out of the study of the material and phenomena of Nature and natural things, and the methods used in investigating the facts of each of them are similar. Further, since science is geared to the business of living and is concerned with explaining the facts about a material world, all specialist scientists must be able to communicate with a mass audience. Thus another thread runs through the fabric of science; it is a thread of simplicity. Scientific discovery is always empirical and therefore must be explicable in simple terms, since science is not only the concern of scientists but of all men in their everyday dealings with life.

It is this interrelationship between the simple and the complex that is important in considering the growth of individual sciences. It is reflected in the history of the development of the modern scientific subjects and is especially well revealed in the collection of material now dealt with as 'Nature Study' in schools. This designation was once given to a study of all natural phenomena, whatever their form; in the beginning it represented all the science there was. It was this study of Nature to which Aristotle devoted much of his thought and observation and of which Juan Luis Vives, in the sixteenth century, wrote in a purely literal sense. In the twentieth century, modern usage has given to Nature Study a special nuance of meaning by which the term is held to cover only some simple account of biological matter for young children and under this heading the account is not commonly associated with a full and free flow of scientific jargon and the infusion of scientific reasoning. It might be suggested that Nature Study, when well taught in the 1960's, has some of the intrinsic qualities that it had for Aristotle because the uncluttered minds of children can, by this means, be introduced to the proper use of their senses in appreciating the wonders of the world about them, a point of view which will be more fully discussed later. However, if this be true, the evolution of this essential stage of enquiry (or, perhaps, the return towards it) must be considered. Any absolute link between twentieth century usage and, say, the Aristotelian usage of the term 'Nature Study' is tenuous but the changes in the terminology applied to the biological sciences throughout those intervening centuries mark a process that is evolutionary, with the concomitant growth, digressions and consolidation that this word implies. The development of the subjects of science is partially reflected in the teaching of them in the schools; even more important, the reasons why these subjects gained admittance to school curricula have to be evaluated.

Another term much in use by scientific writers is 'Natural History', but rarely has it been used in its literal sense of describing the history of Nature so that now it has a narrower connotation by which the more academic studies of the professional zoologist are divorced from those of his amateur colleagues. Here again there has been little consistency and in the educational works of the nineteenth century, especially, different authors have used this title for different descriptive purposes. The usages of all of these names have been continuously modified against a changing background caused by increases in the amounts of factual knowledge about the universe. With the increasing intricacy of discoveries about natural phenomena the amassed bulk of data created a need to set finer and finer limits to particular divisions of scientific thought, with the result that writers have tended subtly to modify the terminology of their predecessors and this has often caused a restriction in meaning.

It is against this background that the terminology used in this work is first considered. I have attempted to trace, albeit very briefly, the broad lines of growth of that collection of fact and theory seeking to explain the problems of life and of living things which T. H. Huxley called the 'Life Sciences'. This is followed by an attempt to 'set the educational scene', as it were, in which the biological sciences began to be introduced into the schools, by considering the attitudes towards these subjects of some educational reformers and philosophers.

In this latter account I have quoted from writers such as Vives and Comenius, Hartlib and Milton because they were in the van of the ceaseless attempt to change the material content of school learning. Each of these men was in some way concerned with the study of Nature and advocated that it was an essential part of any educative process. It would be reasonable to generalise by saying that their concern sprang from belief in the intimate involvement of man with the creations of God. There have been other authors who have advocated that the schools of England should include in their syllabuses some study of the biological aspects of natural phenomena but their reasons have not always had their origin in an awe of God's works. Nowadays it seems that there is a brisk desire to lay the foundations of scientific schooling early, so that there is time for specialisation by the pupils. When the cry goes up for more and more scientific endeavour, as it does now, for instance, and Science is viewed as a sort of panacea for whatever ails us, then the teaching of the sciences becomes utilitarian. Perhaps the biological sciences, by their very nature, have suffered less than most in this respect, nevertheless this aspect is one which, in the past, has led to important changes in the amount of teaching of other sciences performed in schools and cannot be neglected in the case of the biological ones.

Succeeding chapters are devoted to discussion of the work done in biology in the educational establishments that existed in this country from 1660 until the turn of the twentieth century. In each of these chapters I have tried to summarise both the origins of a particular kind of scholastic establishment and the feelings and motivations of those men and women who were concerned with the inclusion of nature work in them. By these means it is hoped that the development of the teaching of the biological subjects can be clarified so that the whole thesis portrays that evolutionary process of which I have written above.

1. <u>The Nomenclature used in this account</u>.

Even by modern critical standards the biological writings of Aristotle were in many instances scientific; although no experimenter, he was an observer of things, especially of animals and plants in the field and he produced accounts of these organisms that are exceedingly accurate:

> "Among viviparous animals are man, the horse, the seal, and other animals that are hair-coated and also, of marine animals, the cetaceans. These latter creatures have a blow-hole and are provided with lungs and breathe. Thus the dolphin has been seen asleep with his nose above water and snoring. The dolphin takes in water and discharges it through his blow-hole but he also inhales air into his lungs, so that if caught in a net he is quickly suffocated for

lack of air."(1)

In the book he edited 'Studies in the History and Method of Science', Professor Singer quotes another passage from Aristotle:-

> "Birds and scaly reptiles ..... because of their heat produce a perfect egg, but because of their dryness, it is <u>only</u> an egg, the cartilaginous fishes have less heat than these but more moisture, so that they are intermediate, for they are both oviparous and viviparous within themselves, the former because they are cold, the latter because of the moisture;for moisture is vivifying, whereas dryness is furthest removed from what has life. Since they have neither feathers nor scales such as either reptiles or other fishes have, all of which are signs rather of a dry and earthy nature, the egg they produce is soft; for the earthier matter does not come to the surface in their eggs any more than in themselves. That is why they lay eggs in themselves, for if the egg were laid externally, it would be destroyed, having no protection."(2)

Aristotle asked questions of his environment, many of them posed in these descriptions of animal and plant life, and in doing so he collected facts about organisms from which he was able to theorise. Even if the answers he found were sometimes incorrect and even if they were so often accepted uncritically in later years by other writers, they did comprise descriptions of the organisms <u>as they lived</u>. Aristotle was actively involved with Nature, to which there was, in his time, a factual limit.

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(1) C. Singer quoting Aristotle. 'A Short History of Biology'. Oxford. 1931. Pp. 31-32.
(2) From 'De generatione animalium' C. Singer. 'Studies in the History and Method of Science'. O.U.P. 1921. Vol. II. P. 31.

Professor Singer notes:

> "Aristotle was not content with investigations of the structure and habits of animals in the field which we nowadays call 'Zoology'. He wrote also works on the functions of the organs and parts of the body, that is on Physiology, and also, perhaps, on Botany."(1)

In Aristotle's works, then, are to be found the beginnings of the <u>study of Nature</u>; without a scientific vocabulary the whole mass of natural phenomena found amongst organisms were his to study as one science, and so he laid the <u>foundations</u> of biology.

Many centuries later, so little scientific progress had been made that it was possible for Juan Luis Vives to advocate that the study of all natural phenomena was feasible for a scholar. Believing that nature study was a form of sense-experience, easily understandable by boys, Vives, who appreciated that induction was as much a part of scientific method as deduction, was able to write in his book 'De tradendis disciplinis':

> "The youth will find Nature-study easier than an abstract subject, because in it he only needs alertness of the senses..."(2)

However, Vives was conscious that the world of natural things contained a wealth of matter for the sixteenth century student to assimilate and qualified his advice to such a scholar:

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(1) Ibid. P. 43.
(2) Foster Watson. 'Vives on Education'. C.U.P. 1913. P. 169. quoting from 'De disciplinis', first published in 1531.

"(He).....will seek out and get to know many things from those who inhabit those spots. Let him have recourse, for instance, to gardeners, husbandmen, shepherds and hunters, ... for any one man cannot possibly make all observations without help, in such a multitude and variety of directions. But whether he observes anything himself, or hears any one relating his experience, not only let him keep eyes and ears intent, but his whole mind also, for great and exact concentration is necessary in observing every part of nature, in its seasons, and in the essence and strength of each object of nature."(1)

Thus both Aristotle and Vives could write about the study of Nature in a literal way because the collection of data was only then beginning to be sufficient for the partition of such study into 'subjects' to take place. One branch had been very early the subject of much enquiry for very practical purposes, and this was Botany for a knowledge of herbs was essential in compounding medicines. Noteworthy in this context are the botanical works of Theophrastus (c. 380-287 B.C.), which contained the beginnings of a botanical vocabulary, some fantastic nonsense and a lot that was keenly observed, accurate and useful. The herbalist Crateuas (c. 90 B.C.) produced some accurate sketches of plants for medical uses and Dioscorides produced one of the first herbals during the first century A.D. Charles Singer summarises the position when he writes:

"After medicine, alchemy, and astronomy, the practical sciences in which the West exhibited activity

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(1) Ibid. Pp. 170-171

> in the Middle Ages were botany and optics. Botany was always studied in connexion with medicine. No advance was made in the use of drugs save what was borrowed from the Arabs. There is, however, some indication of a revived interest in nature in the graphic representation of plants."(1)

With the advent of printing the herbal became a particularly useful means of passing on recipes for drugs and accounts of plants, many of them foreign to this country:

> "The medicine of the age ..(the sixteenth century).. laid special emphasis on vegetable drugs, so that physicians were accustomed to distinguish a large variety of native and foreign plants. The artists also had paid much attention to plants, and several had devoted themselves to the study of their habits and habitats. Lastly, the arts of the woodcut and the copper engraving had been perfected, and there was a number of craftsmen capable of producing admirable illustrations of living things and especially of plants. Thus books began to appear in which plants were portrayed with lively skill."(2)

Burton in his 'Anatomy of Melancholy' (1621) mentions the coloured plates of plants in Besler's Herbal and Foster Watson notes that Bartholomew Glanville's compendium of natural history, written in the thirteenth century, contained material about medicine, plants and trees and extracts from the works of Aristotle and Pliny concerning birds and fishes.(3) A particularly accurate herbal was that of Fuchs, whose 'De historia stirpium' (Basel) was published in 1542. Dr. Turner's Herbal was

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(1) C. Singer. 'A Short History of Science' O.U.P. 1941. P. 160.
(2) Ibid. Pp. 175-176.
(3) Foster Watson. 'The Beginnings of the Teaching of Modern Subjects in England' Pitman. 1909. P. 180.

published in three parts in 1551, 1562 and 1568; Gerard's Herbal was written in English in 1597; John Parkinson's 'Theatricum Botanicum' in 1640; Malphigi's 'Anatomy of Plants' was issued in 1665, and Ray's 'Historia Plantarum' between 1686-88. The botanist John Goodyear (1592-1664) published throughout his life accounts of indigenous plants of which the following, a description of alder, is one:

> "The strobilus or fruite of the Alder cometh forth at the beginning of the springe when the leaves first appeare, they growe from the toppes of the last yeres twigges, clusterwise though not so neare together as the berries of the vine, about 8 or 9 in a cluster, ... afterwards growinge like in fashion to an olive not fullie so bigge as a sparrowes egge, composed of many brownish scales standinge verie neare one another betwene which the seed lieth. These usuallie hange on a yere or more."(1)

In the face of so much academic knowledge it is perhaps not to be wondered that D. Guthrie can comment in 'A History of Medicine',

> "Parkinson was the last of the great English herbalists. Herbalism was becoming divorced from medicine; (and was) ..... no longer a subject of scientific study."(2)

Like Botany, zoological studies arose from the greater scientific enquiries of medical men.

However, at first, the published works and picture books contained much that was fabulous and mystical.

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(1) R. T. Gunther. 'Early British Botanists'. O.U.P. 1922. P. 175.
(2) D. Guthrie. 'A History of Medicine'. Nelson. 1945. P. 132.

The Natural History Museum has published some mediaeval natural history cards of the 'Hortus Sanitatis' printed by Jacob Meydenbach at Mainz in 1491. In the account of the picture cards, the Museum authorities note:

> "Soon after the invention of printing a number of books dealing with natural history were produced, for the most part in Germany. Like the earlier Herbals and Bestiaries, from which they were largely compiled, they contain a strange medley of scraps of classical mythology, astrological symbolism, materia medica, and biblical commentary. .... It was characteristic of the mediaeval mind to prefer reliance upon authority to the direct investigation of nature, and this characteristic is seen in the earlier book illustrations. The monks who illustrated the old manuscripts never thought of attempting to draw a herb growing at their doors if a figure could be copied from Dioscorides or Apuleis or from one of their innumerable copyists."(1)

A good example of the way in which biological material was dealt with is the following description of the bat, taken from 'De Natura Rerum':

> "The bat surpasses other quadrupeds in flight. In parts of India there are bats larger than pigeons, with teeth like men. They strike men in the face and bite off their noses and ears and other organs. The story is that this bird has a liking for a loud noise, and its blood removes hair. The bat flies about the earth and walks with its wings and is unclean according to the law."(2)

It was not until the time of Vesalius and later, that men bothered to investigate animals and themselves with anything like a scientific approach and so the fallacies and misconceptions of the old 'authorities' were repeated in

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(1) Natural History Museum. Mediaeval Natural History Cards. Series No. 1. Pp. 1-2.
(2) Quoted op. cit. Series No. 5. Pp. 2-3.

book after book.

Vesalius (1514-1564) who, as a boy, was much interested in natural history and dissected dogs and mice to prepare himself for medical training, studied at Louvain, Paris and Padua. There he gathered the data that he later embodied in the erudite work which he entitled 'On the Fabric of the Human Body' (1543) and which presented anatomy with an enthusiasm and a vital force that were the result of first-hand experience. Yet when Vesalius went to Paris, his teacher, Sylvius, who was a disciple of Galen (c. 131-200), was puzzled by the differences he found in his dissections when comparing them with Galen's descriptions and "alleged that the human body must have become changed since Galen's time."(1)

By the second decade of the seventeenth century the microscope was a practical possibility; indeed, to Robert Hooke (1635-1703) it was a tool by means of which he described the structures of plants and insects. The year 1628 saw the publication of Harvey's ideas on blood circulation and by 1622 Descartes' work on physiology, though theoretical and inaccurate, was embodied in a book on that subject. Besides the collected animal works of the naturalist Conrad Gesner (1516-65), John Ray (1628-1705) had published a book about quadrupeds in 1693 and was

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(1) Guthrie. Op. cit. P. 136.

perhaps best known for an attempt at classification in which comparative anatomy was used as the basis for the differentiation of animals. Several English naturalists are known to have sent material to Ray for inclusion in both the 'Synopsis methodica animalium quadrupedum et serpentini generis' and the 'Historia plantarum' (1686-1704). One of these was Peter Dent, who died in 1689, and was well known as a physician and apothecary as well as a keen naturalist.(1)

Thus, by the 1650's it seems reasonable to infer that the general study of Nature was sufficiently advanced in content (if not in accuracy) to be divisible into the two major branches of Botany and Zoology. In the former case the work was mainly descriptive and based upon utility, whilst zoological studies were broadly anatomical but perhaps included the beginnings of some physiological science. Although the amount of knowledge concerning living things had thus grown in quantity, it is also true that the biological sciences had lost the impetus given them by the naturalism of the older Greek schools of enquiry and had degenerated into a state in which they were governed by doctrines of sheer practical usefulness. From this biology was only slowly recovering:

"The whole atmosphere of the Middle Ages was

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(1) D.N.B.

> unfavourable to an interest in Nature for its own sake. The new contact with classical literature helped to revive and stimulate a purely naturalist interest, and a new generation of naturalists gradually came into existence with a genuine interest in biological phenomena for their own sake, independently of utilitarian aims."(1)

These naturalists were men who, like Aristotle and his followers, became absorbed in the active study of the organisms which interested them instead of relying upon scholarly reading alone. Men like William Turner (c. 1510-68), whose herbals have already been mentioned, who published a book on birds incorporating his own observations.(2) Another, Thomas Moufet (1553-1604) published in Latin in 1634 the 'Theatre of Insects', with his own drawings and notes forming the text. He wrote of grasshoppers and locusts:

> "Some are green, some black, some blue. Some fly with one pair of wings, others with more; those that have no wings they leap, those that cannot either fly or leap, they walk; some have longer shanks, some shorter. Some there are that sing, others are silent. And as there are many kinds of them in nature, so their names were almost infinite, which through the neglect of Naturalists are grown out of use."(3)

Conrad Gesner and Aldrovandi (1522-1605) were, like Moufet, typical of what Singer calls the 'encyclopedic naturalists' and their illustrated works contained collections of facts about organisms and especially about

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(1) A. Wolf. 'A History of Science Technology and Philosophy in the 16th and 17th Centuries.' Allen & Unwin. 1935. P. 394.
(2) C. Singer. 'A Short History of Biology'. Pp. 88-89.
(3) Singer. op. cit. P. 172.

animals. As naturalists their accounts can only be termed natural histories.

At one time the study of nature was synonomous with natural history and T. H. Huxley quotes a passage from Thomas Hobbes' 'The Leviathan', (1651) to this effect:

> "The register of fact is called history. Whereof there be two sorts, one called natural history; which is the history of such facts or effects of nature as have no dependence on man's will; such as are the histories of metals, plants, animals, regions, and the like."(1)

Some two hundred years later M. D. Hill, whose family had run experimental schools at Hazelwood and Bruce Castle, Tottenham, where science teaching was introduced about 1830, wrote as follows:

> "Whatever share our countrymen may have had in the advancement of biological science, it is generally admitted that England is, par excellence, the home of the field Naturalist."(2)

These intervening years produced little change in the ways in which the words 'Naturalist' and 'Natural History' were used. Up to the last century, at least, Natural History described a systematic study of natural objects, animal and vegetable and mineral and naturalists were persons who did the studying. Thereafter, the terminology takes on a more restrictive note. The evidence gathered by the Schools Inquiry Commission (1868), for instance,

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(1) T. H. Huxley. 'On the Study of Biology' 1876. Collected in 'Science and Education - Essays.' McMillan. 1910.

(2) Norwood & Hope. 'Higher Education of Boys in England.' Murray. 1909. P. 395.

shows a narrower usage in the schools at any rate, for the term was applied to any teaching of the natural sciences that was neither chemistry nor physics. A further contraction of meaning has restricted natural history to studies of animal life alone and it is now implied that such pursuits have a quality that is essentially 'popular' - that they are 'lay' studies and more or less unsystematic at that - calculated to preserve an amateur status, as it were. I do not suggest that this is a comprehensive and exclusive evaluation however, since professional zoologists still produce accounts of animals which are called natural histories, for example 'The Natural History of Mammals' by L. Harrison Mathews and Imms' 'Insect Natural History' are both scholarly treatises. Such a subtle and modern emphasis, however, has left unchanged the old assumption that the natural historian was concerned with the observation of animals and plants in their natural environments.

It is interesting, in considering the amateur quality that is implied in the use of the word 'naturalist', to note some data discussed by Professor Leone Levi about the support for science in the 1860's and 1870's.

> "Levi estimated that 15 per 10,000 of the population contributed in 1868, either by learning or by wealth, to the advancement of science. Making allowance for duplication, he concluded that there were 45,000 persons engaged in science in this way - a total which, at first sight, is extremely imposing ..... (however) ..... In 1867 the membership of

all the societies stood at only 3,250, with a gross annual income of £5,380. The membership of the biological societies, on the other hand, was 17,924 with an annual income of £54,614; ..... Clearly this pattern bore little relationship to the economic and social importance, actual or potential, of these sciences; and it is equally evident that the greater part of that which Levi classified as science was not only an amateur activity but, in many respects, a dilettantist one as well."(1)

T. H. Huxley puts the position succinctly.

"As time went on, and the various branches of human knowledge became more distinctly developed and separated from one another, it was found that some were much more susceptible of precise mathematical treatment than others. The publication of the 'Principia' of Newton ..... showed that precise mathematical methods were applicable to those branches of science such as astronomy, and what we now call physics, which occupy a very large portion of what the older writers understood by natural history. And inasmuch as the partly deductive and partly experimental methods of treatment to which Newton and others subjected these branches of human knowledge, showed that the phenomena of nature which belonged to them were susceptible of explanation, and thereby came within the reach of what was called 'philosophy' in those days, so much of this kind of knowledge as was not included under astronomy came to be spoken of as 'natural philosophy' - a term which Bacon had employed in a much wider sense. Time went on, and yet other branches of science developed themselves. Chemistry took a definite shape, and since all these sciences, such as astronomy, natural philosophy and chemistry, were susceptible either of mathematical treatment or of experimental treatment, or of both, a broad distinction was drawn between the experimental branches of what had previously been called natural history and the observational branches - those in which experiment was (or appeared to be) of doubtful use, and where, at that time, mathematical methods were inapplicable. Under these circumstances the old name of 'Natural History' stuck by the residuum, by those phenomena which

(1) D. S; L. Cardwell. 'The Organisation of Science in England.' Heinemann. 1957. P. 78.

> were not, at that time, susceptible of mathematical or experimental treatment; that is to say, those phenomena of nature which now come under the general heads of physiological geography, geology, mineralogy, the history of plants, and the history of animals."(1)

And there in the above passage, in a nut-shell, is a summary of the position I have now reached in this introduction. The investigations of the Schools Inquiry Commission, but briefly mentioned above, take me further. They revealed that whatever popular convention might associate with natural history teaching, the schools which claimed to instruct in that subject taught, in reality, subjects like botany, zoology or occasionally geology, but usually only the former. The questionnaire sent out by the Commission to Headmasters asked specifically whether the boys in the Endowed schools were taught natural history, physics or chemistry.

Although the term 'Physics' was used, the subject was more often cloaked under the name '<u>Natural Philosophy</u>' and this title was much in vogue in English school syllabuses in the eighteenth and nineteenth centuries and variously embraced such topics as mechanics, statics, hydrostatics, optics and astronomy.

Yet another scientific term often found in the literature is '<u>Natural Science</u>', which is defined as the study of material phenomena. In modern usage this would embrace chemistry, physics and the 'life' subjects of botany and

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(1) T. H. Huxley. op. cit. P. 264.

zoology and, perhaps, geology. Nowadays, it is used synonymously with the word 'Science'. In essence it is also synonymous with Aristotle's and Vives' 'Nature Study'. Even so, there has been confusion. An Assistant Commissioner reported to the Schools Inquiry Commission in 1868;

> "Under the term natural science, I mean to include astronomy, natural philosophy or physics (i.e. mechanics, statics, pneumatics, hydrostatics, etc.) and chemistry; under natural history, physiology, zoology, botany, geology, mineralogy."(1)

Prior to this, in 1864, the Clarendon Commissioners, in their Report, discussed the introduction of natural science into the Public Schools' curricula, and commented on the content of 'Natural Science' as follows:-

> "From our present point of view, natural science may be taken as dividing itself into two great branches, the one consisting of chemistry and physics, or the general laws of matter treated experimentally, the other of natural history and physiology, sciences of observation and classification."(2)

This is a point of view very much more in agreement with modern assumptions.

T. H. Huxley noted that Lamarck was the first to use the name '<u>Biology</u>' in 1801 for that part of the natural sciences which would previously have been included in Natural History. Huxley wanted to introduce yet another term into the teaching jargon and this was what he called '<u>physical geography</u>'.

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(1) Schools Inquiry Commission. 1868. Vol. IX. P. 648.
(2) Clarendon Commission Report. 1864. Vol. I. P. 32.

> "To begin with, let every child be instructed in those general views of the phenomena of Nature for which we have no English name. The nearest approximation to a name for what I mean, which we possess, is 'physical geography'; The Germans have a better, 'Erdkunde' ('earth knowledge' or 'geology' in its etymological sense), that is to say, a general knowledge of the earth, and what is on it, in it, and about it."(1)

Matthew Arnold too, borrowed from the Germans. Speaking of the introduction into elementary schools of 'class subjects' for grant-earning purposes, he wrote:

> "I should like to see what the Germans call Natur-kunde - knowledge of the facts and laws of nature - added as a class subject to grammar, geography, and English history. ..... If we have Natur-kūnde as part of the school course, we do not require for such children animal physiology, physical geography, and botany ....."(2)

It is noteworthy that there was this attempt to return to the ideal of giving instruction to children about their natural surroundings and, because the realms of such knowledge had been considerably expanded since the times of the earlier philosophers, there was a corresponding notion that it ought to be general in its scope and simple in its detail. Unhappily this latter proviso was not always observed in practice and young children, for whom such instruction was intended as a painless introduction to science, were often overwhelmed with factual detail and artificiality of presentation.

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(1) T. H. Huxley. 'Scientific Education' 1869.
(2) M. Arnold. 'Reports on Elementary Schools 1852-1882'. H.M.S.O. Pp. 169-170.

The object lessons, which had been introduced into some English Schools as early as the 1820's, also suffered from these defects. Although, by their introduction, it was intended to instruct children about real things, the lessons rapidly became catechetical. In these lessons things natural and manufactured were used as the focal point of the teaching, supposedly to direct attention to the habit of observation. The experiments of Pestalozzi and Froebel, with their emphasis on experience and the educative value of Nature were thus heeded but sadly misapplied in the construction of many object lessons in schools with the result that this teaching never possessed the delightful spark of interest and enquiry that its pioneers foresaw as being its raison d'être. (See P.190)

However, at about the turn of the century, there was a tremendous resurgence of interest in the study of nature as an important part of the education of young pupils. Mr. Medd, secretary to the organisation which arranged a Nature Study Exhibition in London in August 1902, had this to say:

> "We are anxious to show that for every child of every rank and age in every grade of school, urban and rural, Nature Study, quite apart from any possible bearing it may have on rural pursuits or for its botanical or scientific importance, affords one of the most reliable means of developing certain faculties, upon the development of which education in its fullest sense and success in life must be based."(1)

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(1) 'Journal of Education'; August 1902. P. 514 .

A little high-flown, perhaps, but it marks the stage of re-introduction of nature study for children. The contents, the scope, and the aims had changed when compared with earlier times, but there remained a common and important idea that had filtered down through the years, namely the importance and the fruitfulness of giving instruction to a child about its environment. I would suggest that this principle is really inherent in the phrase 'a liberal education'.

The Board of Education injected some of that feeling into their own instructions to teachers in 1905;

> "The term 'Nature Study' is here used in default of a better one for that class of elementary instruction which deals with the outdoor world, with the life of animals and plants, with the clouds and the seasons, the rocks and the soil, in fact with any side of the changing panorama we call Nature.
>
> As a subject it includes something more than Natural History proper, because in addition to observation it demands some touch of the method of scientific inquiry; on the other hand, it cannot be confined within the limits of a particular 'Science', for it may deal with many branches of science and with their applications to such crafts as agriculture or gardening."(1)

The 1913 edition of the 'Cyclopedia of Education' was much more objective about Nature Study:

> "A term which within two decades has come into prominent use in America and England to designate certain studies of natural things, particularly in schools of elementary grade. Also, in a much more limited usage, nature study means popular study of animal or plant natural history outside of schools by children or adults. ..... The term nature study

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(1) Board of Education. 'Suggestions to Teachers.' 1905. P. 48.

was for many years criticised, because etymologically it suggests all scientific studies of nature, and hence is co-extensive with the combined natural sciences; but this objection is no longer urged by prominent scientists, for it is now generally understood in both England and America that nature study means a special type of study adapted primarily to pupils of elementary school age. ..... Here, then, are the essential differences between nature study for elementary schools and science for higher schools: (i) the material for study may be the same; (ii) the observational method of study differs only in degree of advancement; (iii) but the point of view is radically different, for science aims primarily at scientific principles, while nature study avoids these and deals with natural things and processes as they directly concern daily life. ....."(1)

Clotilde Von Wyss wrote on the same lines in an article entitled 'The Teaching of Nature Study' in 1911:

"Although nature-study means the study of nature generally, yet in its more restricted and technical sense it must be associated with the early phase in the evolution of the scientific interest, and must concern itself with aims, scope, and methods that are in tune with these particular mental conditions."(2)

And, a little later in the same article she wrote,

"Since nature study is essentially a particular attitude of mind, which generates a particular method of approach, it is absolutely unrestricted in its choice of material for study. In fact, as it represents the reaction of a young mind to the direct and immediate influence of an unexplored but a priori interesting environment, the more clearly the latter is shown as a complete whole, untouched by the analysis and generalisation of scientific thought, the more perfectly will the conditions of nature-study be fulfilled both in letter and spirit."(3)

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(1) 'Cyclopedia of Education.' 1913. Vol. 4. P. 389.
(2) C. Von Wyss. in 'Broad Lines of Science Teaching' by F. Hudson. Christophers. 1911. P. 24.
(3) Von Wyss. Op. cit. P. 26.

There is then, a modern restriction of the scope of Nature Study to methods whereby children can gain an 'easy' account and make simple observational studies of living things. It is taken to mean a study of animal and plant life at a preparatory level in the hope that this will lead, not only to an interest and a basic knowledge of life, but possibly to a grounding in the methods of science in as far as they are observational. And, finally, another quotation from the 'Cyclopedia of Education' summarises this situation:

> "The distinction between nature study and science may be summarized in the following definitions; Nature Study is primarily the simple observational study of common natural objects and processes for the sake of personal acquaintance with the things which appeal to human interest directly and independently of relations to organised science. Natural Science study is the close analytical and synthetical study of natural objects and processes primarily for the sake of obtaining knowledge of the general principles which constitute the foundations of modern science."(1)

The definitions attempted above have, like the quotations that reflect them, a temporal quality always; in the beginning there was 'nature study' and Aristotle was its prophet. Then it was an all-inclusive term and even though almost two thousand years of specialisation separate the ancient usage from the modern ones there is some common ground between them which is revealed in the above passage.

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(1) Cyclopedia of Education'. Vol. 4. P. 389.

In the foregoing passage I have discussed the many terms which have been used at various times to describe portions of biological study and attempted to show some relationships between those terms. It is now essential to summarise the state of English education before 1660 and to say something about such natural science teaching as there was and something, too, about the writers who advocated such studies for young people.

2. <u>The state of English Education in 1660 and of biological subject teaching</u>.

By 1660, effêctive education in this country reposed in the hands of the two Universities and the endowed grammar schools. In the latter, the syllabus dealt mainly with two subjects of the trivium - grammar and rhetoric - (Logic was almost wholly neglected in the Grammar Schools) but in most schools any systematic teaching was devoted to Latin grammar. Certainly, in their disregard of any novel educational ideas, the Grammar Schools mirrored the apathy shown by the Universities of Oxford and Cambridge where the intellectual vigour of the Renaissance had long since become spent. In those Universities a spirit of enquiry had almost ceased to exist and the studies of the students there were imprisoned within a strict classical discipline of which a symptom was the disputation so scathingly criticised by Vicesimus Knox more than a century later.

Such a system had been a long time building and so its mantle of antiquity was both a blessing and a protection. In English education the critics of hallowed institutions are so often thrown on the defensive because the English public conscience is reverent in the face of the stability it knows that old things must have.

The roots of this system of education were deeply buried in Greek and Roman literature, but these subjects were taught, not for what they had to say, but for the way they said it. The study of grammar and writing style replaced the search for ideas and factual information that has been held to typify Renaissance learning. Further, the schools were the province of the Church and so existed to train future clergymen, lawyers, doctors and state officials, and for these men the language of communication was Latin. At the Reformation the Church and the State were well aware of the desirability and necessity of controlling the training of the young in right and orthodox thinking.

A tenet of Renaissance teaching was that the ancient writers were the repository of all useful knowledge and to a certain extent this was undoubtedly true. Aristotle's writings were as eagerly studied as any other; his 'Historia Animalium' was read, not only for its style, but also because it was considered to hold a factual store of knowledge about natural history, astronomy, mathematics and physical phenomena. However, in the course of accepting the substance without heed of that author's method, everything that Aristotle inferred about his environment went unquestioned until the time of Peter Ramus and after, with the result that accounts of natural history especially, from the Middle Ages onward, were riddled with myth and fairy tales. The inevitable result was that like everything else:

> "Physics and natural history fell into the old medieval discipline of argumentation on generals and particulars, quite apart from any reference to experience and observation ....."(1)

Of this entrenched classicism there were of course critics, just as there were reformers who wished to see a wider curriculum in practice in schools.

J. L. Vives (1492-1540) suggested the replacement of disputation by the "silent contemplation of Nature."(2); Nature was to be examined "with the torch of Christ." and not with the "poor light of heathen authors ....."(3) He recommended that students should read parts of the authors of agricultural works like Cato, Varro, Junius, Columella and Palladius in whose works, despite the presence of a great deal of misconception, details of practical agricultural methods were to be found. Writing of students of nature in his book 'De Tradendis Disciplinis' (1531),

(1) Foster Watson. 'The Beginnings of the Teaching of Modern Subjects in England.' P. 155.
(2) Foster Watson. 'Vives on Education'. P. 169.
(3) Ibid. P. cxiii.

Vives observes:

> "Such students bring great benefits to husbandry, for the culture of palatable fruits, and for remedies and medicines for the recovery of health. For the well-to-do old man, the pursuit of Nature-study will be a great delectation, and it will be a refreshment of the mind to those who have business affairs of their own, or who conduct affairs of state. For not easily may any other pleasures of the senses be found which can compare with this in magnitude or in permanence, since it stimulates the desire of knowledge, which for every human mind is the keenest of all pleasures, therefore whilst attention is given to observation of nature, no other recreation may be sought. It is a sauce to appetite. It is in itself a walking-exercise and a study at one's ease. It is at once school and schoolmaster, for it instantly presents something which one can look at with admiration, and at the same time a man's culture is advanced by it."(1)

It is striking that in this passage Vives embraces many of the sentiments that were put forward in the nineteenth century by men who desired to see the sciences included in school syllabuses. (See Pp.128-9) There is, for instance, something of Ruskin's aesthetic approach and of the practical involvement of the student which Whewell advocated, as well as a liberality of concept reminiscent of T. H. Huxley.

Milton, who also recommended the writers on agricultural topics - Cato, Varro and Columella - criticised the scholastic futility of his time when he wrote of:

> "..... mispending our prime youth at the Schools and Universities as we do, either in learning meer words or such things chiefly, as were better unlearnt."(2)

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(1) Op. cit. Pp. 170-171.
(2) Milton. 'Tractate of Education' 1644 quoted in 'Milton. Complete Poetry and Selected Prose'. E. H. Visiak. Nonesuch Press. 1948.

Milton advocated the study of animals and plants and, indeed, all natural objects and kept a private school (which will be considered in a later chapter) in which he attempted to carry out this preaching.

The Moravian, Comenius (1592-1670) followed Francis Bacon in advocating the cause of experimental science. Although, like many other writers, he used the word 'nature' in a general sense he did realise that the educative process began with the cradle and that the needs of very young children differed from older ones in that they had an avid and wonderful curiosity in the creatures and things that surrounded them. Nature study was a fruitful province for children; by observing the things around him a pupil could be led to understand what the humanist Comenius had grasped when he wrote:

> "Let us then commence to seek out, in God's name, the principles on which as on an immovable rock, the method of teaching and of learning can be grounded. If we wish to find a remedy for the defects of nature, it is in nature herself we must look for it, since it is certain that art can do nothing unless it imitate nature."(1)

His use of 'nature' in the sense of 'experience of things' is illustrated in the following few lines:

> "It is now quite clear that that order, which is the dominating principle in the art of teaching all things to all men, should be, and can be, borrowed from no other source but the operations of nature."(2)

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(1) M. W. Keatinge. 'The Great Didactic of Comenius.' Black. 1896. Chapter XIV. P. 250.
(2) Ibid. P. 252.

And the practical nature of his teaching is exemplified by this:

> "Science, or the knowledge of nature, consists of an initial perception, and needs the same accessories as the external perception of the eye, namely, an object to observe, and light by which to observe it. If these be given, perception will follow."(1)

In his book 'Janua Linguarum' (1631), Comenius set out to teach Latin through the use of vocabularies of <u>things</u> and so material was included about trees, fruits and herbs, shrubs, birds, insects, water creatures, and there was some information about the anatomy of man. Thus, discussing the gut, he wrote:-

> "When the chyle is thus dispatch'd, and thrust down into the small guts through the lower mouth of the stomach (which now is untied and opened wider;) the mesaraick veins suck and draw it out, and having severed it from the grosser refuse (which beeing voided out at the greater guts and fundament, turn into dung and stinking ordure) they carrie it along to the liver (and withal carrie back bloud to the guts:) where again there is a division made."(2)

In the 'Orbis Pictus' (c.1650), Comenius produced an illustrated textbook which included sections giving data on trees, fruits, flowers, herbs, corn and shrubs.(3) The writings of Vives and Comenius are discussed further in the Discussion when their statements about methods of teaching from real things are compared with some made by Pestalozzi and Froebel. (See Pp.265-6)

Sir William Petty wrote, in 1647, to Samuel Hartlib:

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(1) Ibid. Chapter XX. P. 335.
(2) J. A. Comenius 'Janua Linguarum Reserata'. London 1650. Chapter 22.
(3) Foster Watson. 'The Beginnings of the Teaching of Modern Subjects in England.' P. 185.

> "The school should have in it a complete 'theatricum botanicum' - stalls and cages for all strange birds and beasts: children do most naturally delight in <u>things</u> and are most capable of learning them, having quick senses to receive them and unpreoccupied memories to retain them."(1)

Petty recommended in his letter 'The Advice of W. P. to Mr. Samuel Hartlib, for the Advancement of some particular Parts of Learning' that a botanic garden and a museum would also be useful accessories in this training.(2)

Another friend of Hartlib's, the schoolmaster Hezekiah Woodward, believed, like Comenius and Bacon, that science ought to form part of a Grammar School curriculum. In 1641 he wrote the pamphlet entitled 'A Light to Grammar and all other Arts and Sciences or the Rule of Practice, proceeding by the clue of nature and conduct of right reason so opening the door thereunto', and 'A Gate to Sciences opened by a naturale key or a Practicall lecture upon the great book of nature whereby the childe is enabled to reade the creatures there.'(3) Besides the usual religious moral-pointing, Woodward called for science teaching in the schools. Foster Watson describes him as

> "a pioneer of Nature Study in the school ... (who) ... anticipated in his teaching principles associated with Rousseau and Pestalozzi."(4)

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(1) R. H. Quick. 'Essays on Educational Reformers.' Longmans. 1895. P. 210.
(2) J. W. Adamson. 'Pioneers of Modern Education. 1600-1700'. C.U.P. 1921. Pp. 130-131.
(3) I. Parker. 'Dissenting Academies in England'. C.U.P. 1914. Pp. 38-39.
(4) Foster Watson. Op. cit. P. 196.

Charles Hoole (1610-1667), one-time Master of Rotherham Grammar School who later kept a school in Lothbury Gardens, London, and produced 'anglicised' versions of both the 'Janua' and the 'Orbis Pictus', used Pliny's 'Natural History' and Aesop's fables, probably in his London school, since he took his pupils to the museum kept there by the Tradescants.(1) From at least 1637 to 1656 the Tradescants, father and son, kept their museum at South Lambeth and it contained specimens of birds, quadrupeds, fishes, mollusc shells, insects, exotic fruits, and a garden with the plants labelled both in Latin and English.(2)

In 1648, Samuel Hartlib, propagandist for educational reform, typically sponsored a treatise by one Cyprian Kinner entitled 'A Continuation of Mr. J. S. Comenius' School Endeavours' in which object lessons were to be given in schools. He wrote:

> "I shew Naturall Things in the living book of Nature ....."(3)

Samuel Hartlib wrote a preface to a book called 'The Reformed School, which his friend John Dury (1596-1680), published in 1649 or 1650. In it the author advocated that young children should be given the chance of instruction:-

> "In observing all things natural and artificial extant in the world, whereunto their imagination shall be led in a certain method to cause them reflect

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(1) S. J. Curtis & M. E. A. Boultwood. P. 214. P. [illegible].
'A Short History of Educational Ideas'. U.T.P. 1953.
(2) Foster Watson. Op. cit. P. 207.
(3) Ibid P. 199.

> orderly upon them and observe in them their several kinds, coherences, differences, parts, actions, properties, uses, and references unto man by trades and manufactures".(1)

Dury anticipated the vogue of nineteenth century object lesson teaching when he wrote further that a young child of eight to nine years of age ought to be trained,

> "To take notice of all things offered to his senses: to know their proper names, to observe their shapes, and to make circumstantial descriptions thereof by word of mouth and painting in black and white."(2)

Books were in use in schools before 1660 which contained pictures of animals and plants, some fabulous some real. In addition to the Emblem books, Aesop's Fables were used for moral instruction in some schools such as Ipswich (in use in 1528), and at Westminster School (probably from 1560), at St. Bee's Grammar School, Harrow School (in 1590), Rotherham School (in 1630) and later at Hoole's London establishment in 1660.(3) Dean Nowell's Statutes prescribed the following for the pupils of the Friar's School, Bangor (1563);

> "They shall begin with words that concern the head, reciting orderly as nigh as they can every part and member of the body, after that they shall teach the names of sickness, beasts, herbs, shrubs, trees and so forth they shall proceed in good order to such things as may be most frequented and daily used."(4)

Thus, at the start of the period under scrutiny, not

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(1) J. Dury 'The Reformed School' (c.1650) Ed. H. M. Knox. Liverpool U.P. 1958. P. 46.
(2) Ibid. P. 45. Adamson Op. cit. P. 148.
(3) Foster Watson. Op. cit. P. 198.
(4) Ibid. P. 185.

much was known about the stuff of the natural sciences and even less was taught at any stage of schooling, either in the schools or in the Universities. Although real and factual material was developing - the age was one of scientific discovery - hardly any study of nature had percolated into the educational system.

On the Restoration of Charles II there returned to ecelesiastical power the hierarchy of the Church of England and there followed the proscription of all those who were firmly opposed to that body i.e. the staunch Dissenters. In 1662 the Act of Uniformity demanded from all clergy their consent to the contents of the Prayer Book,

> "..... There followed, 24 August (St. Bartholomew's Day), the consequent resignation of upwards of 2,000 rectors and vicars."(1)

These men had been at an University and many of them were schoolmasters and so the effect that some of these ejected Ministers had on the teaching of subjects of biological content will next be considered.

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(1) H. McLachlan. 'English Education under the Test Acts.' Manchester University Press. 1931. P. 1.

CHAPTER I.

THE DISSENTING ACADEMIES.

After the collapse of the Commonwealth and on the Restoration of the Stuart Monarchy in the person of Charles II, the advent of the Royalists caused a clearing-out from educational establishments and livings of Puritans who, faced with the need to make their livelihood and with a zeal to teach Nonconformist youth, set up their own schools after 1662. These men were, at the same time, ministers and teachers and their schools were always small in size and in numbers of students because they operated under the constant threat of persecution and closure.

It has been said of these schools that, in comparison with the Grammar Schools and the Universities, they paid more attention to the inclusion of scientific studies in their curricula and it has also been noted that this teaching was often both experimental and up-to-date.(1) It was probable that the first ejected ministers who kept such schools were guided, in forming their curricula, by their own University training, and also by the need to attract scholars by giving an education which would prepare them for the three main professions, i.e. for the Church, for Law and for Medicine.

A medical education of some sort could be obtained at Oxford and Cambridge and at the Continental Universities,

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(1) I. Parker. 'Dissenting Academies in England.' P. 132., and J. W. Ashley Smith. 'The Birth of Modern Education.' (1954) Pp. 246 Ff.

and perhaps more important, from a practical viewpoint at least, in the hospitals (although this was relatively rare until the end of the eighteenth century) or by apprenticeship to some surgeon. The Dictionary of National Biography contains accounts of many men whose professional training was completed in this way. Nathan Alcock, for instance, studied both at Edinburgh and under Boerhaave at Leyden, graduating M.D. in the latter University in 1737, before going on to lecture at Oxford on anatomy and chemistry, where he found that:

> "..... one professor of the medical faculty gave no lectures, and another did not reside."(1)

Peter Ball (d. 1675) took his degree at Leyden in 1660; William Baylies (1724-1787) graduated M.D. at Aberdeen in 1748, and Nathaniel Fairfax, who was both a clergyman and a physician (he qualified M.D. at Leyden in 1670 having previously gained an M.A. degree at Cambridge in 1661) and who was ejected from the living of Willisham, Suffolk, in 1662, was a contributor to the Royal Society, although never a Fellow. His son, Blackerby Fairfax was also a Cambridge graduate (B.A. 1689, M.A. 1693) who graduated M.D. at Leyden in 1696.

Thomas Alcock (1784-1833) was an apprentice to a Newcastle surgeon and later practised in Sunderland and in London.(2) Similarly, John Andree gained his medical

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(1) D.N.B.
(2) D.N.B.

training by means of an apprenticeship to the senior surgeon at the London Hospital and in 1766 was practising at the Magdalen Hospital; Sir William Lawrence, F.R.S. (1783-1867), was apprenticed in 1799 to Abernethy at St. Barts. Hospital in London.

The Scottish and Dutch Universities, mentioned above, were very important training grounds for many of the later Dissenting Academy tutors who, barred from the English Universities, had therefore to complete their professional training outside this country. The dual role of teacher and doctor was not uncommon, John Aikin (1747-1822), for instance, received his early education at Warrington Academy where medical lectures were given, and then studied medicine and surgery at Edinburgh and London and received the M.D. of Leyden. It is probable that the education received by many such tutors who taught in the later Dissenting Academies was much superior, at least in the realm of the medical sciences, to that obtainable in the English Universities.

Leyden (f. 1574), had medical courses by 1592; botany was begun there by 1600 and by 1636 the University,

> "had blossomed in the establishment of regular practical medicine, which alone was to justify a pre-eminent place for Leyden throughout two centuries or more." (1)

At Glasgow, anatomy was added to the curriculum in 1644

(1) Ashley Smith. Op. cit. P. 64.

and medicine in 1712. Edinburgh had a Chair of Botany in 1676 and a Chair of Medicine in 1685.(1)

Nicholas Hans in 'New Trends in Education in the Eighteenth Century' puts into some sort of perspective the provisions which the Dissenting Academies made towards scientific education when he writes:-

> "The Grammar Schools and Oxford and Cambridge were monopolised by the Church of England and in fact became the nurseries of the Anglican clergy. Even the members of the legal and medical professions were mostly trained outside the two Universities. In the teaching profession, the classical teachers alone had academic training; the teachers of mathematics, scientific subjects and arts and crafts were supplied from outside and seldom attended Grammar Schools and the two Universities. The leading men in the sciences, in philosophy, in social-economic studies, were seldom connected with the Universities and often did not possess English degrees. Many of them completed their unorthodox training in Scottish and Dutch Universities, the Dissenters because of the Anglican monopoly, the Anglicans because the two ancient Universities in the second half of the century did not afford adequate facilities for scientific training. Side by side with the official Anglican system of education two new systems grew up which tried to fill the existing gap. The Dissenting communities established an efficient substitute for University education in their famous Academies, which combined theological with scientific training and produced many outstanding men of the eighteenth century. Vocational education, on the other hand, was promoted by the initiative of private individuals."(2)

Many Dissenting Academies taught something of medical studies and usually this took the form of lectures in anatomy; one can only conjecture that some herbal botany must have been included.

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(1) Op. cit. P. 69.
(2) N. Hans. 'New Trends in Education in the Eighteenth Century.' Routledge & Paul. 1951. P. 15.

Samuel Cradock, who kept Academies at Wickhambrooke, Suffolk, and at Bishop's Stortford from about 1622-1706, had in his care some pupils studying for medical careers.(1) John Woodhouse (1627-1700), was the first tutor of an Academy at Sheriffhales, in Shropshire (1663-1697) of which the Dissenting historian, Josiah Toulmin wrote:

> "The students were conducted through a course of lectures on logic, anatomy and mathematics; beginning usually with the first, and sometimes with one or other of the branches of knowledge. These were followed by lectures in physics, ethics and rhetoric."(2)

Toulmin obtained much of his information from manuscripts written by Woodhouse and he recorded further:-

> "In all lectures the authors were strictly explained, and commonly committed to memory, at least as to the sense of them. On one day, an account of the preceding day was required before a new lecture was read, and on Saturday a review of the lectures of the five days before was delivered. When an author had been about half gone through, they went that part over again; and so the second part passed under a second perusal: so that every one author was read three times. And after this they exercised one another by questions and problems on the most difficult points that occurred. Practical exercises accompanied the course of lectures; and the students were employed, at times in surveying land, composing almanacks, making sun-dials of different constructions, and dissecting animals."(3)

And he wrote of the sources of their text-book knowledge as follows:-

> "In Anatomy, with Gibson (Anatomy of Human Bodies, 1682) was joined the perusal of Blancardi Anatomia Reformata, and Bartholine."(4)

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(1) Ashley Smith. Op. cit. Pp. 38 & 40.
(2) J. Toulmin. 'Historical View of the State of Dissenters in England.' 1814. Vol. II. P. 226.
(3) Ibid. P. 229.
(4) Ibid. Pp. 227-228.

Charles Morton (1627-1698), kept an Academy at Newington Green which possessed a garden, fish-pond and a laboratory, and there is mention that "Law, Divinity, Physick, or what else; ....." were taught.(1) However, Daniel Defoe, who was a pupil at the Academy, claimed that neither medicine nor surgery were included in the syllabus during his time there.(2) Toulmin noted that Morton had an interest in science and published proposals for the use of sea-sand as an agricultural manure in Cornwall.(3)

Just as it can only be assumed that because an establishment concerned itself in any way with medical studies it must also have given some indication of botanical nomenclature and the uses of herbs, so it can only be assumed that because Carmarthen Academy (1668-1820), possessed a microscope in 1799(4), some information about natural history, say, was being imparted; however, the assumption is a most likely one.

An Academy was in existence at Warrington from about 1697 until 1746 and was kept by Charles Owen, a one-time pupil of John Ker, M.D., of Bethnal Green Academy. Owen published a work entitled 'An Essay towards a Natural History of Serpents' in 1742, from the contents of which Ashley Smith quotes the following:

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(1) Ashley Smith. Op. cit. P. 56. quoting Wesley, 'Letter from a Country Divine.' Letter No. 5.
(2) Ibid. P. 58.
(3) Toulmin. Op. cit. P. 234.
(4) McLachlan. Op. cit. P. 62.

> "I ..... a general View of SERPENTS ... a short Account of ... Poison ... where also the SERPENT is used as Food and Physick.
>
> II ..... a View of most Serpents ...
>
> III ..... To which is added a Third Part; containing Six DISSERTATIONS
>
> 1. Upon the PRIMEVAL SERPENT in PARADISE ...
>
> The whole intermix'd with Variety of ENTERTAINING DIGRESSIONS; PHILOSOPHICAL and HISTORICAL. ...1742."(1)

Ebenezer Latham, who was educated at Shrewsbury (where the works of Peter Ramus were read) under the Dissenting tutor Benion and at Glasgow (from 1704), had been, at one and the same time, a village minister and doctor when it was said of him that he had taught

> "..... upwards of four hundred pupils, mostly not destined for the ministry."(2)

One of the subjects included in the curriculum of his higher school at <u>Findern</u> was Anatomy.(3)

Another tutor who was both minister and doctor was Isaac Chauncey A.M., M.D., the first tutor appointed by the Congregational Fund Board (1695), to <u>Hoxton Academy</u>, Moorfields, in 1701. Under a successor, John Eames F.R.S. (d. 1744), Anatomy was taught at this Academy(4) and Archbishop Secker attended Eames' Academy before studying medicine in London and abroad and then being ordained a Minister of the Church of England. Another student there was Samuel Morton Savage, who had studied as an apothecary with his uncle in Wapping before entering Hoxton and,

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(1) Ashley Smith. Op. cit. Pp. 75-76.
(2) Ibid. P. 81.
(3) Ibid.
(4) McLachlan. Op. cit. P. 119.

> "..... in 1744, while still a pupil, he was made assistant tutor in natural science and classics.."(1)

Anatomy was also included as a subject at the second Hoxton Academy (which took over in 1791 the premises vacated by the above establishment some six years earlier) until at least 1805 when a report of the examinations makes mention of the subjects Anatomy and Elocution.(2)

Philip Doddridge, whilst a student at Kibworth Academy (1715-1723), noted in a letter that the third half-year of the course there contained a weekly lecture in Anatomy, based on Eames' course mentioned above.(3) This Academy moved later to Hinkley and then to Market Harborough and finally settled under Doddridge at Northampton in 1729. Here, both Natural History and Anatomy were included in the third year of the syllabus and a microscope was obtained.(4) Job Orton, writing of the earlier courses of study in this Academy, noted:

> "Some other Articles were touched upon, especially History, natural and civil, as the students proceeded in their Course ..... A distinct view of the Anatomy of the human Body was given them ....."(5)

The same author commented that natural and civil history were taught,

> "..... in order to enlarge their Understandings and give them Venerable Ideas of the Works and Providence of God."

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(1) D.N.B.
(2) McLachlan. Op. cit. P. 239.
(3) Ibid. P. 137.
(4) Ashley Smith. Op. cit. P. 135.
(5) Bogue & Bennett. 'History of Dissenters.' 1810. Vol. III. P. 306.

Human anatomy was also thought to be important:

> "..... as it tended to promote their Veneration and Love for the great Architect of this amazing Frame, whose wonders of providential Influence are so apparent in its Support, Nourishment and Motion: and all concurred to render them agreeable and useful in Conversation, and to subserve their honourable Appearance in the Ministry."(1)

Orton's was an excellent account showing the religious background of these studies in the natural sciences in the seventeenth, eighteenth and nineteenth centuries amongst the Dissenters. The anatomy lectures mentioned were continued when the Academy moved to Daventry under Caleb Ashworth in 1752, the year following Doddridge's death.

McLachlan mentions a volume of shorthand notes of Chemistry and Zoology lectures written by Benjamin Penn who was a student at Daventry Academy about 1779-83. It is possible that these lectures were taken down from Timothy Kenrick who was science tutor at Daventry from 1779 until 1784.(2)

The manuscript diary of John Moore, tutor at an Academy kept at Tiverton (1721-29) lists some of the books he acquired for the library and treatises on medicine and surgery were included amongst those volumes.(3)

Warrington Academy opened in 1757 with three tutors and three students.

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(1) Job Orton. Quoted in Ashley Smith. Op. cit. P. 134.
(2) McLachlan. Op. cit. P. 296.
(3) McLachlan. Op. cit. P. 14.

"In 1760 the 'plan' of education for the full course and for the special three years' course was published. A student taking the full course was to spend his first year learning languages and elementary mathematics. In his second year, the study of languages was continued, and Logic, more advanced Mathematics, 'Natural History' and an 'Introduction to Natural Philosophy' were taken".(1)

Joseph Priestley lectured to students at Warrington from 1761-67, and during one year he was known to have delivered a course of 15 - 20 lectures in Anatomy.(2) In 1766 he wrote:

"I had a little school library, consisting chiefly of books of natural and civil history ....."(3)

Priestley was succeeded there by John Reinhold Forster, a naturalist, botanist and one-time explorer with Cook, who lectured in foreign languages and Natural History.(4)

"At Warrington lectures were given at different times by various tutors on different branches of Mathematics, on Mineralogy, Physiology, and Anatomy."(5)

According to the timetable, circa 1778, Anatomy and Chemistry lectures were given twice per week:

"Of external lecturers in the Academy, one was pre-eminent, John Aikin, M.D., only son of the Divinity tutor ... (See P. 38) ..... Before settling in practice at Warrington, he had written an 'Essay on the Ligature of Arteries', afterwards published

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(1) Ibid. P. 210.
(2) Ibid. P. 215.
(3) I. Parker. Op. cit. P. 117., quoting from 'Life and Correspondence of Joseph Priestley.' 1832. J.T. Rutt. Vol. I. P. 64.
(4) Rev. W. Turner. 'Warrington Academy'. 1957. P. 29.
(5) H. McLachlan. 'Warrington Academy.' Chetham Soc. 1943. P. 26.

> with 'Cases on Surgery' by Charles White, an eminent Manchester surgeon, of whom for three years he was a pupil. Dr. Aikin lectured in the Academy (circa 1777) for the bare fees paid by students, giving courses in alternate years (1) on Anatomy and Physiology, (2) on Chemistry; chiefly for the benefit of young men destined for the profession of medicine."(1)

In the same passage McLachlan goes on to note that out of twenty-three students taking the medical course, fourteen went on to further medical studies at Edinburgh, a further six were included in the Dictionary of National Biography and another three included in Munks' 'Roll of the College of Physicians.'(2)

McLachlan writes a further note about Aikin's work:

> "Aikin published in 1782 for the use of his classes a 'Sketch of Animal Anatomy' (Anon.) and 'Heads of Chemistry' ..... From an octavo manuscript volume, written in shorthand, we learn a little more of Aikin's work at Warrington. Thomas Martineau's brother, Phillip Meadows, was a student at Warrington, became a distinguished surgeon at Norwich and died at the early age of 37. The manuscript is entitled 'Haller's Elements of Physiology, etc., abridged by John Aikin, Lecturer in Anatomy and Chemistry in the Academy at Warrington.' It is dated 1781, and comprises two volumes. A pencil note in volume I runs: 'This is not merely a translation of Haller's 'First Lines', but it is abridged directly from Haller's great work 'Elementa Physiologiae' in eight volumes quarto.'"(3)

Of the alumni of the Academy, in addition to the above, specially noteworthy are Thomas Percival, F.R.S., M.D., the botanist Markham Salisbury, George Forster, who emulated Reinhold Forster by travelling with Cook on

(1) Ibid. P. 75.
(2) Ibid.
(3) Ibid.

later voyages and who became Professor of Natural History at Cassel, and Caleb Hillier Parry, F.R.S., M.D., an agriculturalist and physician.(1)

McLachlan draws attention, in another book, to the existence of a volume of shorthand notes of lectures given by George Walker, tutor at Warrington, 1772-74. It is probable that these lectures were delivered at Manchester - Walker was at one time in charge of Manchester New College, (from 1798-1803) which was opened in 1786 when Warrington ceased - and the lectures were divided up so as to cover material dealing with Meteorology, Hydrography, Geology, Mineralogy, Botany and Zoology. Walker also lectured on Anatomy, probably basing those lectures on notes taken from the lectures given at Edinburgh University by Alexander Munroe, a pupil of Boerhaave's.(2) Before the Academy made its first move from Manchester to York in 1803, students attended lectures at the College of Arts and Sciences, in Manchester (1783-1794), where lectures in Anatomy and Physiology were given by Charles and Thomas White.(3)

John Collet Ryland, who attended the Baptist Academy in <u>Bristol</u> during the period of Bernard Foskett's tutorship, (1720-1758), indicated that, in 1744, his own private studies there included Anatomy, and it is known that

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(1) McLachlan. Op. cit. P. 75.
(2) McLachlan. 'English Education under the Test Acts.' Pp. 295-6.
(3) Thomas G. W. 'A Study of the Developments towards the Principles and Practice of Modern Education, as shown by the Dissenting Academies in England.' M.A. Thesis. London. 1949. P. 127.

Foskett did lecture on Natural History, amongst other subjects.(1) His son, John Ryland (1753-1825), followed Caleb Evans as director of the same Academy in 1799. A keen natural historian, he said in a sermon,

> "By the love of the world, here prohibited, is not to be understood our taking pleasure in a survey of the creation around us; a love of the science of astronomy, or geography; or the study of natural history, in any of its branches - zoology, botany, mineralogy, etc., if these are rendered subservient to our contemplation of the power, wisdom, and goodness of the great Creator and if we do not rest in the simple admiration of his natural perfections; but are led to realize his moral attributes, his moral government, and our obligations to serve and glorify him, and to value his favour as better than life."(2)

Another reason that Ryland put forward for pursuing these studies was that,

> "..... the knowledge of the works of nature tends indeed to enlarge the mind, as we read of Solomon."(3)

Amongst the apparatus this Academy possessed was a microscope and Ryland

> "..... organised excursions for the boys to collect plants for herbariums."(4)

and Andrew Gifford presented a volume of notes to the Baptist Academy Library in 1780 in which a passing reference was made to "our course of Natural History and Physics"(5) <u>at Bristol</u>.

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(1) Ashley Smith. Op. cit. Pp. 210-211.
(2) Ashley Smith. Op. cit. P. 216, quoting Ryland 'Pastorial Memorials' Vol. II. P. 285. 1828.
(3) Ibid.
(4) Hans. Op. cit. P. 62.
(5) McLachlan. Op. cit. Appendix I. P. 276.

Homerton Academy (1730-1820), after moves from Newington Green and Mile End, became a training school for ministers and was controlled by the Schismatic and Calvanistic King's Head Society (1730). From 1801, Dr. John Pye Smith was tutor there in Science and languages;

> "Moral Science, Logic, Ethics, Pneumatology, Physiology, Anatomy and Chemistry were subjects in which he was keenly interested, and he had some knowledge of Botany, Materia Medica and the Theory of Physic ....."(1) "In his Inaugural Address, Pye Smith outlined the Plan of Studies in his department. Lectures on Natural Philosophy, Astronomy, Chemistry and Natural History were to occupy two years - two lectures a week."(2)

Samuel Stennett, who kept an Academy in London for a few years from 1758, published, in 1783, his suggestions for a wide curriculum for students undergoing ministerial training;

> "Under Natural Sciences are mentioned Astronomy, Zoology and Botany, and the study consisting of 'diligent enquiry into the works of nature, in order to collect thence enlarged and exalted ideas of the perfections of deity.'"(3)

It seems, from the above references, that what little teaching of biological subjects there was in the Dissenting Academies during the period under scrutiny was ancillary to the medical studies which many of them provided, and harmonised with the humanistic conceptions characteristically held by the tutors. G. W. Thomas, in summarising the history of the earlier academies makes the point that science was but poorly represented in their curricula.(4)

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(1) Op. cit. P. 182.
(2) Ibid.
(3) Ashley Smith. Op. cit. Pp. 208-209.
(4) G. W. Thomas. Op. cit. P. 76.

Certainly there is little mention of any natural science subject teaching in these schools until the middle of the eighteenth century. However, by dealing at all with practical dissections or with Natural History, Botany or Zoology, the Academies exhibited a sharp contrast with the Grammar Schools and Universities in England at the same period. It would be wrong, however, to represent these relatively few instances of biological teaching as forming a system of such scientific teaching that was anything more than sparse.

Can the medical and biological subject teaching given in some of the Academies be put into some sort of perspective? D. S. L. Cardwell discusses the advancement of science in general in the following passage:

> "In the most general terms we can presume that the successful prosecution of science depends upon a number of 'internal' factors, the chief among which are: the cultural heritage of abstract knowledge and practical techniques, the free circulation of ideas and constructive criticism, freedom of research, the adequate endowment of research and the state of the ancillary educational machinery."(1)

Applying Cardwell's hypothesis we can see that the grasp of knowledge and techniques must have been largely missing because the biological sciences, despite some factual discoveries, were hardly established as such and still merely the adjuncts of medicine. Research, such as it was, was an amateur effort and principally classificatory and the ancillary machinery of education was

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(1) D. S. L. Cardwell. Op. cit. P. 2.

represented by the two Universities and the Grammar Schools, and both institutions neglected science teaching. But the Academies did have some access to ideas circulating from the Continental and Scottish Universities where many of the later tutors had been trained.

Some biological teaching could only be achieved in the later Academies, like that at Warrington for instance, when a greater degree of religious tolerance allowed these schools to settle down and put out roots, as it were, in order that the influx of factual knowledge and educational ideas might be the more efficiently assimilated. Other authors have made much of the scientific bias which many of the Academies did reflect in their studies, especially after the turn of the eighteenth century. The scientific subjects most commonly taught, apart from branches of Mathematics, were Natural Philosophy and Chemistry. These were subjects which became increasingly important in the technical and commercial fields after 1750, as the process of industrial expansion continued in this country. However, it must be admitted that the Dissenting tutors showed little desire to alter their teaching to facilitate their pupils' self-advancement alone, although, to a certain extent their syllabuses had to be utilitarian.

Even so, the reasons for the inclusion of any biological teaching found in the Academies can hardly have been wholly utilitarian. Why then should they, almost alone of scholastic bodies, have included some Natural History, or Botany, or Zoology in their curricula?

There were many influences at work amongst the body of Nonconformist teachers. The Dissenting Academies had suddenly been formed to provide an education for the children of the adherents of Dissent. There is no reason to suppose that non-conformist parents then, as now, would not demand a good education and one adapted to contemporary life. If syllabuses changed and broadened, as they undoubtedly did during the history of the Academies, then such expansion must have been partially due to the pressure of demand. However, these schools were well attended during the eighteenth century, because of the relative breadth of their studies. Many Anglicans are known to have gained an education in Dissenting Academies and there was often no difficulty in obtaining students. Thus it cannot be assumed that parental pressure was the critical factor in causing the Academies to widen the scope of the studies they offered; if the education provided by these schools was popularly held to be superior to that obtainable at Grammar Schools and Universities in England then the causes of this superiority were more likely to be found 'internally', in the ideals of the Dissenters than in the pressure of parental interference.

One argument used continuously in education wherever the introduction of new subject-matter into a curriculum is mooted is that the new material will serve to increase the mental awareness of its recipient; the novelty, in this context, is likened to a sort of whetstone to make the imagination keener and to inculcate desirable habits of logical inference. This is a well-tried shibboleth and there is no reason to suppose that the tutors in the Academies did not, on occasions, use it.

From 1600 onwards there runs through the educational activities and writings of the reformers a streak of rationalism which supposed that, because of his possession of the power of Reason, man occupied an apical position with regard to natural life, and this doctrine forged a direct philosophical link between man and God. Rationalism demanded that reason be the ultimate authority in religious matters. The power of reasoning was to be applied to the only two sources of God's purpose, the Book and His creations.

> "The Scripture prescribes general rules, but leaves us to apply them; it names and demands the several virtues, and points out some of the principal instances in which we are to practise them; but leaves us for exact and thorough of them to the exercise of our own reason, and a careful observation of our own tempers, and of human life."(1)

It followed that if men were to find God and understand His purpose, a knowledge of the content and processes of Nature became a vital and integral part of their studies. Baxter wrote, in his 'Reformed Pastor', (1655/7),

> "Your study of Physicks and other Sciences, is not worth a rush, if it be not God by them that

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(1) Ashley Smith. Op. cit. P. 102, quoting Thomas Amory.

> you seek after. To see and admire, to reverence and adore, to love and delight in God appearing to us in his works, and purposely to peruse them for the knowledge of God, this is the true and only Philosophy.."(1

The Puritan 'frame of Mind,' admittedly a generalisation, was a serious one dominated by a wholly personal relationship with the Creator. Study, theny was the aim of many of the Dissenters and their habit of doubting established authority made a fertile field for the spread of Ramist doubts about accepted scientific knowledge. It was an excellent thing when all that Aristotle wrote was not blindly accepted but probed experimentally. G. W. Thomas has something to say concerning this new spirit with which the Dissenters approached the sciences.

> "After the re-imposition of religious tests at Oxford and Cambridge, they were free to give expression to this opinion in their own educational institutions. The introduction of experimental science into the curricula of the academies was not merely the result of subservience to passing fashion, or the needs of professional training. It was an acknowledgement by the Dissenters that the arguments of the scientists were preferable to those of the Aristotelians. The growing development of interest in the value of experiment ran side by side with the widening acceptance of the belief in the right of an individual to criticise authority ....."(2)

A final comment upon the Puritan attitude towards Nature and science is provided by D. S. L. Cardwell and is, I think, pertinent at this point:-

> "Another study of the relationship between religion and science, this time in seventeenth-century England, forms part of a very interesting

(1) Ibid. P. 285.
(2) G. W. Thomas. Op. cit. P. 74.

paper by R. K. Merton. Following a suggestion of Max Weber's, Merton examines in great detail the connexions between Puritanism and science; and, after careful analysis reaches the conclusion that the Calvanist cosmology coupled with the characteristic 'ethic' as expounded in sermons and religious writings provided strong stimuli for the development of science. This, he claims, is validated by the very large number of Puritans active in seventeenth-century science and associated with such enterprises as the foundation of the Royal Society. It is important to notice that Merton does not maintain that religion is the independent and science the dependent variable; nor does he suggest that a set of religious beliefs is sufficient to account for the emergence of great scientists, the Newtons and the Boyles of this world. On the contrary, he says quite explicitly that the relationship between religion and science was one of reciprocal reaction."(1)

It would seem reasonable to summarise these suggestions by saying that there developed amongst the Puritans an attitude of inquiry into the reasons for their existence and of the things that surrounded them. That their world was provided and governed wholly by God was a necessary part of their beliefs and their faith; therefore, in order to begin to understand the Deity it was first imperative that they knew more about the tangible expressions of the will of their Creator and, by these means, thus come to a closer understanding of Him and of themselves.

A notable feature of the later Academies was their tendency to specialise in certain subjects; in most, the students were allowed a freedom of enquiry in startling contrast with that of the Grammar Schools and Universities. There was also, as is mentioned above, a certain liberality

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(1) D. S. L. Cardwell. Op. cit. P. 5., discussing R. K. Merton's 'Science, Technology and Society in the 17th Century England' Osiris. Vol. 4. 1938. Pp.360-63

towards the entrance into them of Anglicans, a feature which persisted until the onset of their decline. After the accession of George I, the Acts against them were not enforced and the Academies ceased to be peripatetic, settled and began their expansion and experimenting. Many of the tutors were Fellows of the Royal Society - John Eames and John Ward of Moorfields, John Horsley of Morpeth, George Walker of Warrington and Manchester, Abraham Rees, Andrew Kippis and John Corrie of Hackney, for instance - and so they were in contact with current scientific thought of which biological studies, although forming a minor part of the Royal Society's discussions, were not excluded.

In certain of the Dissenting Academies, then, there were experiments in education which produced schemes of study that were pronouncedly liberal in so far as they showed breadth of subjects all interwoven in response to a basically humanistic concept of life.

> "The major merit of these scientific studies was as Adamson has rightly said that they 'formed part of the ordinary scheme of work for all students, and experimental study carried on within the limits of a single building must have entered more intimately into the daily life of the majority of the pupils than was the case at Oxford or Cambridge'"(1)

It is easy, when discussing science teaching in these schools to give a glowing account for the evidence is both well documented and voluminous. This is not possible, however, when Natural History and like subjects are considered; but in a purely relative sense, when the other

(1) G; W. Thomas. Op. cit. P. 78.

educational institutions are compared with them, the Academies show a remarkable endeavour in this sort of teaching and the tutors engaged in it were men well qualified and grounded in their subjects.

CHAPTER II

THE PRIVATE SCHOOLS

Before the State was influenced to take part in the provision of schooling for the children of this country, much of the education that was provided was organised privately. In the preceding chapter some account has been given of aspects of scientific teaching which were available to students in several of the Dissenting Academies; further, an attempt has been made to investigate the reasons for biological material having been included in the syllabuses of those Dissenting Academies. Accordingly I propose to treat those Private schools and Academies, about which evidence is available to show that in them subjects of a biological nature were taught, in a somewhat similar manner.

In the twentieth century, because the State seeks to guarantee and, in part, provide a system of universal education, the erroneous assumption is often made that the terms 'schooling' and 'education' are synonomous ones. Even if we accept that education is most properly a formative process whereby bases of techniques of inquiry about things are initiated this does not mean that what goes on in the schools under the guise of education is necessarily the same thing. Although the tutors of some of the Dissenting Academies were intent on pursuing the meanings of the works and words of God and so interested themselves and their students in natural phenomena it was also true that their students were equipped, at the same time, to enter a profession. It is not suggested that the Dissenting Academy tutors were wholly concerned with materialism in education, and in fact a note to the contrary has been included above (see P. 51). However, it is difficult indeed to divorce what is taught in any establishment from the facts of economic survival, whether this be of the individual or of the community. Certainly the Private Academies kept for profit were materialistic; what Halèvy wrote of such schools in the nineteenth century was true of any wherein the owner was a tradesman dealing in 'education':-

> "The State still stood aside. Everything was still left to the same foundations of ancestral piety, the endowed schools. These were the public schools where the children of the gentry and upper middle class received their education and the grammar schools attended by the children of the lower middle class. Around these venerable institutions, and some more recent foundations which strove to imitate them, was the same old welter of private schools, whose head-master might occasionally be an enthusiastic and disinterested educational reformer, but was more often a tradesman, intent on making his profit out of his customers."(1)

This is a gloomy view and it is my purpose to trace just how far it is justified, but first some account of the growth of the private school system is necessary. No matter what their form may be, existing institutions, in education as elsewhere, are always the targets for

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(1) E. Halèvy. 'Imperialism and the Rise of Labour.' Benn. 1951 edn. P. 148.

reformers and philosophers - people whose common ground is often a distaste for the status quo - and it is as well that men should feel that they can influence the replacement of an existing system with one that they believe to be superior for out of this disagreement can come progress. New ideas, when put into practice, represent evolution at work. However, since the evolutionary process is not invariably a progressive one, many of the attempts at reform in education have proved to have blind-endings. Comenius and the pan-sophists, for instance, aware of the narrowness inherent in teaching grammar almost exclusively in schools, proposed to widen the scope of school studies, postulating that children would be better served by a more comprehensive training about all the phenomena of the material world. Milton carried this hypothesis to its logical conclusion when he proposed that an educational scheme for the professions of soldier or statesman might well embrace, in the sciences alone, such studies as mathematics, natural philosophy, some astronomy, geography, natural history, medicine and anatomy, the practices of engineering, agriculture and navigation and a knowledge of architecture. All of this, with the inclusion of Grammar, theology, Italian, ethics, politics, philosophy and law, was to be completed by the time the student had reached the age of twenty-one.(1) Milton made some

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(1) J. Milton. 'Tractate of Education.' taken from 'Milton. Complete Poetry and Selected Prose.' Ed. E. H. Visiak. Nonesuch Press 1948. Pp. 676-679.

attempt to perform this encyclopaedic brand of schooling when he taught his two nephews, Edward and John Phillips, at Aldersgate St. in 1639. Other pupils, relations and the sons of friends, joined them in 1643, thus forming a private school in which lectures were given in Greek and Latin, agriculture, natural history, architecture, military science and astronomy.(1) Milton suggested, too, in the 'Tractate' that these studies should form part of the curriculum in Academies to be opened in English cities, when medicine, anatomy and a knowledge of animal and vegetable life might also be included.(2)

Philosophical condemnation of the grammar school curriculum continued for a long time; in fact, it was still loudly voiced in the nineteenth century (see Chapter V), but the endowed schools slumbered on and parents who desired any form of education for their children other than instruction in the Grammars of Latin and Greek were forced to turn elsewhere to look for it.

There was, for instance, the movement to introduce types of Courtly Academies into this country. These have been described by Hans as:

> "New vocational schools for the nobility ..... purported to prepare the noble youth for his profession as a courtier and soldier and introduced military subjects, mathematics, physical training and

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(1) J. W. Adamson. 'Pioneers of Modern Education'. P. 183.
(2) Ibid. P. 184.

accomplishments."(1)

Sir Thomas Gresham endowed a College in 1575 which did not prove very successful, and the endowment only became effective on the death of his widow in 1596, and in 1635 Sir Francis Kynaston obtained a licence to set up a 'Museum Minervae' in Covent Garden, which was to be a Courtly Academy. Included in the course of studies were to have been physiology and anatomy but the Museum was never established. J. W. Adamson writes about the 'Museum' as follows:-

> "An ambitious scheme was launched by ..... Sir Francis Kynaston, who in 1635 was licensed to maintain at his house in Covent Garden a so-called Museum Minervae for the education of young noblemen and gentlemen. The course was to extend over seven years and students made their choice from a very wide range of studies, on condition that 'no gentleman admitted shall exercise himself about more than two particular sciences, arts or qualities, whereof one shall be intellectual, the other corporall.' The curriculum was to include arithmetic, algebra, fortification, architecture; astronomy, optics, navigation, cosmography; physiology, anatomy; heraldry, antiquities, common law and the study of legal documents; Hebrew, Greek, Latin, Italian, French, Spanish, German; music, vocal and instrumental; riding, dancing and deportment, painting, engraving and writing."(2)

In 1649, Sir Balthazar Gerbier set up a Courtly Academy at Bethnal Green and a pamphlet was published which listed the subjects available for study there. Modern languages, civility, history and geography, arithmetic, geometry and cosmography were all listed and,

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(1) Hans. Op. cit. P. 64.
(2) J. W. Adamson. 'A Short History of Education'. C. U. P. 1930. P. 178.

> "the students of the Bethnal Green Academy also learn 'Naturall experimentall Philosophy,' by which is to be understood 'severall means serving to the enriching of noble and profitable Sciences'."(1)

The last phrase in the above quotation is very reminiscent of Lord Herbert of Cherbury (1583-1643) who, writing earlier and recommending the study of botany, said:

> "It is a fine study and worthy of a gentleman to be a good botanic, so that he may know the nature of all herbs and plants, being our fellow creatures, and made for the use of man;"(2)

In Gerbier's Bethnal Green Academy medicine, plant and tree grafting and the study of soils were also included as being subjects of use to gentlemen. Samuel Hartlib proposed that the science of Husbandry was a fitting subject to be taught to apprentices and J. W. Adamson in 'Pioneers of Modern Education' includes a quotation from a tract by Hartlib to this effect:

> "Why may we not conclude that in the science and trade of Husbandry, which is the mother of all other trades and scientificall Industries, a Collegiall way of Teaching the Art thereof will be of infinite usefulness?"(3)

Abraham Cowley, writing in 'A Proposition for the Advancement of Experimental Philosophy' (1661) suggested that an Academy should be formed with laboratories, gardens, animals and resident professors who would research and

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(1) Adamson 'Pioneers of Modern Education'. Op. cit. P. 188.
(2) Foster Watson. 'The Beginnings of the Teaching of Modern Subjects', (quoting Herbert, 'Autobiography' Lee's 2nd Edn. P. 31.) P. 174.
(3) Adamson. Op. cit. Pp. 112-113. from Hartlib 'Essay for Advancement of Husbandry Learning'. (1651)

teach in medicine, anatomy, chemistry, the history of animals, plants, minerals, agriculture and gardening, amongst many other subjects "and, briefly, all things contained in the catalogue of natural histories annexed to my Lord Bacon's 'Organon'"(1)

Thus, many propositions were made concerning the means of providing a fitting form of education for young gentlemen, but most of the schemes never came to fruition.

The private tutor, however, was an important figure in the schooling and training of many of the sons of the upper classes, in fact, one of the marks of the gentleman was that he had little specialist training but a grounding in the classics and had made a Grand Tour. To a certain degree John Locke, who favoured the private tutor over the school as a means of teaching may well have influenced the upper and middle classes in the choice as to how and where their sons would receive their classical education. However, there were obviously occasions on which some sort of scientific information was imparted to the sons of the wealthy for, as Hans writes:-

> "At that time the post of a private tutor to scions of a famous house was both honourable and lucrative. Many outstanding men of science readily accepted such posts which brought them an income and the patronage of some influential statesman or a peer."(2)

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(1) I. L. Kandel. 'History of Secondary Education'. Harrap. P. 149.
(2) Hans. Op. cit. P. 182.

Hans quotes such examples as Joseph Priestley's teaching of the Earl of Shelburne's sons between 1772 and 1780 and William Sherard, who was a botanist and Fellow of the Royal Society and who was tutor to Sir Arthur Rawdon from 1689 until 1694 before undertaking tutorial activities with the Russell family, first with William Russell from 1695-99 and then, from 1700-1702 with Henry who became the second Duke of Bedford.(1) Two other botanists who held similar posts were Colin Milne (1743-1815) who was tutor to Lord Algernon Percy, and Benjamin Stillingfeet who taught William Ashe-Windham from 1724 until 1728.(2) Thomas Lawson (1630-1691), who was employed by a Mrs. Fell to teach her daughters botany and the use of herbs as medicines, was a one-time schoolmaster, and Edwin Lankester (1814-1874), acted both as a doctor and as science tutor to the family of Mr. Wood of Campsell Hall, near Doncaster.(3)

After the legislation of 1779 Protestant nonconformists were allowed openly to teach and keep schools and a lot of them were then able to open private schools, especially in the towns and cities where there was a demand from the developing middle class manufacturers and merchants for a better type of education than was available in the endowed grammar schools.

Although most of the earlier private schools were predominantly commercial, classical or showed a military

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(1) Hans. Op. cit. P. 183.
(2) Ibid.
(3) D. N. B.

or naval bias in their teaching, there were a few in which the study of scientific subjects was pursued. Some of the headmasters were Fellows of the Royal Society, among them Benjamin Morland, (1657-1721), and Peter Newcome, (1715-1799), of Hackney Academy, which had,

> "..... an uninterrupted existence at the same place for about 140 years, which rarely happened among private schools."(1)

Aylmer Bourke Lambert, a botanist who collected specimens for his own little museum before he even went to a school(2) attended at this Academy and certainly retained his collector's appetite there since the students

> "..... had excursions for the study of natural history."(3)

There is evidence to suggest that J. B. Florian, who advocated in 'An Essay on an Analytical Course of Studies.' (1796), that:

> "Philosophy and the sciences ought to be made the principal study of young persons."(4)

included in his proposed course of studies for twelve to thirteen year-old-boys instruction in natural history, whilst the thirteen and fourteen-year-olds were to have a much more ambitious syllabus which included anatomy, the theory of surgery, Medicine and Pharmacy, Pneumatology and Physiognomy.(5) Florian opened his Academy at Bath

(1) Hans. Op. cit. P. 70.
(2) D.N.B.
(3) Hans. Op. cit. P. 72.
(4) Op. cit. P. 79.
(5) Ibid.

and it may be that these subjects were taught there.

An agriculturalist, John Randall, kept an Academy at Heath, near Wakefield from about 1740 until 1754 and another at York until the 1770's;

> "William Hey, (1736-1819), the surgeon, was at Heath till 1750 and acquired his taste for science there."(1)

writes Hans, but there is no report as to the nature of his studies, although it might be reasonable to presume that botany or horticulture could well have been included in the syllabus.

Robert Harrow kept a boarding school, certainly from 1745, at Cheshunt, Herts. and it seems that he wanted to attract the sons of gentlemen to it because Hans quotes:-

> "with dancing, fencing, fishing and fowling; also the knowledge of gardening and agriculture and all sorts of manly exercises. They will be shown (what is known to very few) that one acre judiciously managed is sufficient to keep three horses a year."(2)

Andrew Marshall, M.D., (1742-1813),

> "taught anatomy privately in Bartlett's Court, Thavies Inn, from 1785 to 1800.",

and Solomon Sawrey, (1765-1825),

> "attended Marshall's lectures in 1794 and attracted the attention of his master by a dissection of the nerves of the eye."(3)

The private schools of the nineteenth century seem

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(1) Op. cit. P. 94.
(2) Lyson's 'Collectanea' Vol. 2., quoted by Hans, op. cit. P. 97.
(3) D.N.B.

to have broadened their curricula in comparison with those of the preceding century. In general, the education given in them, in the biological sciences, had much less of an emphasis upon medical subjects with the result that natural history, botany and, occasionally, zoology, find mention in their syllabuses.

In 1815, Dr. L. Carpenter, (1780-1840), who was keeping a boarding school at the time, published a 'Systematic Education on Elementary Instruction in the various Departments of Literature and Science with practical rules for studying each branch of knowledge', in two volumes, which contained a chapter on natural history and included botanical and zoological material.(1) Lant Carpenter, who was educated at Northampton Academy, kept his private school at Bristol, which he gave up in 1829, (the fees were 100 guineas per year) and James Martineau studied physics, chemistry, mathematics, geology and physiology there and scientific experiments were performed and the teaching illuminated by the use of specimens, diagrams and charts.(2) W. Johnstone A.M., who was Master of Stanmore Academy, published, in the 'Results of Experience in the Practice of Instruction or Hints for the Improvement of the Art of Tuition as regards the Middling and Higher Classes of Society', (1818), his belief that Heraldry, Botany and

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(1) E. L. Greenberg. 'Private Academies in the First Half of the Eighteenth Century'. M.A. Thesis, London 1953. P. 98.

(2) B. Simon. 'Studies in the History of Education 1780-1870'. Lawrence & Wishart 1960. Pp. 110-111 & D.N.B.

Natural History should be taught in such schools.(1)

At Ardwick Green, Manchester, Duffield Academy existed from 1822 to 1853 to provide:

> "Classical, Mathematical and Philosophical Education. ..... In addition to the regular course of English, French, Classical and Mathematical Instruction, a great variety of information is imparted to the pupils, respecting the Phenomena of Nature, the Processes of Art and philosophical and Literary subjects in general."(2)

The Rev. Charles Burton, L.L.D., F.L.S., who was an excellent botanist, published an advertisement in 1828 notifying prospective customers that he was prepared to provide instruction at his home in a wide variety of subjects such as geography, history, arithmetic, geometry, algebra, astronomy, botany, chemistry and stenography.(3) The Rev. J. R. Beard kept a Private Academy at Manchester in 1829 wherein lectures were delivered on 'The Elements of Science' as part of the course of instruction.(4) In Manchester, too, during the 1830's, there was an Academy in George Street, kept by the Rev. John Wheelden which prepared students in medical studies for entrance to Apothecaries' Hall.(5) George Edmondson, (1798-1863), who was educated at the Quaker school of Ackworth (of which more will be written in the Chapter dealing with Proprietary Schools) opened a private school at Blackburn in 1830 and at Tulketh Hall, near Preston, a little while

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(1) Greenberg. Op. cit. Pp. 80-81.
(2) Ibid. P. 85, quoting the Manchester Guardian for Jan. 11th, 1823.
(3) Ibid. P. 86.
(4) Ibid. P. 87.
(5) Ibid. cit. P. 65.

later. The latter school possessed about 800 acres of land, and agriculture was added to the syllabus; amongst the lecturers at Tulketh Hall were Professor Tyndall, Dr. H. Debus, F.R.S., and Professor Frankland.(1) According to Miss Greenberg, Edmondson also opened a technical school at Queenwood Hall in Hampshire and incorporated metalwork, woodwork and agriculture in its syllabus.(2) A Mr. J. T. Barker kept an Academy at Deptford where he gave public lectures to large audiences on Botany and Astronomy; however it seems most likely that these were to adult audiences.(3) It is known that the Rev. J. Bruce taught Animal Physiology at his Academy in Percy Street, Newcastle in 1835.(4)

The Nesbit family, Anthony, John Collis and Edward Planta Nesbit combined their talents to keep a private school at 38, Kennington Lane, Lambeth, from 1840 onwards. They described their school as a:

> "Classical, Commercial, Mathematical and Scientific Academy and Agricultural Training School"(5)

and John Collis Nesbit is known to have taught chemistry at the Academy and is said to have introduced natural science teaching there; certainly, he taught agricultural chemistry. In their prospectus they stated that botany,

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(1) D.N.B.
(2) Greenberg. Op. cit. P. 72.
(3) Ibid. P. 48.
(4) Ibid. Pp. 90-91.
(5) Ibid. P. 100.

geology and chemistry were considered as being very important for agricultural training and amongst the lectures listed as delivered at the school between January and June of 1846 were ones on botany by Professor J. C. Johnson of Guy's Hospital, and on natural history by Edward Planta Nesbit.(1) An advertisement in the 'Educational Times' concerning this school, mentioned that lectures were delivered at the school on chemistry, agricultural chemistry, mineralogy and geology.(2)

Brian Simon discusses a Report published by the Manchester Statistical Society in 1834 concerning the number of superior private schools in a northern industrial city:-

> "There were thirty-six boys' and seventy-eight girls' schools with a total of 2,934 pupils; just under 7 per cent of the total number of children attending school in Manchester. The majority of these schools, eighty-nine, had been established since 1820 and a high proportion of teachers were dissenters. An analysis of the curricula showed that the average boys' school provided teaching in reading, writing, grammar, arithmetic, geography, history, mathematics and languages, up to the age of about fifteen. A few schools also taught natural history and drawing.."(3)

In these few, early examples of private schools there is a slight mirroring of the change from medical studies to the study of botany as a subject which was reported in Chapter I. It would be logical to assume that, if any private school offered to teach botany, some demand for such instruction must have existed. The reasons why this might have been so are topics that I wish to discuss

(1) Op. cit. Pp. 100-108.
(2) Educational Times. No. 38. Nov. 1850.
(3) Simon. Op. cit. P. 113.

in a later chapter, and at the close of this one, but it may be worth noting at this point that these reasons can only have been utilitarian in so far as botany was an associated study of horticulture and agriculture. I would suggest that it was these two latter subjects which kept the flag of biology flying, as it were, during the eighteenth century in affording subjects of 'useful' instruction for some of the sons of the middle classes and a number of the private schools had an agricultural bias. Certainly, instruction in zoology was non-existent and whilst there were more botanical studies in the nineteenth century schools this took the form of a 'polite and gracious' study for the dilettante and the naturalist, but it must be remembered that biological topics figured much less frequently in private school advertisements than such sciences as physics and chemistry, mathematics and the commercial subjects and useful languages. A fuller discussion of these problems will be dealt with at the end of this chapter.

By the latter half of the nineteenth century the private schools were many and varied - some, a very few, were predominantly classical still in their schemes of studies and some were technical - but many were 'multilateral', a term used by Hans to describe schools in which modern languages, modern subjects like history and geography and commercial and scientific subjects of some sort were included. By 1851 it was estimated (with what degree of accuracy is not known) that, whereas there were approximately 22,731 scholars attending six hundred and four grammar schools, the private school population numbered something in the region of 640,000 pupils.(1) Because of the ephemeral nature of some of these private schools, the Schools Inquiry Commission was only able to make a rough approximation when it was estimated, in 1868, that private schools might number about 10,000.(2) At the same time the Commission estimated, with more accuracy that the number of endowed schools or establishments of like foundation numbered about 3,000.(3)

By the middle of the nineteenth century, then, there existed a great and growing demand for private education and this especially by the middle classes for their children.

This rather nebulous group was constantly being added to by the elevation in social status of some tradesmen, professional men, farmers and craftsmen whose economic situations were improving during the eighteenth and nineteenth centuries with the growth of trade and industrialism, as well as the concomitant increase in the number of professional men whose services were vital to such economic expansion. It is possible that their views upon what constituted a worthwhile schooling for their sons were pragmatical.

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(1) Educational Times, April 1851.
(2) S.I.C. Vol. I. P. 6.
(3) S.I.C. Vol. I. P. 108.

Appearing before the Taunton Commission in 1866, Sir James Kay Shuttleworth stated:-

> "At present the great idea which the humbler portion of the middle class have of rising, is the making of money, but with the growth of a higher sense of the use of education and of the elevating influence of literary pursuits, literary distinction would come to be valued by them. Just as in the most educated portion of the middle classes who are not very wealthy their sons devote themselves to a purely scholastic or scientific profession, so in the humbler portions of the middle classes the same desire and instinct would arise."(1)

At a time of increasing application of science to industry and commerce, and when the economy of the country had ceased to depend completely on agriculture, middle class parents somewhat naturally desired that their children should have an increasing share in the new prosperity and an up-to-date schooling was one of the means to that particular end. There was a need for an understanding of the facts of science upon which this prosperity was based. That such instruction was unlikely to be found in the Grammar schools seemed self-evident and, further, there was a deep prejudice against the ingrained classicism of those schools and of the commanding influence that the Church exerted over them, which body not only tended to manage the schools for its own interests but also appeared to be biased in the favour of the upper classes. In the nineteenth century there arose an increasing exactitude of biological and geological studies due to the work of

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(1) S.I.C. Vol. V. P. 922. Q. 17,567.

such men as Lyell, Darwin and T. H. Huxley, among others, culminating in the postulation of theories of evolution, and this caused greater conflict between science and religion. In schools where the Church of England was in active control those modern and radical changes of approach to the biological sciences were not likely to be reflected in the teaching or the new ideas dealt with in the syllabus until much later in the century. This point is illustrated by a footnote in an article by Jean Bremner in the School Science Review:-

> "H. Alleyne Nicholson's Advanced Textbook for Schools' was also published in 1870 and this comment in the 'Non-Conformist' implies the Church's attitude to the new approach to zoology. With apparent relief they accept Nicholson's "safe" textbook. '..... We have only to add that Christian teachers and the adherents of a spiritual philosophy may safely put this book into the hands of their pupils. There is nothing theological in the book, but on the other hand there is nothing anti-theological.' (Review quoted in 'List of Scientific Works and Memoirs of H. Alleyne Nicholson, 1873, pp. 13-14)"(1)

The following quotation by Mr. C. H. Stanton, an Assistant Commissioner of the Schools Inquiry Commission is also noteworthy:

> "I cannot help noticing the fact, which may be a mere accident, that all the largest middle class private schools in my district were kept by dissenters. Taunton, Frome, Plymouth, and Yeovil all contain large schools of which the master is not a member of the Church of England, but mixed up with the pupils at all of them are a large number of Churchmen's sons. I nowhere found the least reluctance amongst the middle class for either Churchmen to send to dissenters' or dissenters to send to Churchmen's schools. This reluctance is only conspicuous in the class above. There were 40 boys, sons of

(1) Jean P. Bremner. 'Some developments in teaching Zoology in schools in the Nineteenth Century.' School Science Review, Vol. XXXIX 1957. P.76.

Churchmen, at the Independent College at Taunton."(1)

Although the urge to find a vocation or a trade for their sons provided a very strong reason for choosing a private education, not all of the middle class parents were swayed by this particular desire. Quite often a school could be found which was cheap - an excellent quality in the eyes of many - and as long as it kept their children from contact with the grammar school boys, who might well have come from poorer homes, then little else mattered. So many of the private schools quoted fantastically long lists of the subjects which they professed to offer that it is probable that parents who cared little for the end product of the schooling would be attracted by the thought that their children could receive a varied tuition relatively cheaply.

Private schools existed to make a profit. As such, they had at least to pay lip-service to any ideas that parents may have had on the educational needs of their children. One commercial schoolmaster wrote woefully of "parental tyranny" and quoted,

> "If you please, sir, mother says I'm not to learn Latin, as I'm not going to be a doctor," and "If you please, sir, father says he don't see what use geography is to me, as I'm not going to be a merchant."(2)

No profit was likely to accrue to a private school which, by refusing to pander to parental demands, found

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(1) S.I.C. Vol. VII. P. 65.
(2) Educational Times. No. 46. July, 1851.

itself unable to compete with those kept by schoolmasters who were only too eager to acquiesce. It followed that there were private schools which were efficient as teaching institutions and also private schools that were sufficiently flexible in their curricula so that they could offer wide ranges of subjects. Whereas these schools were relatively long-lasting it does not necessarily follow that they were invariably efficient.

At least parental pressure ensured that, as the Report of the Schools Inquiry Commission noted, the private schools were open to new ideas.(1) Experimentation, on the other hand, was not a characteristic of the Grammar schools for so many had statutes which were quite rigid in their prescriptions as to what could be taught or about the size of the staff and in these ways many of the Endowed schools were restricted. Further, their endowments, fixed centuries earlier in many cases, were not always sufficient to bear the heavy cost of building expansion or to pay for the introduction of costly apparatus for science, etc.; however, in a defence such as this there can be little doubt that, had the resources been available in many cases, the spirit was weak. The following extract from Mr. Giffard's report to the Schools Inquiry Commission, written in 1865, concerns <u>Blechingley Grammar School</u>, in Surrey, which had a private school

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(1) S.I.C. Vol. I. Pp. 299-302.

attached to it. The Assistant Commissioner's report, although hinting at better teaching conditions, is rather mixed in its attitude to the results obtained:-

> "The private section of the school contains a better class of boys, chiefly the sons of tradesmen and farmers. This branch of the school is superintended by the son of the head master, who has a trained assistant paid by himself. I examined some of the boys in arithmetic, English Grammar and English history, and geography. The arithmetic was creditably done, but the other subjects were at a very low ebb. No language, either ancient or modern, besides English, is taught. Occasional lectures are given in botany, in which the master is a proficient."(1)

These Assistant Commissioners paid some attention to certain private schools in various parts of the country. Mr. Bryce and Mr. Fitch made what visits the proprietors of private schools in Yorkshire and Lancashire would allow them; in no case did they identify a school by name when reporting adversely.

In 1861, in Lancashire, Mr. Bryce found that Bolton, with a population of 70,395, possessed one Grammar school, one Proprietary school and five Private day boys' schools; at Wigan, (population 37,658), there were four private schools to one grammar school, whilst the only secondary schools at Accrington (population 17,688) were two private schools. In his account of his investigations Mr. Bryce divided the schools first into those which he described as providing "a classical and commercial education", and which were more or less selective in the class of boys

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(1) S.I.C. Vol. XI. P. 154.

they received and which charged fees higher than those of the Grammar schools. He tabulated these schools according to the subjects taught:-

Total No. of boys in each school.	No. taking Nat. History	No. of hours per week in this subject.(1)
34	7	-
23	23	½
110	47	1
22	22	occasionally.
27	-	-
36	28	1

Of six schools which were sampled as being typical, in one way or another, of his second grading of private school, being mainly commercial schools where a little Latin or sometimes Euclid might appear on the syllabus and in which the schooling was cheap, there was not one that professed to teach natural history. In the first type, listed above, the total number of boys in the private schools that did teach natural history was 225; 127 of these had some sort of instruction in that subject, whereas 73, out of 160 boys took chemistry and 26 out of 146 took physics. Bryce noted that natural history was a popular choice of subject, along with French, English, History, Geography and Drawing.(2)

At one of these schools, where all three sciences

(1) S.I.C. Vol. IX. Pp. 544-545.
(2) Ibid. Pp. 534-549.

were taught to the boarders, this Assistant Commissioner wrote:

> "As a specimen of the aesthetic influences which are brought to bear on the pupils of some of these schools, I may mention that in the dining hall (which was also the sitting room) of one of them I saw over the chimney-piece three pictures. On the one side was a highly coloured representation of the heart and lungs, on the other a corresponding one of the stomach and intestines, and in the middle, a picture of the Crucifixion."(1)

Bryce found that all of these schools, cheap or otherwise,

> "..... pursue with very little energy any but the directly practical branches of knowledge."(2)

In them, Latin, Greek and Mathematics were more or less disregarded and in his account of the subjects taught he continued with the note:

> "French, on the other hand, as well as natural science, while utterly unknown in the meaner private school, is in the better ones pursued much more briskly than by the grammar school masters, and parents either are, or are supposed to be, charmed by the attention bestowed upon what they call a 'practical' subject."(3)

Later in his report, Mr. Bryce compared some figures showing the distribution of the teaching of some subjects between grammar and private schools in Lancashire; for Natural Science and Natural History the figures are given below - in the case of those quoted as 'Natural History', Bryce included pupils learning physiology, zoology, botany, geology and mineralogy:-

(1) Op. cit. Vol. IX. P. 571.
(2) Ibid. P. 550.
(3) Ibid. P. 573.

	Endowed	Private
Natural Science.		
Percentage of schools teaching it	21	33
Percentage of boys learning it	11	14
Natural History.		
Percentage of schools teaching it	17	20
Percentage of boys learning it	10	12

However, Bryce pointed out the variation in what was meant by those titles when he wrote:-

> "No reliance is to be placed upon these statistics, especially under the heading 'Natural History', for many schools who teach only some catechism of general knowledge, or give now and then an object lesson, or use as their reading book a set of 'Tales about Animals', construe such instruction as the teaching of Natural Science or Natural History."(1)

It is this cautionary note which is important in attempting to value the place of teaching of biological studies in the private schools (and, indeed, in the Grammar Schools, a point that will be discussed further in a later chapter; see Chapter V). For instance, Mr. Bryce stated that where natural history of any sort was taught it was only rarely an important part of the work, that its scope was often limited to physiology and that whereas the more expensive schools might sometimes have lectures and displays of plants and animals in the poorer types of school this sort of instruction was usually accomplished, if at all, by catechism alone.(2) By such means schoolmasters could present to the paying public impressive lists of subjects that their schools could offer to pupils even

(1) Op. cit. Vol. IX P. 648.
(2) Ibid. P. 649.

though the lessons may never have been regularly given or the lectures have been quite isolated and with little teaching significance. There are two further points that illustrate the nineteenth century attitude to biological studies and which are worth considering at this point and these are amply illustrated by two quotations from Mr. Bryce's reports when he considers the teaching of botany and zoology. First, discussing botany and physiology, he wrote:

> "Of the branches of natural history it seems to be admitted that botany is the easiest and pleasantest, since the materials are abundant, and the classification depends for the most part on matters of structure which the pupil can examine for himself, with the aid only of a knife and a pocket lens. ..... Physiology is popular among some teachers, who insist on its practical value, as teaching the needs of cleanliness, pure air, and so forth."(1)

Zoology, however, was noted as being much more difficult in practice since:-

> "Zoology supplies beautiful materials for the teaching of the principles of classification, and may be found agreeably treated in some schools. The objection to it is that less can be done by direct observation than in botany: the teacher must trust to pictures and now and then a skeleton or two."(2)

It is interesting to see how the biological sciences were regarded, at least in the manner of their teaching, as being almost purely classificatory and how the object lesson was to be presented with pictures and a skeleton or two, reflecting an attitude of mind which still, un-

(1) Op. cit. P. 651.
(2) Ibid. Vol. IX. P. 652.

fortunately, seems to linger in present-day nature study teaching in some junior and infant schools. Bryce believed, as did many others, that natural science and natural history could be used, in schoolteaching, as subjects of practical utility, to create tastes and interests and to promote intellectual habits of mind and to exercise the faculties of observation and induction.(1) These viewpoints were presented again and again before the Taunton Commission in its deliberations upon Grammar school curricula as recommendations for the inclusion of the sciences in schools; botany furnished a pleasant pursuit, its material was everywhere and easily obtainable and the subject had aesthetic overtones of beauty that were appealing. These factors, coupled with the reasoning expressed by Bryce above, make it easy to understand why botany, of all the biological sciences, was the one most likely to be found in the syllabuses of schools.

In Yorkshire, another Assistant Commissioner of the Taunton Commission, Mr. Fitch, received information from, or visited, 81 private schools which contained some 3,979 pupils. He estimated, in his report, that there were probably nearer one hundred and sixteen private schools in that county. Mr. Fitch quoted two advertisements as being descriptive of the way in which so many of these schools made encyclopaedic claims in defining their courses

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(1) Ibid.

of instruction. One such professed to teach:

> "Human physiology in its relation to the laws of health, or the art of maintaining high bodily health and vigour; chemistry in its application to arts manufactures, agriculture and common life."

as well as listing English, Geography, History, Mathematics, Commercial subjects, German, French, Latin and Greek and all the various possible subdivisions of those subjects as being available to students.(1) Another advertised that it had an elementary department, a commercial department, a classical department and said of the latter:

> "..... the classical department consists principally of those intended for the learned professions, their course of study comprises Latin, Greek, the modern continental languages, Euclid, algebra, geometry, plane and spherical trigonometry, conic sections, mechanics, history, geography, natural philosophy, including botany, chemistry, hydrostatics, optics, etc., landscape drawing and painting."(2)

From the information he received regarding natural history teaching in boys' private schools, Fitch reported that 13 schools, out of 20 he sampled, did in fact teach some science under this heading. The owner of one girls' private school made great play of having a visiting lecturer "in the season" to discourse on astronomy, heraldry, botany and architecture and stressed that the girls went out, when the weather was fine, to gather flowers and dissect them and then have a lesson on their structures. Fitch attended some of these lectures and found them

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(1) Op. cit. Vol. IX. P. 261.
(2) Ibid.

"charming, accurate and incomprehensible" so that, later, when he examined the pupils on the matter of the lectures there was little understanding of what they had heard.(1) It is not improbable to suggest that this must have been a common result to many students of the lecture method of imparting scientific knowledge.

In Northumberland, Mr. Hammond conducted a similar sort of inquiry. So as not to advertise them he numbered the schools he inspected; out of twenty-four he dealt with, only a private school of good standing in Newcastle and one other claimed to teach natural history subjects. In the former there were 195 boys of whom 40 took Natural History and used Wood's 'Natural History' as a text-book, while in the second there were supposed to be 32 boys similarly engaged out of a total roll of sixty-five pupils.(2) The same report dealt with private schools in Norfolk; only four of them had pupils taking natural history.

Of all the private schools in these two counties the best Mr. Hammond could report was:

> "In fact I believe there is only one school in the two counties in which any real and substantial knowledge of these branches of study is imparted. This is the chief private school at Newcastle. It returns two boys as studying physics, forty as studying natural history, and twenty-one as studying chemistry. An ample apparatus is accessible to the older pupils, and excellent object lessons in natural history, physiology, and comparative anatomy are in use."(3)

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(1) Op. cit. Vol. IX. P. 294.
(2) S.I.C. Vol. VII. P. 554.
(3) Ibid. P. 414.

Mr. Giffard, investigating the schools of Surrey and Sussex, had the following to say of the private schools in his area:-

> "Natural Science does not enter into the teaching of preparatory schools, nor into the curriculum of the lowest stratum of private schools. The proportion in which it is taught in other schools, varies with the terms. Thus, whilst 50 per cent of the private schools, whose terms for boarders are about £50 profess to teach some branch of natural science, only 20 per cent of the schools whose terms are lower pay any attention to it. The more expensive schools can afford to pay for the services of a professor; the humbler schools content themselves with teaching given by their own staff. One lecture per week seems to be the maximum time devoted to the subject. The branch usually chosen is physiology; chemistry or some branch of physics being preferred in a few schools."(1)

The Assistant Commissioners were agreed that, although some of the private schools were undoubtedly first-class, there were many that were unsatisfactory. A great weak spot was that caused by parental demands and consequent interference. It was paradoxical that, whilst this need to satisfy the parents that the schooling their children were obtaining was of high quality and sufficiently wide in subject matter caused these schools to be experimental in their curricula, it was also the ruination of many. The stability of some of the better private schools was a reflection of the fact that parents found the type and range of their curricula satisfactory whereas so many of the transitory schools existed briefly in the hope of a quick profit and it was not be wondered at that the Assis-

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(1) Op. cit. Vol. VII. P. 196.

tant Commissioners found them to be so poor. Active parental interference weakened the effectiveness of the schools in the long run since the demands they made must have been almost wholly utilitarian. The number of private schools which did exist in the nineteenth century, however, speaks volumes for the desire which existed for educational provision.

The schools suffered, too, from the consequences of the laws of supply and demand; in general they were unsettled and several times in their reports Assistant Commissioners spoke of the speed with which private schools opened and closed their doors, so that by the time an Assistant Commissioner was able to inspect a school it had ceased to exist. Salaries were rarely even relatively adequate and sometimes mere pittances were paid to assistants with the result that these establishments cannot have been expected to attract the most efficient, keen and well-trained of teachers. Further, since the whole idea of a private school was to make money for its owner, cash was rarely ploughed back into the business and equally rarely was money made available for the purchase of scientific equipment or books, to say nothing of providing reasonable accommodation for the pupils. In 1861, for instance, it was said of private elementary schools:

> "When other occupations fail, even for a time, a private school can be opened, with no capital beyond the cost of a ticket in the window. Any room, however small and close, serves for the pur-

> pose; the children sit on the floor, and bring what books they please: whilst the closeness of the room renders fuel superfluous, and even keeps the children quiet by its narcotic effects. If the fees do not pay the rent, the school is dispersed or taken by the next tenant."(1)

Nevertheless the demand for private schooling, accounted for in part by popular need, was also partly the result of what amounted to a lack of faith in the education that was provided by the Grammar schools. Although these latter schools may have had the benefits of permanence, tradition and independence of parental whims, they were also much more hidebound, their curricula mostly fixed by ancient statute and much more out of touch with the educational needs of nineteenth century society. The chief claim to fame of the successful private schools was that they profited from the opportunity to experiment with curricula and methods. By the acid test of their continued existence in supplying what was popularly needed some of them became notable for many years, increasing the numbers of their pupils when the grammar schools were in a period of decline.

Although when natural science and natural history were taught in the good private schools, the teaching was probably much better than that of a lot of grammar schools attempting to introduce the same subjects, it must be admitted that, in the case of the biological subjects, there was little of it. In the eighteenth century there

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(1) Report of the Newcastle Commission. 1861. Vo. I. P. 94.

were some private establishments providing instruction in medicine and it was quite common for surgeons to keep their own dissecting schools for specialist pupils. Agricultural and horticultural botany were also to be found in the curricula of certain academies and had a great deal of practical usefulness, but in the nineteenth century, the principal subjects to be found in private schools were botany and physiology and no really confident case can be made out for their usefulness then. (See, however, Chapter VI P. 202 for a note on the work of George Combe in pioneering physiology teaching in elementary schools). Physiology, perhaps, was important from the educationalist's point of view in providing a knowledge of health and hygiene, but whether there were many parents who took this view is problematical. Botany had an aura as the gentlemanly science and was becoming popular throughout the country with the middle classes; much depended on the interests and attainments of the owners of the schools, as well as what was in popular fashion, and much of the botany that was taught may well have been introduced because a proprietor, or his assistants, knew something about it. And, lastly, this subject was both easy and cheap to introduce and this could have been the most important factor of all.

CHAPTER III

THE PROPRIETARY SCHOOLS

(In this chapter those schools which were considered in the Reports of the Clarendon Commission (1864) and those of the Devonshire Commission (1870) as Public Schools are omitted and reviewed in a later chapter, even though such schools may have had their origins in proprietary ownership.)

Many schools were first started by members of religious sects for the sole use, at first, of their own children and sectarianism originated early among the Protestant Dissenters. The Baptist sect began in Holland under the leadership of John Smyth, who died in 1612, and the first English Baptist group came into being in, or near, London in that year. Congregationalism, which was well established at the beginning of the Civil War, probably had its origins in the preaching of Robert Browne, who founded a church in Norwich in 1580. Browne and his followers believed that ordination and the system of church worship were wrong. He, however, conformed about 1586, becoming Rector of Achurch.(1) The great majority of the Dissenters were Presbyterians, a sect which can trace its foundation from about 1572 when Thomas Cartwright asserted that the offices of Bishop and Deacon were not allowable and that all ministers were equal. In that year, an anonymous pamphlet summarised some of the Puritan objections to the orders of service and the titles of the Church of England.(2)

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(1) C.P.S. Clarke. 'A Short History of the Christian Church'. Longmans. 1950 edn. P. 333.
(2) Ibid. Pp. 328-329.

Methodism can be traced to the evangelical activities of George Whitefield and the Wesleys about 1738 when a great religious revival began under the stimulus of the simple enthusiasm of John Wesley with his attractive doctrine of personal justification by faith. Coming at a time when the Church of England was in a state of religious and moral apathy the travels and preaching of these men helped to uplift the poorer populace from the enveloping miseries caused by swollen populations in towns and cities. The weight of increasing industrialism, too, was becoming burdensome and was a contributory factor to the degeneration of the living conditions of the poorer classes. The Nonconformists were increasing in numbers during the eighteenth and nineteenth centuries to such an extent that,

> "The growth of Nonconformity is, perhaps, most clearly realised from the estimate that in 1700 the proportion of Dissenters to Churchmen was one in twenty-four, and in 1800 one in four."(1)

By law, the two English Universities excluded Protestant Dissenters from 1662 until 1871; Catholics, too, were excluded. The Public and Grammar schools were either Church foundations or controlled by the Church of England; the headmasters of grammar schools and many private schools were usually clergymen of the Church of England. Teaching in the Dissenting Academies after the Act of 1662 was so fraught with danger, due to the demand

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(1) F. Smith. 'A History of English Elementary Education. 1760-1902.' University of London Press. 1931. P. 32.

that all schoolmasters should subscribe to the Liturgy of the Church of England and hold the Bishop's licence to teach, that most of these Academies were peripatetic until certain of the restrictions were removed in 1779.

Thus, just as these Academies had provided an education for the sons of Dissenters when persecution was rampant, the religious sects of every type took steps to ensure that, when conditions of toleration allowed, their children should receive an education in which their own particular religious beliefs and moral principles would be adhered to. All that has been written about such Proprietary schools, especially in the nineteenth century, points to the fact that they were both modern in outlook and efficient.

However, not all the Proprietary schools were formed and owned by religious denominations and the Schools Inquiry Commission made a good working definition in 1868:

> "The term 'proprietary schools' is usually applied to a certain class of schools which are the property of a body of shareholders, but the Schools Inquiry Commission (1868) use the expression as meaning schools which were not endowed, nor the property of the master or mistress who taught in them. These proprietary schools principally owed their origin either to the want of schools of a more public character than any private school, even of long standing, could possibly assume, or to the desire of a particular religious denomination to have a school in which religious instruction might be given in complete accordance with their views."(1)

(1) Report of the Consultative Committee on Differentiation of the Curriculum in Secondary Schools. Board of Education. 1923. P. 9.

Many of these schools, which were established during the earlier part of the nineteenth century, were organised on public school lines, though with a scheme of studies usually less rigidly classical and certainly costing less. They were formed, usually as joint stock companies, by all shades of religious opinion and by parents who foresaw that by this method they could control the type of education their children received and so make sure that it was worthwhile. Some of them became as famous as the Public schools and soon were 'classified' with them. Schools like Cheltenham, which was founded in 1841 by the Evangelicals, contained a Modern Side and was an attempt to create a new kind of educational body. Marlborough was founded in 1842 to provide an education for the sons of clergy and, like Rossall, founded in 1844, has been considered in the next chapter.

The Quakers have always had an interest in Nature and natural phenomena which is in keeping with their humanistic attitude to life and to religion and so the Quaker schools have mirrored the sect's interest by teaching natural history. The first Quaker establishment for secondary education was founded at <u>Ackworth</u>, near Pontefract, in 1779 by Dr. John Fothergill who was a physician in London and whose great grandfather was numbered amongst George Fox's first followers. Dr. Fothergill learned his profession first as apprentice to Benjamin Bartlett, a Quaker apothecary in Bradford and afterwards at Edinburgh, where he took his degree in medicine in 1736, and at St. Thomas's Hospital. These steps were typical of the training of many medical men of Dissent and have been outlined in Chapter III. Miss Elfrida Vipont, in a book about Ackworth School, has this to say of Dr. Fothergill:

> "An eminent physician and a noted botanist, Dr. Fothergill was a supporter of scientific research in many branches. He was elected a Fellow of the Royal Society in 1763 and received other honours both at home and abroad."(1)

Considering Dr. Fothergill's scientific background and the fact that George Fox himself had suggested, in 1675, the founding of a school to teach botany and languages(2), it is disappointing to find that the first mention of anything that may have been connected with natural history at Ackworth occurred in 1821 when the pupils formed an 'Association for the improvement of the Mind', a society which devoted itself to such pursuits as essay-writing and formed a library and some sort of a museum.(3) A Horticultural Society was founded there in 1835 and lasted for about twelve years(4) and the 'Association for the improvement of the Mind' was re-constituted in 1852 as the 'Ackworth Literary and Scientific Society'.(5) In the 1840's, Ackworth engaged some visiting lecturers who talked to the pupils about electricity, pneumatics,

(1) E. Vipont. "Ackworth School." Lutterworth Press. 1959. P. 14.
(2) Ibid. P. 15.
(3) Ibid. P. 66.
(4) Ibid. P. 89.
(5) Ibid. P. 67.

geology and the physiology of plants(1); by the time of the Taunton Commission, fifty-four of the one hundred and ten girls on the roll were divided into three classes, each of which had a weekly, thirty-minute lesson in Natural History for which they used Lindley's 'School Botany' and Hooker's 'Flora'(2), whilst the boys had a weekly lecture on one or other of Physics, Chemistry and Natural History.(3) In 1884, the bakehouse was turned into a room for the boys to pursue Natural History(4) and a Natural History Society for the girls was started in 1886.(5)

The Quakers founded a girls' school in 1824 at Stoke Newington and there the following subjects were taught: Writing, English, Arithmetic, Astronomy, Geography, Ancient and Modern History, Physics, Chemistry and Natural History, French and Needlework and Latin, Greek, German and Italian were included in the curriculum as optional subjects.(6)

Thomas Binns founded a Quaker school at Grove House, Tottenham, in 1828 and natural history was included amongst a number of modern subjects taught there.(7) Bootham School, in York, was also founded in 1828:-

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(1) W. A. Campbell Stewart. 'Quakers and Education.' Epworth Press. 1953. P. 148.
(2) S.I.C. Vol. XVIII P. 686.
(3) Ibid. P. 644.
(4) Vipont. Op. cit. P. 128.
(5) Ibid.
(6) Campbell Stewart. Op. cit. P. 76.
(7) Ibid.

> "The first Natural History Society at a school in England was begun there in 1834."(1)

and a strong interest in natural history expeditions as well as in geology, conchology and botany, were developed. By 1868 it was recorded that lectures had been given to all the boys in Physics, Chemistry, and Natural History and that, in the latter subject, there had been four or five such lectures on Animal Physiology and two delivered on Vegetable Physiology in the six months previous to the forwarding of the data to the Schools Inquiry Commission.(2) An Assistant Commissioner, reporting on this school, wrote:

> "In chemistry, botany and animal physiology, regular courses of conversational lectures are given, which are amply illustrated by diagrams and experiments, and duly supplemented by book work."(3)

The Headmaster, John Ford, speaking before the Commission, said:-

> "There is an annual show, gentlemen not belonging to the school are asked to judge, and prizes are awarded for botanical collections, collections of butterflies and beetles, collections of plants, collections of parts of plants, illustrating botanical principles. There is a written examination on botany. Prizes have been established for these things."(4)

And Campbell Stewart reports that by 1878,

> "..... the botany and zoology, each so eagerly studied in free time as well as in class, were drawn together into one study, which was called

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(1) Op. cit. P. 148.
(2) S.I.C. Vol. XVIII. P. 683.
(3) Ibid. Vol. IX. P. 237.
(4) Ibid. Vol. V. P. 288.

biology. Two microscopes were added to the school's equipment."(1)

The Quaker Girls' school at the Mount, in York, (founded in 1785 at another site, Trinity Lane, in York) is discussed by Winifred Sturge and Theodora Clark.(2) The authors include some letters written by Anne White, who was a pupil at the school in the 1830's. One of them, dated 1835, includes this short passage about botany,

> "Botany is greatly the fashion now. All the girls are looking for flowers and pressing them. They then gum them on paper, and write under them their Latin names and species. The books look quite pretty. I have not yet begun one, as I have no tin box to gather them in. H. Brady gets them for the girls. I believe they are 1s. 6d. or 2s. 4d. apiece. I do not know that it would be worth while for me to get one: dost thou think it would?"(3)

Another account of the school, describing the period of its history some time just after 1839, includes the following passage;

> "We took a constitutional walk almost every day between twelve and one o'clock, generally through the quaint old city; and once a week in the forenoon we went some miles into the country ..... At all times and places, when practicable, we gathered ferns, pressing, naming, and arranging them. The love of Nature in its various phases of skies, trees, water, flowers, meadows, birds, and insects, was thus strengthened and fostered, and to this part of my education I am indebted for much of the pleasure I have had through life. On our return, or sometime during the day, we devoted a short time to Botany, learning the names of many flowers....."(4)

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(1) Campbell Stewart. Op; cit. P. 151.
(2) Sturge and Clark. 'The Mount School - York'. Dent. 1931.
(3) Op. cit. Pp. 48-49.
(4) Ibid. Pp. 53-54.

Records exist, from 1842 to 1858, that committees of girls were appointed to take care of the museum specimens in mineralogy, botany and conchology and to collect more of them, (1), and a microscope was presented to the school in 1852.(2) Obviously botanical studies were included in the teaching and many of the girls must have had a keen interest in botany.

Ayton School, south of Middlesbrough, was founded in 1841 and Campbell Stewart writes that its first Headmaster:

> "..... explained that the school gave a thorough English education in reading, writing, arithmetic, English grammar, and geography, with frequent explanations of 'the articles that are in constant use, for food, furniture, clothes, etc.' He states that there was exposition of the forces of nature, the leading principles of natural history, natural philosophy, and agricultural chemistry, and instruction in blackboard - and pencil-drawing. Latin and French were taught later, and there was work on the land for the boys and in the house for the girls, four or five hours each day."(3)

From the foregoing there is little doubt that the education provided was an attempt to relate theory to factual, everyday things, and the school later became important as an agricultural establishment. Geological and botanical museum collections were organised (4) and the author quotes from the Headmaster, George Dixon, who wrote something soundly based on scientific principles in the 'History of Great Ayton School' (1891) when he said:

(1) Ibid. P. 64.
(2) Ibid. P. 70.
(3) Campbell Stewart. Op. cit. P. 71.
(4) Ibid. P. 148.

"It was our wish in all their Natural History pursuits, to direct them to Nature herself instead of depending on books,"(1)

There can be no doubt of the importance placed in the branches of natural science at this school:-

"The work was to develop by collections of plants, moss, lichens, fungi, on to the collection of shells. Certainly, in the early years of the school a keen interest in natural history was kindled and a quite advanced standard of study was aimed at to give body and shape to the developing knowledge. A course book (Johnson's 'Agricultural Chemistry') was used for part of the work. Agricultural chemistry, astronomy, geology, and botany were studied, and many experiments were tried to preserve specimens of flowers and plants. Such specimens were marked and displayed to the whole school. Some of the boys left school with a portfolio of 200 or 300 accurately described specimens ... The enthusiastic interest manifested by scholars and teachers in Natural History in the early years of the school was quite a feature in the establishment, hence a Friend in speaking at one of the school conferences said, 'The Society of Friends are deeply indebted to Ayton School for introducing the study of Natural History into many of their schools.' They even began a botanical class in the village which gave one young local gardener, William Mudd, an introductory interest which took him finally to be Curator in the Botanical Gardens at Cambridge University."(2)

Now, although the school was, to a certain extent, a specialist one, there is, in this lengthy quotation, something of the excitement and keenness which must have made the school almost unique in its attitude to the sciences in the first half of the nineteenth century.

At <u>Sidcot</u>, which was established in 1808, scientific work had appeared by the fifties. Natural History expedi-

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(1) Ibid.
(2) Ibid. Pp. 148-149.

tions were organised and, as a result, plant collections and collections of birds' eggs were made. In the next decade or so, lectures were given on physics, animal and vegetable physiology and entomology.(1) In the seventies, the girls at this school had been commended for the work achieved in natural history and elementary science had been included in the curriculum.(2) Natural History was conducted at Penketh School but it was in out-of-school hours from 1842 onwards, (3) and in that year, at Sibford School, near Banbury, Oxford, some gardening and agricultural work was included in the syllabus, along with

> "..... the usual interest of Friends in natural history."(4)

However, an inspection in 1903 resulted in a gloomy report:

> "The only science which is taught in the School is some very elementary chemistry, to which 1½ hours per week are devoted. The second year girls are taught a little Nature Study, but it is more of the character of object lessons than Nature Study property so-called ....."(5)

Natural history diaries were kept by pupils at the Saffron Walden School, where particular interest was shown in the natural history of the surrounding Essex countryside. By 1884, Wigton School had a chemistry laboratory added to it and there was already existing at the school

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(1) Campbell Stewart. Ibid.
(2) Ibid. P. 151.
(3) Ibid. P. 148.
(4) Ibid. P. 73.
(5) Ibid. P. 154.

a great interest in the teaching of such branches of biology as natural history, entomology, ornithology, and botany, as well as astronomy.(1)

I think that this brief account of the Quaker schools illustrates, quite clearly, how quickly the Quaker love for and interest in natural history was translated into live teaching in their schools; in some cases these science subjects existed in those establishments almost from their foundation. The teaching was always biased towards the practical side and there can be little doubt that the lessons were an integral and exciting part of the curriculum. This was, of course, aided by the fact that many of the pupils had their own particular branches of interest in natural history and were, in many cases, prepared to make their own, extra-curricular investigations. It is not surprising, then, that natural history, accepted almost as a religious credo, prospered to a much greater extent in the Quaker schools than elsewhere.

University College, London, was founded in 1828 and financed by a joint stock company. It was intended that boys of sixteen to nineteen should attend and the establishment was intended to cater for sons of middle class people and to give them a higher education. Medicine, Zoology, Botany, Anatomy and Physiology all had chairs. Professor Lindley, the horticulturalist was Professor

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(1) Campbell Stewart. Ibid.

of Botany and Charles Bell was Professor of Medicine.(1) A school was founded in connection with University College. The pupils had a free choice of the subjects they wished to take from the curriculum which offered English, Latin, French, German, applied mathematics, Chemistry, Physics, botany and physical geography among other subjects.(2) Science was included in the teaching at the Leicester Proprietary School (f. 1837) where experiments were demonstrated and, at the Liverpool Institute, in the 1840's, natural history and chemistry were taught.(3)

In 1858 the Headmaster of the Methodist school, Woodhouse Grove, mentioned in his report that there was some instruction in photography given in the school, as well as lectures in chemistry and "biology" and that there were lessons in common things for the junior boys.(4) The biology mentioned would most probably be natural history at that time. Another Methodist proprietary establishment, Kingswood School, had school gardens which were cultivated by the pupils in the second half of the eighteenth century.(5)

The Taunton Commission Reports are a vast repository for information concerning secondary education in this

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(1) Simon. Op. cit. Pp. 118-123.
(2) Ibid. P. 116.
(3) Ibid. Pp. 116-117.
(4) F. C. Pritchard. 'Methodist Secondary Education'. Epworth Press 1949. P. 90.
(5) Ibid. P. 169.

country in the middle of the nineteenth century and in each volume, where the Assistant Commissioners reported concerning the schools in their areas, there is some data about various types of proprietary schools. The following pages are not intended to stand as an exhaustive survey of such schools, since the time available permitted no more than what is hoped will prove a judicious sampling of the many recorded there.

The Forest School for boys, at Walthamstow, laid a claim to having organised a class of fifteen boys to take physics, chemistry and natural history for ninety minutes each week, for which privilege the pupils paid 45s. for each subject, and the Walthamstow Mission School for girls, which was a boarding school having fifty girls on its rolls, reported that thirty of its pupils studied natural history. The report from this school went so far as to name the pages studied in Brewer's 'Guide to Science' and a note was attached to the effect that the school had a large garden attached to it, but whether this was meant as a claim to using it for natural history teaching or whether as proving that the building had pleasant surroundings is not made clear.(1)

In Holborn, The Western Metropolitan Jewish School, which had sixty boys in its care, returned thirty of them as learning the three sciences recorded above;(2) the

(1) S.I.C. Vol. VIII.
(2) Ibid. Vol. X. P. 241.

Islington Proprietary School, an institution which provided an 'education for professional and commercial life' showed twenty-seven of its pupils learning natural history;(1) the West Central College for Young Ladies, in Bloomsbury, had a teacher who specialised in elementary science - a comparative rarity - and there were twenty-five girls learning both physics and natural history there.(2) Another London school which noted its gardens was the North London Collegiate School, and botany was taught to the girls of that school, so that, no doubt, the gardens were utilised for that purpose.(3) This school was established in 1850 in order 'to give a good secular education on a religious basis at moderate cost to girls of middle class.' (See also Chapter VII P. 245)

Epsom College belonged to the Royal Medical Benevolent College and was a school for the sons of doctors. Although it had a professor who gave weekly and comprehensive lectures in natural science, the boys had either to attend the science lectures or the drawing class. Five-sixths of the boys preferred to attend the latter.(4)

There was a proprietary school kept by the International Education Society at Isleworth from 1864, which had seventy pupils taking physics and chemistry and

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(1) Ibid. P. 245.
(2) Ibid. Vol. X.
(3) Ibid. Vol. X.
(4) Ibid. Vol. VII.

fourty-one learning natural history. In this school some oral instruction was given, too, in human physiology.(1)

At Brighton, there was a school for tradesmen's sons kept at No. 7, Ship Street where thirty-one boys, out of a total roll of ninety-seven, took natural history and there was mention of the use of Bray's 'Physiology'(2) and, at Lancaster House, No. 47, Grand Parade, a new school was in process of erection to house a proprietary school already in existence and teaching natural history to about one third of its students.(3)

In Taunton, the West of England Dissenters' Proprietary Schools kept an establishment in which teaching about vegetable and animal physiology was included in the syllabus, but the school was low in numbers.(4) In the same town was the Wesleyan Collegiate Institution and its Headmaster, Thomas Sibly, gave the following evidence before the Commission:

> "- Are there any means to secure that the boys understand the lectures?
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> - Yes, they take notes of the lectures, write them out neatly in books provided for the purpose; the senior class taking notes at the time and the junior pupils taking it from dictation. They are afterwards examined carefully on the subject. The course is experimental as far as possible; the subjects are chemistry, natural philosophy, and astronomy; and animal physiology is generally

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(1) Ibid. Vol. XII.
(2) Ibid. Vol. XI. P. 474.
(3) Ibid. Vol. XI. P. 479.
(4) Ibid. Vol. XIV.

taken with considerable care.
- Any botany?
- We go through the course of physical science, including botany, in two and a half or three years.."(1)

Sibly was very keen on Geology and led expeditions by the boys to the Quantock Hills. He was instrumental in starting school gardens at Taunton and communicated his enthusiasm for this pursuit to the pupils.(2) Another Methodist institution, the Wesley College in Sheffield possessed a botanical garden. (See P. 107)

At Bristol College, founded about 1834, there was a clearly organised division of the school into two groups, and Adamson, in his book, 'English Education, 1789-1902', comments on it when he writes that it bore,

> "..... clear indication, on the part of those who made it, of the contemporary German Gymnasium and Realschule. The school was to 'divide' about the age of twelve to fourteen. Those who stood below the dividing line were to follow a common course in Latin, arithmetic, geography, French or German, or both languages. Above the line was a bifurcation. Boys intended for the Universities should study together Latin, Greek, algebra, geometry and 'mixed mathematics as studied at universities.' Other boys should be grouped together for instruction; Greek should be omitted from their course, which was to include mathematics, physics or natural history, spoken and written French or German."(3)

The influence of German schools and their education has already been met with in an earlier chapter in connection with Matthew Arnold's endorsement of Naturkunde. There was in England, during the nineteenth century, a great admiration for the Prussian efficiency in organisation

(1) Ibid. Vol. V. P. 343.
(2) Pritchard. Op. cit. P. 169.
(3) J. W. Adamson. "English Education 1789-1902. C.U.P. 1930. P. 50.

and there arose a belief that its reflection here, in our educational systems, would prove worthwhile.

At the Liverpool Institute High School, there were said to be one hundred and ninety-five pupils, of whom only three took some form of natural history instruction and they used textbooks by Agassiz and Gould.(1) At the Manchester Mechanics' Institution Commercial and Scientific Day School for Boys, founded in 1857, which was a school well spoken of by Mr. Bryce, natural history was taught to ninety boys out of two hundred and thirty on the roll, and at the Salford Catholic Grammar School (1862) natural history was listed as the only science taught there and about half of the pupils took advantage of the fact. A branch of this school was the Liverpool Blackburne House Girls' School, founded in 1844, where some ninety girls, out of three hundred, had a progressive lecture course, not only in physics and chemistry, but also, surprisingly, in zoology, where lectures were given on vertebrate animals.(2)

The Wesleyan Proprietary Grammar School at Eccleshall, near Sheffield, had a botanical garden and there were forty pupils in this school taking natural history and chemistry, being divided into four classes for that purpose.(3) The Bradford High School was a proprietary school

(1) S.I.C. Vol. XVII.
(2) Ibid. Vol. XVII.
(3) Ibid. Vol. XVIII. P. 665.

which had two classes totalling thirty-five students (out of about forty) who read natural history. The upper class had lectures in vegetable physiology and the lower class examined and described plants with the aid of Gill's 'Botany'.(1) In Leeds, natural history was taught at the Ladies' Educational Institute (2) and at Berwick upon Tweed, at the Corporation's Academy, six students were returned as taking the subject with the aid of Balfour's 'Botany'.(3)

Mr. A. K. Isbister, who had been connected with the Jews College in Finsbury square, had been Headmaster of a proprietary school in Islington and was editor of the 'Educational Times', was also Headmaster of the Stationers' School in 1865 and appeared before the Taunton Commission. In his evidence, he mentioned that science formed an important part of the curriculum at that school; natural philosophy, chemistry and mechanics were taught there and botany, zoology and geology were introduced to boys of about ten to twelve years of age in what was really a nature study course.(4)

When sampling the returns made to the Nineteenth Century Commissions, and those of the Taunton Commission in particular, we must make due allowance for the undeniable impulse, which must have plagued many Headmasters,

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(1) Ibid. Vol. XVIII. Pp. 648-649.
(2) Ibid. Vol. XVIII.
(3) Ibid. Vol. XIX.
(4) Ibid. Vol. V. Pp. 29-30.

governing and proprietary boards, to manufacture a silk purse out of a sow's ear. When reading the Taunton Commission, we often detect a great discrepancy between that which schools claimed they could and did teach and what the Assistant Commissioners actually found on their visits. A number of reports of natural history teaching in the proprietary schools sampled above seem rather vague and perhaps glib. Even so, there can be little doubt that others were teaching botany, animal physiology and occasionally zoology in a truly scientific and worthwhile fashion. Most of these schools were founded after the 1850's when, not only was there an increasing demand for scientific instruction, but science and the sciences were growing in stature, broadening their concepts and amassing greater and greater amounts of factual data. It was the proprietary schools (many of which have still to be considered in the next chapter as Public schools which they had become) that were much more attuned to the newness of the spirit of science. They were founded for very definite purposes by bodies dissatisfied with the type of education that was available or by religious sects. Not all of them were good schools, indeed many were small, local and second-class, but they had the saving grace of modernity and they were in sympathy with the modern subjects and so made some attempt to teach them.

CHAPTER IV.

THE PUBLIC SCHOOLS

(This chapter includes material concerning some schools which, although they were founded as proprietary establishments, soon became so famous and important that they were and are ranked as Public schools.)*

In a century when private philanthropy and the zeal of the secularists were responsible for much of the education available, the Public schools of England existed purely and simply for the purpose of providing a fitting education for the sons of the new, upper middle classes and those of the ruling aristocracy who were not privately tutored. Remembering that the nineteenth century was one of increasing industrialism it is easy to understand that there was a growing uneasiness at the lack of scientific teaching in the schools catering for the sons of gentlemen. Whereas, in previous centuries the more 'chivalrous' studies of heraldry, horticulture, dancing and fencing, the art of husbandry and the grammar of the Latin and Greek languages were the important and useful and 'polite' studies, with a shifting economic emphasis towards industrialism a knowledge of the scientific basis of manufacturing techniques began to be an important consideration in the training of those who ruled by right or by financial influence. The policy of introducing science into the schools, many of which had, for centuries, provided a classical training only, was one of expediency;

* E.g. Cheltenham (1841), Marlborough (1843), Rossall (1844), Radley, (1847), Wellington (1853), Epsom (1855), Clifton (1862) and Malvern (1863).

like most changes made in the educational system of this country, it was gradual.

In 1832 the Quarterly Journal of Education was protesting:

> "Is it reasonable or creditable, or decent, that boys of fifteen years of age and more should know absolutely nothing of the simplest laws of mechanical philosophy? That they should know nothing of the growth, production and manufacture of the various objects which are daily subservient to their necessities and pleasures? That they should be absolutely or almost altogether ignorant of the climate, productions, and geographical distribution of the animal, vegetable, and mineral kingdoms, and even of the moral and social condition of their fellow-creatures scattered over the globe?..."(1)

Impetus was given to ideas of introducing some science into the Public school curriculum by the results of the great Exhibitions that were held, in England in 1851 and in Paris in 1867, for instance, and which provided English manufacturers and their Parliamentary lobbyists with alarming yardsticks by which to measure their efficiency and their 'know-how'; the result was anxiety:

> "..... nearly every witness speaks of the extraordinarily rapid progress of Continental nations in manufactures, and attributes that rapidity, not to the model workshops which are met with in some foreign countries, and are but an indifferent substitute for our own great factories, and for those which are rising up in every part of the Continent: but, besides other causes, to the scientific training of the proprietors and managers in France, Switzerland, Belgium and Germany, and to the elementary instruction which is universal among the working population of Germany and Switzerland. There can be no doubt ...

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(1) Simon. Op. cit. P. 100. Quoting Q. J. of Edn. Vol. III No. 6 April 1832. Pp. 268-9.

> that the facilities for acquiring a knowledge of theoretical and applied science are incomparably greater on the Continent than in this country, and that such knowledge is based on an advanced state of secondary education."(1)

It is important, too, I think, to add that the insularity of the English peoples was greater in the nineteenth century than it is now and that the arrogant assumption that the term 'Englishman' was a synonym for one who was, above all, naturally efficient, victorious in arms, a trader par excellence and an influence in the world, if not by Divine Right, at least by forceful action. In a highly patriotic age it came as something of a shock to discover that, whilst the sons of gentlemen were being prepared for their essential roles in government, both politically and economically, in a fashion which was certainly centuries old and possibly almost medieval, other countries, which for many years had been considered to be inferior, had rapidly surpassed England in the new, twin powers of manufacture and mechanisation.

Even so, the State was not anxious to intervene; when Sadler wrote, in 1908, of the decision that the State should set a minimum standard of universal school training, his words were particularly descriptive of the attitude of the State to Public school education before the setting-up of the Public Schools Commission:

(1) Report of the Select Committee on Scientific Instruction. Ordered by the House of Commons to be printed. 15th July 1868. P. vii.

> "The decision to adopt this principle was reached after a conflict of opinion which had lasted for three generations. It was reached with reluctance, because most Englishmen would rather things were done freely than under compulsion by Government. Voluntary effort has for generations played a great and stimulating part in English education....."(1)

But, in the case of the Public Schools, Whig and middle class criticism mounted, especially in the columns of the 'Edinburgh' and 'Westminster' Reviews and, despite the opposition of such Headmasters as Goodford (Eton), Moberley (Winchester) and Scott (Westminster) the Public Schools Commission was appointed to inquire into the administrative organisation of Eton, Winchester, Charterhouse, St. Paul's, Merchant Taylor's, Harrow, Rugby, Shrewsbury and Westminster and sat from 1861 until 1864. This, the Clarendon Commission, drew attention to the neglect of science instruction in these schools when they noted the almost complete absence of natural science from the education available to a Public schoolboy.

Natural Science had been established at Rugby in 1837 when Arnold had introduced Physics and Tait had later brought Botany, Chemistry and Geology into the syllabus:

> "In 1859 a laboratory and lecture room were built and the teaching included botany, chemistry, physics and geology. At this time a boy on entering the school had to choose between science and modern languages."(2)

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(1) M. Sadler. 'Continuation Schools in England and Elsewhere.' Manchester University Press. 1908. P. xi.
(2) D. Turner. 'History of Science Teaching in England.' 1927. P. 88.

Although Shrewsbury had been presented, in 1731, with the herbarium specimens of Samuel Downes M.D. (1) there is little exaggeration in the following extract from an article in the 'School Science Review':

> "When, in the fifties of last century, polite society was flocking to the Royal Institution to hear the popular scientific lectures of Michael Faraday and John Tyndall, their sons, who were receiving a traditional classical education, had no such privilege."(2)

It was reported by the Clarendon Commission that, at Winchester, there was a Saturday lecture of one hour's duration at which the whole school was expected to attend and this lecture dealt with scientific subjects.(3) Dr. Moberly, the Headmaster, had previously instituted a botany prize and some boys went botanising on their own.(4) At St. Paul's, botanical study was 'named' for the Midsummer holiday from Henfrey's 'Elements of Botany' and Lindley's 'School Botany' and flower collections were encouraged.(5) At Eton, during the fourteen years preceding the Commission's enquiries, voluntary lectures had been given in Comparative Anatomy and Geology, amongst other scientific topics, but an ex-student suggested that these lectures were attended in order to kick up a row!(6)

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(1) Gunther. Op. cit. P. 201.
(2) D. Thompson. 'Science Teaching in Schools During the Second Half of the Nineteenth Century.' School Science Rev. Vol. XXXVII. P. 299.
(3) Clarendon Commission. Pt. I. Table C. P. 395.
(4) Ibid.
(5) Ibid. P. 415.
(6) Ibid. Vol. III. Pt. I.

At the time that the Commission collected evidence it was reported that Harrow had no regular school study in physical science but that boys could elect to be examined, after private work, in geology and botany (1); however, the evidence suggests that these examinations were undoubtedly of a low standard. Soon after this there was a change when Dean Farrar, who was science master there, had brought some organisational ability to bear upon the work of his department:

> "By 1866 a scheme was in operation by which any boy staying at Harrow for three years might have the opportunity of being introduced to elementary astronomy, zoology, botany, chemistry and physics."(2)

Farrar, in a paper delivered before the British Association in 1867, publicly declaimed his faith in science:

> "I must avow my distinct conviction that our present system of exclusively classical education is a deplorable failure. This is an age of progress and we keep spinning round and round on the same pivot, an age of observation and experiment and we keep bowing and scraping to mere authority."(3)

In their report, the Commissioners were much influenced by the type of studies carried on in the Prussian Gymnasium, in which 'Naturkunde' was taught, and they recommended:

> "the introduction of the elements of natural

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(1) Ibid. Vol. IV. P. 167.
(2) Thompson. Op. cit. P. 299.
(3) Farrar. 'Some Defects in Public School Education.' British Association. 1867.

science into the regular course of study",

and they considered that school science should be divided into observational studies, like natural history and physiology, and experimental lessons in physics and chemistry (See P. 20) and the report continued with some further words concerning scientific studies as follows:

> "Education with us is, in this respect, narrower than it was three centuries ago, whilst science has prodigiously extended her empire, has explored immense tracts ..... It narrows unduly and injuriously the mental training of the young, and the knowledge, interests, and pursuits of men in maturer life. Of the large number of men who have little aptitude or taste for literature, there are many who have an aptitude for science which deals, not with abstractions, but with external and sensible objects;"(1)

Nevertheless, although the introduction of science into Public School curricula was stressed, the Commission recommended that the classical languages and the study of their literature were to remain as the major school studies. But the Clarendon Commission had succeeded in unearthing some disturbing facts and some equally disturbing errors of omission and, in 1871, the Devonshire Commission began an exhaustive investigation into the position of science in the educational establishments of England. R. L. Archer, in his book 'Secondary Education in the Nineteenth Century' summarises the position of this Commission succinctly:

"This Commission was intended to act as a

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(1) Clarendon Commission. Vol. I. P. 32.

> general headquarters for the scientific army to decide the plan of operations, and as such it was urgently needed. The allied army of mathematicians ... of chemists intent on preserving British industry against foreign competition, of biologists and geologists setting out with a missionary zeal to spread a new outlook on the universe, of naturalists intent on using Nature as a purifying agent on the pettiness of economic man, and physiologists eager to improve sanitary conditions and the national physique, had each found that they had rushed certain positions and each believed that the next position on its own front was the key to the situation."(1)

I believe that Archer's words form a very reasonable comment on the transition of science during the nineteenth century from a series of studies which were of absorbing interest and importance, only to a small proportion of the population, to a position where the sciences had become vital factors in the living conditions and the livelihood of a much larger proportion of the population of this country. The passage quoted above also serves as a reminder that the sciences had grown in the breadth of their studies and so the various factions were eager to give evidence in support of the inclusion of their own particular science in the general scheme of English education.

As part of their fact-finding task, the Commissioners caused a questionnaire to be sent out to 202 schools which had endowments or incomes of over £200 per annum. Among them were such schools as Eton, Rugby, Westminster, Harrow, Dulwich, Manchester Grammar School, Clifton,

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(1) R. L. Archer. 'Secondary Education in the Nineteenth Century' 1921. P. 138 and following.

Rossall and Taunton College, to name a few taken from the list given in the Commission's Sixth Report. A number of these schools were Proprietary ones; such establishments as Cheltenham, Rossall, Marlborough, Wellington and Clifton, for instance, are dealt with in this chapter according to their modern ranking as Public schools.

One hundred and twenty-eight schools replied to the questionnaire and they gave enough information to show that some form of science was taught only in sixty-three. Of these, thirteen had some laboratory accommodation and eighteen possessed some sort of scientific apparatus. In at least thirty schools no regular time was spared for studies of a scientific nature.

At Clifton College, about four boys were learning zoology and botany was taken by some twelve boys in the Senior school; this latter subject was also included among the subjects taught to the Juniors and, in 1869, there was a flourishing Natural History Society in the school, with botanical, zoological and entomological sections in it. There is an interesting passage concerning the method of teaching zoology at Clifton College, at this time, contained in the School Science Review:

> "At Clifton College, Alleyne Nicholson's 'Manual of Zoology' of 1870 was in use and, judging from the fact that it reached its second edition in 1872 and its third the following year, it must have been a popular choice for the schools and colleges for which it was written. Nicholson's approach is an interesting one for it is a compromise between the traditional systematic approach

to the study of the animal kingdom and the introduction of physiology and zoological distribution into the syllabus."(1)

Botany was taught at Cheltenham where eight boys from the Classical department had some instruction in natural history and practical work was conducted in botany in the summer months with occasional microscope work in the winter, (2) and, by 1875, zoology had also entered the syllabus there.(3) Botany was taught, too, at Taunton College School (now King's College Taunton) to a small number of boys and again there was practical instruction which included dissection and the students had to write up schedules, describe their flowers and classify them.(4) Both botany and chemistry were very popular amongst the boys who took them but, according to the Headmaster, this was due more,

> "to the special enthusiasm displayed in teaching these subjects, not to any interest inherent in the subjects ....."(5)

The Sixth Report of the Commission contains, in Appendix II, an account of the Rev. Tuckwell's ideas on science teaching at Taunton. There he recommends botany and physiology teaching in graded courses in his school and there are hints about biological visual aids, and Henslow's

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(1) Jean P. Bremner. 'Some developments in Teaching Zoology in Schools in the Nineteenth Century.' School Science Review. Vol. XXXIX. 1957.
(2) Devonshire Commission Report. VI. Report. Appendix II. Pp. 150-152.
(3) Bremner. Op. cit. P. 75.
(4) E. S. Brown. 'Zoology in the Schools, 1851-1951'. School Science Review Vol. XXXV, 1953.
(5) Devonshire Commission. Op. cit. P. 24.

textbook on botany and Huxley's on physiology are both recommended too. (See Appendices 1 & 2). Both in this Report and in that of the Schools Inquiry Commission "a useful little book called 'Guide to Knowledge'" is pronounced invaluable.(1)

In the summer months, Winchester College organised several classes in Botany and there were botanical illustrations and collections to aid the boys in their identification of specimens.(2) At Marlborough, where the Headmaster considered that botany would be a valuable study for young boys,

> "Series of lectures have from time to time been given by different masters on geology, animal physiology, botany, etc., with satisfactory results in increasing the stock of knowledge possessed by a good many boys, and giving a marked stimulus to a few."(3)

There was no laboratory, but the lectures were considered to be a part of the school course (4) and the classes had been running for several years, according to the returns, and botanical collections were said to be much encouraged.

In 1872, at Wellington, botany was taught but the course of lectures cost eleven guineas and there was an additional cost to be met by the pupils of £4 10s. 0d.

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(1) S.I.C. Vol. V. P. 151.
(2) Devonshire Commission. Op. cit. Appendix II. P. 24.
(3) Ibid. [illegible]
(4) Ibid. Appendix V.

for botanical diagrams.(1)

By the time of the Devonshire Commission there had been some improvement in natural science teaching at Harrow due to the work of Farrar:

> "Comparative anatomy has been taught to a few boys, with some success, by making them read Professor Huxley's 'Physiology', as an introduction to the subject. The teacher gives one or two elementary lectures on the subjects of each chapter before it is read. The tissues are examined and carefully drawn. Comparative Osteology is then commenced. Specimens of every important order are then examined and made out with the teacher's help, or by reference to such books as Professor Flowers' 'Osteology of the Mammalia'. Specimens of dissected animals are then examined, and dissections of all the classes of animals are made."(2)

However, the following admission is also made in the Report of the Commission:-

> "At Harrow ..... a few boys receive instruction in Comparative Anatomy and Physiology during the half holidays, and other times which they can arrange with the teacher."(3)

At Dulwich, in 1871, a few of the more advanced pupils had taken Comparative Anatomy for the special purpose of preparing for the London Medical School Entrance Examination. Rugby gave instruction to the Middle School boys in either botany, geology or elementary physiology, and a short course on physiology was given in the Sixth form. Botany, at this school, was taught by lecture, by the use of textbooks and by prac-

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(1) Ibid. Appendix II. P. 144.
(2) Ibid. P. 185.
(3) Ibid. Appendix II. P. 23.

tical work.

> "Flowers are dissected and examined by every boy, and their parts recognised and compared in different plants and then named. No technical terms are given till a familiarity with the organ to be named or described has given rise to their want. ... Fruit, seed, inflorescence, the forms of leaf, stem, root are then treated; the principal facts of vegetable physiology illustrated; and the principle of classification into natural orders explained ....."(1)

Miss Bremner, in an article in the 'School Science Review', quotes an extract by J. M. Wilson from his book 'Notes on the Early History of Rugby School Natural History Society, 1916.' describing his method of conducting a class of 30-40 boys, from the ages of thirteen to sixteen, through an investigation of the Herb Robert. He asked for a description of the flower:-

> "'Some pink leaves,' is the reply. 'How many?' 'Five.' 'Any other parts?' 'Some pink little things inside.' 'Anything outside?' 'Some green leaves.' 'How many?' 'Five.' 'Very good. Now pull off the five green leaves outside and lay them side by side; next pull off the five pink leaves and lay them side by side; and now examine the little things inside.' ..... they find ten ..... and finally the curiously constructed central column, and the carefully concealed seeds."(2)

This is a passage describing an observational method which would not be amiss today; however, Canon Wilson was a trained observer himself and in the 1870's one of the drawbacks to the introduction of the biological sciences into schools was the difficulty of obtaining trained teachers, especially those capable of teaching scientific subjects.

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(1) Ibid. P. 106.
(2) Bremner. 'Some Aspects of Botany Teaching in English Schools in the Second Half of the Nineteenth Century.' School Science Review. Vol. XXXVIII. P. 379.

At both Rugby and Clifton College botanical expeditions were undertaken, whilst at Taunton, Cheltenham and the City of London School (where, by 1875, zoology had been introduced into the syllabus) (1) the select few who took botany were given practical lessons. (2)

From 1870, Clifton College possessed a museum containing fossil specimens, shells of British land- and fresh-water snails and those of their marine counterparts, preserved Lepidoptera, Coleoptera and birds' eggs, stuffed birds, skulls, skeletons and an herbarium.(3) Rugby's museum had a fossil collection, too, an herbarium, a series of anatomical dissections, skulls and skeletons, birds' eggs, a small number of shells and a collection of butterflies.(4) A scientific museum existed at Cheltenham and there were museums at Taunton and Marlborough, whilst at Dulwich a Natural History Museum was in process of formation and Winchester had a room made available for the use of the boys who collected objects of natural history interest.(5)

In 1865, the Rev. E. Thring, M.A. appeared before the Schools Inquiry Commission and answered questions put to him about science provision at Uppingham, where he was Headmaster,

(1) Bremner. 'Some developments in Teaching Zoology .....' Op. cit. P. 75.
(2) Devonshire Commission. Op. cit. Pp. 29-30.
(3) Ibid. P. 45.
(4) Ibid. P. 47.
(5) Ibid. P. 49.

> "We have a natural science class, but it is on paper. It can be taught, but nobody will learn it. Then there is French, music, chemistry, and we have a lecturer in botany, ... I took great pains about the botany. I went the length of going out myself a good deal with the one or two I got to join, but nobody would come."(1)

The same apathy did not exist (at least on paper) at Clifton where it was reported in the 1870's:

> "Every tree and shrub has a conspicuous label attached to it bearing the English and Latin name, the natural order, and the native country of the specimen ....."

and where there was a rockery and aquatic plants in sunken pots and a total of somewhere near twelve hundred species of flowering plants.(2) However, Thring's desires eventually prevailed at Uppingham since, during his Headship, a school garden was opened there, an aviary stocked and a Natural History Society was organised and developed.(3) The nature and extent of the botanical studies carried on at Clifton are well illustrated by the Intermediate examination paper for the Third forms there which was set in 1871. (See Appendix 3).

Rugby, like Clifton, had a Natural History Society. It was formed in 1867 and there was a scheme of fortnightly meetings and a few excursions during the year. The Natural History Society at Marlborough was formed in 1864 with fifty members, and botanical, archeological,

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(1) S.I.C. Vol. V. P. 101. Qq. 9960 & 9962.
(2) Devonshire Commission. Sixth Report. App. II. P. 47.
(3) Report of the Consultative Committee on the Differentiation of Curriculum for Boys and Girls. B. of Education. 1923. P. 12.

entomological and geological sections existed within it. Similar Societies were formed at Winchester in 1870 and at Wellington College in 1868. Cheltenham Natural History Society had a student secretary and about 40 members, Marlborough had about 50 members in its Society, there were fifteen in the Rugby N.H.S., twenty at Wellington and about ten in the Natural History Society at Clifton.(1) During the fortnightly meetings of the Society at Wellington, papers had been read on such topics as 'The Mosses', 'Snakes', 'The Natural History of Man' and 'Recent Discoveries on the Sea Bottom'.(2)

There was some variation in the use of biological textbooks according to the answers to the questionnaire; Oliver's 'Elementary Botany' was in use at Rugby, Clifton, Winchester, Charterhouse, City of London School and Taunton College, and supplemented with Bentham's ageless 'British Flora' and Asa Gray's 'Class Book of Botany' for seniors at Rugby, with Balfour's 'Manual of Botany' for seniors at Cheltenham, and with Lindley's 'Descriptive Botany' at Taunton. Students at Clifton used Kirke Rolleston's 'Forms of Animal Life' for physiology and this was an illustrated textbook which described the anatomical make-up of some fifty varied animal types. Nicholson's 'Manual of Zoology' was also in use there for zoology (see page 118).

(1) Devonshire Report. Appendix II. Op. cit. Pp. 49-53.
(2) Ibid. P. 144.

Huxley's textbook on physiology and Carpenter's 'Vegetable Physiology' were both used at the City of London School and the latter textbook was also in use at Taunton and Marlborough.(1) Daniel Oliver's textbook, mentioned above, contained some original manuscripts of Professor Henslow's on botany which were embodied in the text. Professor Henslow organised an elementary school with observational botany lessons forming the main plank in his curriculum and this school will be mentioned later, in the chapter devoted to natural history teaching in elementary schools. Oliver's 'Lessons in Elementary Botany' was published in 1866, re-edited in 1880 and, before 1900, 67,000 copies of it had been sold.(2)

And lastly, I append an advertisement, the results of which I can only conjecture:

> "A good collection of moths and butterflies, for any other useful article of equal value. F.W.R., College School, Taunton."(3)

The Rugby Science Master, Canon J. M. Wilson, writing in 'Essays on a Liberal Education' (1867) stressed that school science should lead to the development of powers of observation, reasoning and the judgement of evidence and put forward the point of view that guidance in two different branches of Natural Science was an essential

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(1) Ibid. Pp. 25-28.
(2) Bremner. 'Some Aspects of Botany Teaching ...' Op. cit. P. 378.
(3) Scholastic Register. 1869.

part of such an education.(1) Concerning the teaching of geology and botany, he wrote:

> "I am quite sure that this is the first business of our profession as schoolmasters, to hold this truth strongly against all comers, that 'humanity', and nothing else is to be our object."(2)

A little earlier, however, Dr. Moberly of Winchester had said, in his evidence to the Clarendon Commission:

> "..... except for those who have a taste for physical sciences and intend to pursue them as amateurs or professionally, such instruction is worthless."(3)

and, before the same Commission, Dr. Kennedy, the Headmaster of Shrewsbury, said that the natural sciences

> "..... would not furnish a basis for education at all; I should consider them as an assemblage of facts not as supplying principles.(4)

T. H. Huxley became a Governor of Eton, from 1879 to 1884, and during that time biology teaching was introduced there, a science block constructed and money was spent on prizes, apparatus and Cambridge scholarships.(5) In his evidence, before the Devonshire Commission, Huxley noted one great weakness in the science teaching in all schools, such as it was. He pointed out that there was a great and catastrophic lack of qualified science teachers, a deficiency which applied as much to the Public schools

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(1) Quoted in 'Secondary Education.' The Spens Report. H.M.S.O. 1938. P. 40.
(2) Quoted in 'Educational Times.' April. 1872.
(3) Clarendon Commission. Vol. I. P. 147.
(4) Ibid. Vol. IV. Qq. 694-700.
(5) C. Bibby. 'T. H. Huxley - Scientist, Humanist and Educator.' Watts. 1959. P. 173.

as it did to the elementary and grammar schools, and he proposed the novel theory that schools and colleges should be opened for the very purpose of training teachers.

Dr. Moberley's remarks, and those of Dr. Kennedy, show them to belong to what I would describe as the 'laissez-faire' school of thought among the Public school teachers. However, there appeared in 1868 the 'Essays on a Liberal Education' edited by the Rev. F. W. Farrar (see page 115). The writers, who included Professor Sidgwick of Cambridge, Professor J. Seeley, E. E. Bowen who created the 'Modern' side at Harrow, and J. M. Wilson who was science master at Rugby (see P. 122) and later Headmaster of Clifton, were in agreement that the classics, which formed almost the whole of Public school teaching, were outmoded as the basis of a liberal education and saw the need for the introduction of other studies in such an educational process. Even before the 1860's, William Whewell had urged the necessity of including the sciences in any liberal scheme of studies. In 1867 J. S. Mill, in his 'Inaugural Address at St. Andrew's', stated that a liberal education must contain both science and literature, whilst Herbert Spencer, in his articles 'Education, Intellectual, Moral and Physical' published as a book in 1861, claimed that science was the most important of all studies and that school curricula should be based on the sciences. The words of T. H. Huxley may well close this passage. Huxley was a protagonist of the sciences and especially of biology, but even more was he a believer in the value to men of a system of education that was more liberal in concept and in breadth of studies than anything which then existed in the schools. In 'A Liberal Education and where to find it', Huxley wrote as follows,

> "Well, what I mean by Education is learning the rules of this mighty game. In other words, education is the instruction of the intellect in the laws of Nature, under which name I include not merely things and their forces, but men and their ways; and the fashioning of the affections and of the will into an earnest and loving desire to move in harmony with those laws."(1)

By 1875, at least, zoology was established as a study for examination purposes at Cheltenham College, the City of London School, Clifton College, Clifton St. Peters' and Harrow, whilst, as the evidence suggests, botany was already a reasonably well established subject in many of the Public schools of this country. It would seem that the biologists and scientists had achieved some success when Biology, as such, began to figure in the Public school curricula - or at least, in some of them -

> "The Leys School and Shrewsbury both began it (Biology) in 1882, and I have been able to obtain some information about the type of work carried on at the former through the kindness of the headmaster. A prize for physiology was awarded in 1884, and by 1891 there was a small class whose chief aim was the Intermediate examination for the London B.Sc., such famous men as Bancroft, Bainbridge and Sir Henry Dale were members of this class, and they

(1) T. H. Huxley. 'Science and Education - Essays.' Op. cit. P. 83.

> carried out dissections, cutting and staining of sections and microscopy under a window at the end of the chemistry lab."(1)

D. M. Turner introduces a passage in 'History of Science Teaching in England' which, while not directly appertaining to the teaching of biology in Public schools, does at least point to the sort of conditions which existed at the next, 'higher' level of academic organisation:-

> "The following extract from Sir Arthur Shipley's reminiscences shows that students of biology, even in the 70's, suffered from the lack of adequate laboratory instruction. 'When I began to study Botany in 1879 at St. Bartholomew's Hospital, the only attempt at practical work was to hand flowers round the lecture room, which we sometimes dissected but I am afraid more frequently threw at the lecturer. In the following year when I came up to Cambridge, apart from the medical school there were recently constructed laboratories for the teaching of zoology and physiology, but excepting the herbarium there was no laboratory for teaching botany ..... the Cavendish laboratory was then, as now, doing work which has made it the Mecca of all physicists throughout the world. The Chemical laboratory was there also, but ill-housed and inconveniently arranged.' (A. E. Munby. 'Laboratories - Their Plannings and Fittings.' London, 1921. Introduction by Sir Arthur Shipley p. xiii.)"(2)

In this context, it is worth noting that the Devonshire Commission had already forecast that there would be some difficulties inherent in any attempt to introduce science as a curricular subject into the schools of England and that not the least of these were the cost (it would prove expensive to build or extend existing accommodation),

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(1) E. S. Brown. Op. cit. P. 74.
(2) D. M. Turner. 'History of Science Teaching in England.' Chapman & Hall. 1927. P. 130.

the necessity of engaging more staff and these difficult to find, the fact that school curricula were, even then, held to be over-crowded with subjects impossible to neglect, and the undeniable fact that headmasters and governors, themselves brought up and steeped in classical traditions, were not eager for change.

There was, however, one Headmaster, namely Sanderson of Oundle, who was more than ready to innovate and experiment. At his school, in 1909, the boys were conducting agricultural experiments in cross-breeding wheats and repeating Mendel's experiments with peas, and biology was an integral part of the curriculum for all boys.(1)

Despite hints that biological sciences were being relegated to unwanted corners of other laboratories, the evidence amassed by the Devonshire Commission suggests that, whatever the parlous state of the life sciences in Public schools before 1870, after that decade botany, zoology, physiology, biology were all subjects which began to appear in the curricula of most of those costly institutions. I use the word 'suggest' because I do not wish to hypothesise about the degree of establishment of these subjects, before the turn of the twentieth century, in schools of entrenched classicism. E. S. Brown puts his viewpoint most firmly when he writes:-

> "The span of 100 years chosen as the period to be covered by these addresses is fortunate as far as

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(1) 'Sanderson of Oundle'. Chatto & Windus. 1923. Pp. 135-13

the schools are concerned, because the entire history of biology teaching in schools just fits into this period."(1)

Brown uses the word 'biology' in its Lamarckian and modern sense as being concerned with botanical and zoological studies; although such a subject had undoubtedly been preceded by the separate studies of botany and zoology in Public schools, none of these sciences were firmly rooted there, a fact that the Thomson Committee pointed out in their Report published in 1916. (See P. 176) The Report of this Committee also includes this passage about the science teaching in Public schools:-

> "..... An examination of the answers (to the questionnaire) shows that while the great majority of these schools offer adequate opportunities for the study of Science to those boys whose parents desire it, there has in the Public Schools as a whole been no general recognition of the principle that Science should form an essential part of secondary education. If this principle were recognised, all boys would receive a reasonable amount of instruction in Science, extending over a substantial part of the school course. They do not now."(2)

This Report was also concerned with Preparatory school examinations:-

> "..... It is also clear, from the answers to the questionnaire circulated to the Public Schools, that while these examinations are designed to test the knowledge of boys in English subjects, French, Latin, Mathematics, and sometimes Greek, knowledge of such Science as might properly be taught to boys of preparatory school age is either not tested at all or tested in an incidental manner. Again until three years ago nature study was included as an

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(1) E. S. Brown. Op. cit. P. 71.
(2) Thomson Committee Report. L916. P. 20.

> optional subject in the common entrance examination for Public Schools, but we are informed by one of the representatives of the Preparatory Schools Association that 'few candidates took it, the reason being that the subject was not required as a condition for entrance into the Public Schools.'"(1)

The Report then suggested that nature study should become an examinable subject for Public School entrance scholarships and that a candidate's failure in the subject should disqualify him from possession of a scholarship.(2)

At the beginning of this chapter, it was pointed out that the furore over science instruction in the Public Schools began, in part, on a basis which was almost vocational, in that the sons of the upper middle classes had an economic duty to perform and, to understand and control this, some measure of scientific instruction was valuable. Now I am of the opinion that, in England after the eighteenth century, education and the doctrine of 'usefulness' are almost inseparable in fact, if not in theory. If this is correct, then all the lip-service paid to ideas of 'Liberal Education' by successive Commissions may well have become translated, by Public School Headmasters, into the severely practical question: 'What does a man need if he is to govern men?'' If such a viewpoint of utility was taken it is understandable why some physics and chemistry crept only gradually into the Public School curriculum after the 1850's. But the biological sciences, based as they have been upon discoveries made in the other two,

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(1) Thomson Committee. Op. cit. P. 30.
(2) Ibid.

are only now, in the twentieth century, offering more than a relatively limited defence to the acid tests of utilitarianism. Certainly, during the latter half of the nineteenth century, the amount of chemistry and physics taught never rivalled the studies of the classics, or the teaching of English and of foreign languages in the Public Schools and the biological sciences, even though they may have been represented in many curricula, were of even less importance. The Spens Report summarises the attitude to Science after the Devonshire Commission's Report was published:-

> "The Report recommends that (i) in all Public and Endowed Schools a substantial portion of the time allotted to study should, throughout the school course, be devoted to Natural Science, and that not less than 6 hours a week on the average should be assigned to this purpose; (ii) in all general school examinations not less than one-sixth of the marks should be allocated to Natural Science, and that in any Leaving Examination the same proportion of marks should be maintained. It is significant that the Report omits to define precisely the character of the scientific teaching to be given. Contemporary scientists were unanimous in urging that Natural Science should be taught, but apparently they had never attempted to determine what specific sciences should be taught. The Commissioners, accordingly, merely record their opinion that school laboratories should be constructed to supply accommodation for practical work in Physics as well as in Chemistry, and that many persons of experience in education had arrived at the conclusion that Chemistry was not so well fitted for the practical instruction of young pupils as Physics."(1)

What the nineteenth century Commissions did seem to agree upon was that botany, zoology, natural history and their simplified forms, called nature study were the obser-

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(1) Spens Report. 1938. H.M.S.O. P. 41.

vational sciences, and not what might be termed abstract and mathematical sciences, and so, if they had to be fitted into any scheme of education which was to be called broad and liberal, they could well precede chemistry and physics, a point of view put forward in the Report of the Bryce Commission on Secondary Education, published in 1895. (See P. 175)

In the records of the various Commissions which considered Science in the Public Schools whilst, as more and more schools were questioned by each succeeding Commission there is greater mention of botany, zoology and biology etc., this is probably quite relative to the numbers of schools examined and the increasing breadth of their curricula. There appears, also, the suggestion that, except for the purpose of the specialist biologist or intending medical man, these studies might occupy only a stage in the scientific educational ladder. This is a point of view to which I intend to return in a later chapter.

CHAPTER V.

THE GRAMMAR SCHOOLS

After 1660, it was two hundred years before there was sufficient impetus of interest or consternation as to the state of the endowed Grammar Schools and secondary education in this country to cause some measures of reform to be undertaken in the curricular organisation of these schools. During this period, the schools suffered many vicissitudes.

In general, the Grammar Schools were governed, both by the Bishop's licence which the master and usher needed before they could teach and which (although it fell into disuse before 1800) was not finally abolished until the Endowed Grammar Schools Act of 1869, and also by the Church itself, a body which continued to exercise a jealous control over teaching appointments and the nature of the curriculum. Whatever else a grammar school education might have been, it was conducted under the aegis of the Established Church and organised in accordance with acknowledged principles. The maintenance of the barrier between the ruling classes and those ruled was upheld at the expense of experiment and reform.

During these centuries, however,there was an ever increasing volume of criticism of the standard of secondary education and consequent demands for some experiments and for curricular reform. Even so, it was the educational philosophers and reformers who, almost alone, sniped at and pilloried the grammar schools because of their antiquated methods. Even as early as 1605 Francis Bacon wrote, in the 'Advancement of Learning',

> "This kind of degenerate learning (he was referring to the slavish imitation of Latin and Greek grammar constructions) did chiefly reign among the Schoolmen: who having sharp and strong wits, and abundance of leisure, and small variety of reading; but their wits being shut up in the cells of a few authors (chiefly Aristotle their dictator) as their persons were shut up in the cells of monasteries and colleges, and knowing little history, either of nature or time, did out of no great quantity of matter and infinite agitation of wit spin out unto those laborious webs of learning which are extant in their books."(1)

In that same work, Bacon suggested that the study of nature might well be included in school curricula.

Hezekiah Woodward, who went to a Worcestershire Grammar school at the beginning of the seventeenth century and, in 1644, was Master of St. Saviour's Grammar School in Southwark, wrote in 'A Childes Patrimony' (1640) as follows:

> "I spent five yeers and an halfe in the Grammar Schoole, trained up according to the bad fashion ..... of most Teachers then and now."(2)

and, in the same work, he protested about the methods in use in Latin teaching:

> "Our proceeding at this point is very preposterous;

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(1) F. Bacon. 'Advancement of Learning'. Ed. W. A. Wright. 5th edn. 1900, Oxford. P. 31.

(2) Quoted in C. B. Freeman. 'A Puritan Educator: Hezekiah Woodward and his 'Childes Patrimony'.' B. J. Edn. Studies. Vol. IX. No. 2, P. 138. May 1961.

and indeed Lilly hath led the way, and we follow him hood-winkt, as if we would not see more (low statured-men though we are) than he did an hundred yeares ago, and more, and standing ever since, as it were, upon his and others shoulders."(1)

In 'The Reformed School' (c. 1650), John Dury wrote:

> "The last and least part of true education is only minded in the ordinary schools, and that in a very superficial and preposterous way; for children are taught to read authors and learn words and sentences before they can have any notion of the things signified by those words and sentences, or of the author's strain and wit in setting them together, and they are made to learn by heart the general rules, sentences, and precepts of arts before they are furnished with any matter whereunto to apply these fules and precepts. And when they are taught these things wherein reason is to be employed, they are led into a maze of subtile and unprofitable notions, whereby their minds are puffed up with a windy conceit of knowledge, their affections taken off from the plainness of useful truths, their natural corrupt inclinations to pride, vainglory, and contentiousness not reformed but rather strengthened in perversity; so that they become both unwilling to seek and incapable to receive any truth either divine or human in its simplicity, for their heads are filled with certain terms and empty shows of learning which neither contain any substance or solidity of matter or give them any address by way of method to make use of that which they know for the benefit of mankind."(2)

Milton, in his 'Tractate on Education' (1644), noted how the grammar schools had slipped into errors inherent in the close study of Latin grammar to the neglect of literature and, of course, to the dominance of those schools by classical teaching. Writing to Samuel Hartlib, he spoke of,

> "..... the many mistakes which have made learning generally so unpleasing and so unsuccessful."(3)

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(1) Ibid. P. 139.
(2) Edited by H. M. Knox. Liverpool. 1958. Pp. 36-37.
(3) J. Milton. 'Tractate'. Op. cit. P. 673.

John Locke, in 'Thoughts Concerning Education' (1692), criticised those narrow and fruitless disciplines of classical teaching in the schools:

> "When I consider, what ado is made about a little Latin and Greek, how many Years are spent in it, and what a Noise and Business it makes to no Purpose, I can hardly forbear thinking that the Parents of Children still live in fear of the School-master's Rod, which they look on as the only Instrument of Education; as a Language or two be its whole Business."(1)

Almost two hundred years later, T. H. Huxley was able to write along the same lines in an essay, 'A Liberal Education; And where to find it',

> "Now let us pause to consider this wonderful state of affairs; for the time will come when Englishmen will quote it as the stock example of the stolid stupidity of their ancestors in the nineteenth century, ... If there be a nation whose prosperity depends absolutely and wholly upon their mastery over the forces of Nature, upon their intelligent apprehension of, and obedience to, the laws of the creation and distribution of wealth, and of the stable equilibrium of the forces of society, it is precisely this nation. And yet this is what these wonderful people tell their sons:- 'At the cost of from one to two thousand pounds of our hard-earned money, we devote twelve of the most precious years of your lives to school. There you shall toil, or be supposed to toil; but there you shall not learn one single thing of all those you will most want to know directly you leave school and enter upon the practical business of life.'"(2)

The monopoly of the Grammar School curriculum held by the study of Latin and Greek left little room for any other subjects before the middle of the nineteenth century.

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(1) J. Locke. 'Thoughts Concerning Education.' Ed. by R. H. Quick. C.U.P. 1934. P. 128.
(2) T. H. Huxley. 'A Liberal Education; And where to find it.' Pp. 94-95.

Such an instance as that of:

> "Richard Thompson, second master of Manchester Grammar School, (1696-1721)," who "was known as a master 'skilled in botany'".(1)

was an exception. There were teachers in Grammar Schools, in the sixteenth and seventeenth centuries, who were also medical men; such schoolmasters as Philemon Holland, Headmaster of Coventry Grammar School in 1628, Christopher Johnson, Headmaster of Winchester (1560-1571), and William Hill, Headmaster of Sutton Coldfield Grammar School, all of whom had studied medicine, may have imparted some of their botanical knowledge, for instance, to their pupils although this is conjecture alone.(2) Holland, for instance, was Headmaster for some ten months only and his M.D. degree was either Scottish or from some foreign University according to the Dictionary of National Biography. William Hill, who was born in 1619 and died in 1667, practised medicine after leaving Sutton Coldfield for London, whilst Johnson, who had an Oxford medical degree, according to the same source, was known to have practised both during his teaching career at Winchester and afterwards in London. There is a stronger possibility that another Grammar School teacher may have passed on some of his love for and knowledge of plants:-

> "Robert Uvedale, (1642-1722), became master of the grammar school at Enfield, Middlesex. (About 1644). He was a 'great lover of plants, and, having

(1) Hans. Op. cit. P. 40.
(2) Foster Watson. 'The Beginnings of the Teaching of Modern Subjects.' Op. cit. P. 176.

> an extraordinary art in managing them, is become master of the greatest and choicest collection of exotic greens that is perhaps anywhere in this land.'"(1)

It must be borne in mind that, although the criticisms by the authors listed above were no doubt justified in terms of educational theory, all of the endowed schools were not necessarily unmoved by the effects of the great changes that were taking place in England, after the seventeenth century, as a result of scientific discovery and the applications of science in agriculture and in the rising industries. In most grammar schools the Statutes excluded the introduction of 'modern' subjects and attempts to override these were forbidden by law. As late as 1805, the Leeds Grammar School case, in which Lord Eldon pronounced in favour of the traditional Latin and Greek studies and against a proposal to introduce mathematics and modern languages to the syllabus, proved a setback to many a grammar school that lacked the money to introduce a private Act to alter its Statutes.

Many of the existing endowments were inadequate for the upkeep of the school buildings; even supposing that trustees had so wished, the addition of modest facilities for science, in some of the smaller grammar schools, would have proved too expensive.

There was, between 1660 and 1860, not only a rise in population in this country (between 1760 and 1830, for instance, the population more than doubled) but a shift-

(1) Gibson. 'Account of several Gardens near London.' 1691. Archeologia, 1794, xii. P. 188, quoted in Gunther, Op. cit. P. 34.

ing of its density from the country to the towns and cities, with the result that some country grammar schools, which had once been important in providing an education for the sons of the local farmers and gentry, shrank both in numbers of scholars and in importance, whilst those in the towns became swollen with pupils and proved inadequate to accommodate all those demanding secondary education. Thus, in some areas the grammar schools declined whilst, in others, overcrowding was responsible for robbing them of the better class of pupils whose parents could afford to pay well for the type of education they wanted for their children.

According to Curtis, John Locke's educational philosophies also had some effect upon the grammar school population in the eighteenth century at least:

> "Locke's denunciation of the grammar and public schools, although it had little effect in improving them, was of considerable assistance in emptying them of their most promising pupils. His advice to provide private tutors was followed by large numbers of the upper classes, who sent their sons, after a period of private tuition, to tour the Continent rather than to study at Oxford and at Cambridge."(1

After 1799, when the restrictions restraining Dissenters from keeping schools were removed, there came into being an increasingly large number of private and sectarian schools. An exaggerated claim for these was made in the 'Educational Times' in 1851:

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(1) S. J. Curtis. 'History of Education in Great Britain.' U.T.P. 1948. P. 61.

> "That the Grammar Schools, while they overlook the poor, do but a small share of the work among the middle classes, is evident from the fact, that there are about sixteen thousand private schools in the country, a proportion of more than fifteen to one."(1)

In fact, the Schools Inquiry Commission of 1868 estimated that there were probably about 10,000 private schools in operation in the country at that time, and that estimation was probably a high one. (See P. 73). The Newcastle Commission estimated, in 1861, that the number of scholars in the Public and Endowed Grammar Schools, between 1858 and 1861, was 35,000, whereas the number attending Proprietary and superior Private schools was 286,768.(2)

By the nineteenth century, then, the position of the once-great Grammar Schools as a source of secondary education, had become threatened by competition, but this was not the only reason for their inadequacy, according to a letter in the 'Educational Times' of April 1851, they were suffering from neglect and abuse and were oppressed and in a state of decay.(3) By the middle of the century the call for reform of the Grammar School curricula was not sounded on purely philosophical reasons alone. These endowed schools, which constituted the sole source of secondary education for the children of the ever-increasing middle classes whose parents could not afford a satisfactory private education, were either no longer functioning

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(1) Educational Times. No. 43. April 1851.
(2) Curtis. Op. cit. P. 57.
(3) Educational Times. No. 43. April 1851.

as efficient centres of schooling or were unable to provide the type of education that these people, with a growing awareness of the social and economic facts of life, were beginning to demand for their sons and daughters.

Life in England was much changed when compared with the preceding hundred years. Biological progress was slowly causing an alteration to take place in the primitive agricultural processes of earlier centuries. Experimental breeding of livestock and attempts to improve cereal crops and stocks had begun. In the first half of the eighteenth century, for instance, Jethro Tull invented a drill for seed sowing and made scientific experiments, with the aid of a microscope, to investigate the physiological needs of plants and seeds during growth.(1) About the same time, Bakewell of Dishley conducted breeding experiments with cattle and sheep.(2) Because of the increase of population there was a greater demand for foodstuffs of all kinds and larger acreages of land were put under cultivation. The bigger farms were owned by a rich and often curious gentry and, with guaranteed markets, many of them were prepared to experiment with methods of tilling the land and crop production. Research and the dissemination of research were fostered, both by the Board of Agriculture (1793-1822) under the dynamic Arthur Young, and by the Royal Agricultural Society, founded in 1837, the Journal

(1) Lord Ernle. 'English Farming Past and Present.' 1932. P. 172.
(2) Ibid.

of which was a mine of information for farmers, especially since it was a relatively new way of passing on the fruits of the experience of others in an age when communication was difficult and extensive travels were not undertaken lightly by the majority of working farmers. Of Thomas Coke, who by manuring his land and by breeding experiments improved the productivity of his farm immensely, it was said:

> "In May and June, when the grasses were in bloom, (he) gave his simple botanical lessons to the children of his tenantry, who scoured the country to procure his stocks of seed."(1)

The natural sciences were growing in the importance of their applications to the business of living, for there were improvements in the standards of medical knowledge and hygiene. The expectation of life in 1660 was about 27 years, in 1800 it was 40, but after the turn of the century it rose rapidly. In 1857 Pasteur had begun to study fermentation; in 1866 Lister showed that surgery could and should be conducted in as nearly aseptic conditions as possible; from 1865 clean water, proper sanitation and sewage disposal became, albeit slowly, much more features of English social life.

From about 1760 onwards, this country was becoming increasingly concerned with the consequence of the growth of industrialism. Industrial expansion and production, based as they were upon scientific knowledge and research, called for increasing numbers of chemists, engineers,

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(1) Op. cit. P. 219.

clerks, accountants and all types of trained men. These people were not all specialists in the sciences of course, but they were men who were capable of undertaking responsibility and the type of education they needed was much broader in its range of subject-matter, and often partly scientific, so that increasing pressures were put upon the schools for this sort of provision.

Further, there grew up an active interest in science amongst the middle and lower classes of the country. With the inception of Rumford's Royal Institution in 1799 there was, especially under men like Davy and Faraday, an instrument of research which also served to spread knowledge much more widely than hitherto had been possible. Although scientific discoveries were still made by amateurs, like Cavendish, Priestley, Watt, Michell and Rumford - men who often had both the private means and the time to indulge in science more in the manner of a devoted hobby - there were signs of the popular interest in matters of science which was later to become so important. The Manchester Literary and Philosophical Society, for instance, was founded in 1781 and the Birmingham Brotherly Society, founded in 1796, existed for the purposes of improving the knowledge of its members in:

> "..... Reading, Writing, Arithmetic, Drawing, Geography, Natural and Civil History, and Morals, or in short, whatever may be generally useful to a manufacturer, or as furnishing principles for active benevolence and integrity."(1)

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(1) Hudson. 'The History of Adult Education.' P. 30. Quoted in Gregg. 'Social and Economic History of Great Britain. 1760-1950.' 1950. P. 256.

The Mechanics' Institutes, of which so many were founded early in the nineteenth century, also served to popularise science at least for a time, and indicated that the interest in science was not only found amongst the middle classes and the diletanttes. There was, then, an ever increasing urge for scientific knowledge in England and the middle class parents, looking for some schooling that would incorporate science in its teaching, became bitterly aware that such an educational type did not exist, nor was there any haste to provide it in the existing school system.

The rising pressure of reforming zeal compelled a scrutiny of the type of education available at a secondary level. It was an education for the professions; for the Bar, for medicine, for the Church and for government. England, however, was no longer clearly divided into two great social strata - the age was one in which the middle classes were increasing in number, influence and in their vociferation, - and the devotion of the middle classes to commercial and industrial pursuits created a demand for an utilitarian form of education.

> "A knowledge of the three R's and a little history, grammar, and a smattering of French and German, is generally considered sufficient to fit a young man to succeed in business. This is a question which manifestly admits of some difference of opinion - for in these days of commercial activity a young man who wishes to prosper in business must, perforce, have a talented mind, to enable him to cope successfully with his compeers in trade. ..... If a young man is placed at the head of a large manufactory, it is most important he should possess a technical knowledge of the articles to

> to be manufactured - or how can he expect to be able to direct rightly the workmen in his employ, who require a man at their head who thoroughly understands his business both technically and practically."(1)

Another commentary in much the same fashion, was by Augustus de Morgan (who became Professor of Mathematics at the new London University) and who wrote even earlier, in the 1830's:

> "..... among the first commercial peoples of the world, who depended for their political greatness on trade and manufactures, there was not, generally speaking, in the education of their youth one atom of information on the products of the earth, whether animal, vegetable or mineral, nor any account of the principles whether of mechanics or of chemistry which, when applied to those products, constituted the greatness of their country".(2)

Mention has already been made of the aftermath of the great industrial Exhibitions, held both on the Continent and in England, which resulted in a rising fear amongst manufacturers that this country was losing its paramount place in the sun of commerce. (See P. 111) The pattern of Continental schooling was keenly studied and the Prussian schools, with their two main, efficient and lengthy courses given in the Gymnasien and Realschulen, made a great impact on educational thought, there being agreement that the system had made for an efficient nation, both economically and militarily.

In 1848, a writer in the 'Educational Times' advocated the teaching of sciences such as animal physiology, zoology, vegetable physiology and botany to middle class

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(1) Gibbs Educational Guide. March. 1876.
(2) Q. Journ. of Education. Vol. 3. 1832. quoted by D. S. L. Cardwell, op. cit. P. 49.

pupils because, he felt, those subjects were interesting in their content and also could be used to cultivate the faculties of thought and investigation. (1) Much has been made of the 'middle classes' and I have mentioned them often; the 'Educational Times' defined them, in 1849, as:

> "..... those who, though depending on their profession or mercantile skill and exertions for the maintenance of themselves and their families, are raised above the deteriorating influences of petty trade; together with all those who, though living on independent means, have not been so richly endowed with fortune's favours as to be enabled to establish their families independently of professional or commercial pursuits."(2)

Thus defined, the children of clergymen, teachers, lawyers, doctors, officers, merchants and the highest strata of those engaged in trade were to receive a liberal education:

> "It has then reference to that which is non-technical, to the abstract cultivation of his intellectual faculties, and to the acquisition of those elementary arts which furnish means for the external exhibition of knowledge, and for its material application."(3)

In the same year and in somewhat the same vein, a Mr. Edward Lane of Plymouth, lecturing to the College of Preceptors on 'The Pleasures and Advantages of the Natural Sciences', advocated the teaching of those studies to, "People, enlarge, and tranquillize the mind."(4) Botany he recommended for pleasure.(5)

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(1) Educational Times. No. 7. April, 1848.
(2) Educational Times. No. 17. Feb., 1849.
(3) Ibid.
(4) Educational Times. No. 18. March, 1849.
(5) Ibid.

In 1854, the 'Educational Times' further commented:

> "Some time back the trustees of a grammar school at Llandovery, South Wales, a town described in the guide-books as by no means habitable by civilised people, advertised in the Times newspaper for a Second Master, who was to teach mathematics, chemistry, and botany. Science and literature are forgotten things by our educators generally. Hereby we mean practical science and living literature. ..... the majority of sixth-form boys from the grammar schools - know nothing of the flowers in their paternal green-houses, or of the character of the earth's crust under their ancestral estates.
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> Every scholastic establishment of any pretensions should have its botanic garden, its observatory, and its laboratory."(1)

T. H. Huxley was in the van of any movement which sought to widen the scope of the grammar school curriculum, especially if that movement concerned itself with the introduction of science subjects. In 1854, he wrote:

> "..... it appears to me that, as with other sciences, the <u>common facts</u> of Biology - the uses of parts of the body - the names and habits of the living creatures which surround us - may be taught with advantage to the youngest child."(2)

In the same essay, Huxley went on to write:

> "Biology needs no apologist when she demands a place - and a prominent place - in any scheme of education worthy of the name. Leave out the Physiological sciences from your curriculum, and you launch the student into the world, undisciplined in that science whose subject-matter would best develop his powers of observation; ignorant of facts of the deepest importance for his own and others' welfare; blind to the richest sources of beauty in God's creation; and unprovided with that belief in a living law, and an order manifesting itself in and through endless change and variety, which might serve to

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(1) Educational Times. March. 1854.
(2) T. H. Huxley. 'On the Educational Value of the Natural History Sciences.' 1854. in 'Science & Education - Essays' MacMillan. 1910 P. 64.

> check and moderate that phase of despair through which, if he take an earnest interest in social problems, he will assuredly sooner or later pass."(1)

In all his writings on this topic, Huxley was at pains to point out that, whatever their uses as practical sciences, natural history and biology could form an important part of a scheme of education that he termed 'liberal', and in this respect he showed a humanistic attitude to educational theory. A further quotation from the same source will serve to illuminate this statement:

> "There is yet another way in which natural history may, I am convinced, take a profound hold upon practical life - and that is, by its influence over our finer feelings, as the greatest of all sources of that pleasure which is derivable from beauty. I do not pretend that natural-history knowledge, as such, can increase our sense of the beautiful in natural objects ..... But I advocate natural history knowledge from this point of view, because it would lead us to <u>seek</u> the beauties of natural objects, instead of trusting to chance to force them on our attention."(2)

By the beginning of the nineteenth century there was a plethora of criticism and advice directed towards effecting a change in the manner of teaching in the grammar schools. From the turn of the nineteenth century, the 'Edinburgh Review' and, from its publication in 1831 until it was discontinued in 1836, the 'Quarterly Journal of Education' ceaselessly attacked the facilities for learning provided by secondary education, and, although these journals focussed much of their attention on the Public

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(1) Ibid. P. 65.
(2) Ibid. Pp. 62-63.

Schools it soon became apparent that there was great public concern on this matter. In 1809, for instance, the Rev. Sydney Smith, whilst reviewing R. L. Edgeworth's 'Professional Education' wrote in the 'Edinburgh Review':

> "The English clergy, in whose hands education entirely rests, bring up the first young men of the country as if they were all to keep grammar schools in little country towns; and a nobleman, upon whose knowledge and liberality the honour and welfare of his country may depend, is diligently worried, for half his life, with the small pedantry of longs and shorts. ..... It is in vain to say that we have produced great men under this system. We have produced great men under all systems. Every Englishman must pass half his life in learning Latin and Greek; and classical learning is supposed to have produced the talents which it has not been able to extinguish."(1)

S. J. Curtis, in his book, 'History of Education in Great Britain', speaks of,

> "..... the torrent of criticism, invective, and abuse,"(2)

that the Liberals, in particular, brought down upon the Government. B. S. Cane puts it in another way when he writes,

> "It is well known that many Victorians were tremendously alive to the need for including scientific and technical studies in the curriculum of post-primary schools. Early enthusiasts were encouraged by the support of eminent persons, and by grants of the Department of Science and Art. Various Royal Commissions recommended the scientific subjects for their intellectual discipline; they suggested that Science and Mathematics were two of the modern subjects which should replace Latin and Greek in many local secondary schools."(3)

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(1) 'Edinburgh Review' 1809; reprinted in 'English Historical Documents' XI. P. 695.
(2) S. J. Curtis. Op. cit. P. 76.
(3) B. S. Cane. 'Scientific and Technical Subjects in the Curriculum of English Secondary Schools at the turn of the Century.' B. J. Edn. Studies. Vol. VIII, No. 1. 1959. P. 52.

Amongst the Reports of the nineteenth century Commissions, there is a great amount of factual data about the subjects contained in the curricula of Grammar Schools which was published in the Reports of the Schools Inquiry Commission in 1868. The results of this inquiry were not encouraging; of 782 endowments, 50 schools had ceased to exist, and of 209 classical schools, 132 sent no boys to the Universities.

Concerning the existing science teaching, the Commissioners reported:

> "The Cause of Natural Science probably suffers as much from indifferent teaching as from absolute exclusion from the schools."..... "At present it not uncommonly happens that natural science, accepted as a necessity, is delegated to some master of no great mark ....."(1)

An Assistant Commissioner, Mr. Fitch, writing of the West Riding of Yorkshire, reported to the Commission,

> "Leeds was the only grammar school in which I have found a resolute and systematic attempt to teach science."(2)

and he noted that headmasters rarely thought of science as a serious part of the school course. All the boys at that Grammar School had to include two science subjects in their course and botany, elementary chemistry, natural philosophy and mechanics were available for them to choose from. There was also a more advanced course in which zoology was added to the list of science subjects given above. Dallas' textbook of zoology was used for this

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(1) S.I.C. Vol. I. P. 34.
(2) Ibid. P. 133.

as well as Oliver's and Henfrey's books on botany.(1) Such systematic courses were rarities in the Endowed schools.

However, before giving further extracts from the volumes of the Taunton Commission, it is as well to point out that the information supplied by the schools in answer to detailed questionnaires was often at variance with the facts discovered by the Assistant Commissioners when they inspected them. For example, Witney Grammar School, in Oxfordshire, claimed to have 32 pupils of which 11 were taking some sort of course in natural history, but the Assistant Commissioner found only 24 boys on the books when he visited the school and his report made no mention of any science teaching. Another school at Malden, in Essex, showed 52 scholars as attending the school, but when visited by Mr. Elton only nine were present. Four of these were taught natural history and chemistry, and textbooks and specimens were used to supplement the lectures. Another, a semi-classical school at Hingham, in Norfolk listed 15 pupils as taking physics, chemistry and natural history, but the standard of the instruction was very elementary. In Hertfordshire, Enfield Grammar School, could boast of only four pupils learning natural history and the school buildings had been condemned.

Textbooks were the main source of knowledge at

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(1) S.I.C. Vol. IX. p. 182. and Select Committee on Scientific Instruction. App. 14. 15th July 1868. P.467

Wellingborough, Northants., for the two students who were reading agricultural chemistry, and the same was the case at Huntingdon, where about four, out of sixteen boys, took natural history, whilst, at Peterborough, prizes were given for the subject and Gibson's 'Agricultural Chemistry' was in use.

It is noteworthy how often, in the tabular information given in the Taunton Commission Reports, there is no evidence to show that any real teaching of the biological sciences was performed and the claims to instruction in those subjects rest in fact in the boys reading for themselves or having an occasional lecture. Thus the Free Grammar School at Wisbech claimed to have 42 pupils taking natural history with the aid of textbooks and of rare lectures. Dismal though this sounds, the report on the establishment intimates that it was little more than a village school concentrating on English, geography, history and arithmetic. The classical school at Tiverton, Devon, reported one student, out of one hundred, taking science! The non-classical Smith's School, Broadwinsor, Dorset, claimed that more than half its twenty-two pupils were reading natural history from text-books, but the school was a poor one, inhabiting buildings in a state of disrepair. The school at Bideford, Devon, used Crossley's 'Class Book' and, by the showing of specimens, twenty-one boys were held to be taught physics and natural history.

At Wotton-under-Edge, Gloucester, there were fifteen students only, and seven were reputed to read natural history from text-books. The semi-classical school at Newcastle-under-Lyme returned some 53 pupils as learning physics, natural history and chemistry, mainly from Crossley's 'Class Book', but the Assistant Commissioner was impressed neither by the state of the school buildings nor by the attainments of the pupils.

In Somerset, the Grammar Schools at Ilminster and Shepton Mallet completed returns which noted that they had pupils engaged in studying natural history as well as other sciences. There were eighteen boys in the former school and their tuition was effected by means of lectures, the showing of natural history specimens and chemical and physical experiments. In each case they had one lesson per week of each subject. At Shepton Mallet,

> "..... Elementary lectures in Physics were given by the master, and experiments shown with the air-pump, etc."(1),

and the thirty-two boys concerned were divided between two classes for a weekly lesson of an hour in which Chambers 'Animal Physiology' was one of the books used. Natural history was taught at Maidstone Grammar School, along with chemistry and there were four classes, of which each had one lesson lasting for half-an-hour per week. A Gloucestershire classical school, at Thornbury, had only thirteen pupils but lectures were said to be delivered in natural

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(1) S.I.C. Vol. XIV. P. 92.

history and physics. Physics and natural history lectures and demonstrations were used to teach these sciences at Worcester Cathedral School, together with Chambers' 'Introduction to the Sciences'. Here the returns showed 50 boys, arranged in three classes, each having an hour of science per week. In the same county, the semi-classical school at Bewdley claimed to make provision for lectures, specimen demonstrations and experiments for seventeen boys in physics, natural history and chemistry.

Mr. Bryce reported of Oswestry Grammar School:

> "It would be proper to add to the natural history, which is now taught with good results, some teaching of natural science, particularly of chemistry, with a special view to its utility for agriculture."(1)

Birmingham English School had twelve students taking natural history and chemistry; by 1870, Birmingham Grammar School had established a Natural History Society which was actively engaged in collecting specimens for the establishment of a museum.(2) The King's School at Canterbury showed 26 boys as taking natural history out of a total of 102 on the roll.

According to its returns, the boys of Lincoln Grammar School were encouraged in their natural history pursuits by prizes offered after examination on some book like Coleman's 'British Butterflies'.(3) The semi-classical school in the Lincolnshire town of Spilsby had two classes,

(1) S.I.C. Vol. XV. P. 5.
(2) Scholastic Register. Feb. 6th. 1871.
(3) S.I.C. Vol. XVI. P. 266.

each of fifteen boys, taking physics and natural history, and, in the information supplied to the Taunton Commissioners, the school authorities stated that Chambers' 'Zoology' and 'Animal Physiology' were in use there.(1) Miss R. M. McDonald notes that there is information in the Taunton Commission Reports that physiology was taught in schools in the County Palatine of Lancaster and in Surrey and Sussex also;(2) (See S.I.C. Vol. VII. P. 196 and Vol. XI. P. 649.)

The schools of Cheshire seemed to run the whole gamut of proficiency: at Acton 7 boys out of 42, took chemistry, physics and natural history with the aid of specimen objects and demonstration experiments; at Runcorn out of 100 boys only 21 took natural history but they had five half-hour oral lessons for the purpose; at the Free Grammar School of Nantwich there were only twenty boys in the establishment and natural history was taught with the aid of a magic lantern; at Sandbach Free Grammar School natural science was compulsory for all the 83 boys on the roll and the weekly time devoted to the sciences varied from four to eight hours.

Some illustration of the teaching of science in Lancashire schools may serve to point out what was perhaps typical of many throughout the country wherein it was professed to teach natural history amongst the scientific

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(1) Ibid. Vol. XVI. P. 304.
(2) R. M. McDonald. 'The History of the Teaching of the Biological Sciences in English Grammar Schools, 1850-1952.' M. Ed. Thesis (Dunelm). 1953. P. 32.

subjects listed in the returns to the Schools Inquiry Commission, namely that their claims were too often grandiose and unsupported by achievements. The classical school at Middleton showed thirty-seven pupils learning the three sciences chemistry, physics and natural history; however there was only one master and the school was a poor one. A similar school at Wigan was, in fact, run-down and no longer classical; at Colne, half the thirty-seven children on the roll were supposed to be taught natural history with the aid of Crossley's text-book, but this semi-classical school was probably only of elementary standard. The Grammar School at Kirkham listed an impressive number of scientific text-books which it claimed to use in the teaching - Brewer's 'Guide to Scientific Knowledge', books on agricultural chemistry and geology, Crossley's 'Class Book' and the Irish Board of Education's 'Third Lesson Book' completed the list, but these volumes seem to have been the sole method of instruction to which the children had access. The Stand School at Pilkington had only one master, any scientific instruction given was from textbooks and the boys completed their education at fourteen. At Whalley, almost half of the 38 boys were taught Animal Physiology, however.

At Leeds, of which some brief mention has been made, (see P. 153), Henfrey's 'Botany' was used and Mr. Fitch wrote of the school:

> "In the upper forms, boys are allowed to substitute certain branches of science for Greek; 36 are studying Chemistry, and nearly an equal number are receiving systematic instruction in other branches of physical science. There is an excellent laboratory and ample apparatus and other provision for the teaching of these subjects."(1)

The schools at Saddleworth and Pontefract quoted the use of text-books only for their natural history instruction; Kirkby Ravensworth school supplemented an hour's lesson each week with the use of a textbook, but the teaching of all subjects in that school was said to be careless.

The semi-classical school at Alnwick professed to teach both natural history and physics but the instruction was of a low standard; at Carlisle, these two subjects were supplemented by chemistry but lectures were given only in the winter. The Wigton school claimed to have thirteen pupils taking natural history.

At Sevenoaks, the natural history studied was mainly botany and, at Ashford,

> "Botany, chemistry and natural science in general receive more than usual attention."(2)

Of Wye Grammar School, Mr. Elton reported,

> "A proposal has been made to set up a middle class school in the place of this grammar school on the model of those at Hurstpierpoint, Shoreham, and elsewhere. The charge for boarders would be about thirty guineas, for day boys inhabiting Wye, about eight altogether. Latin would of course be taught,

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(1) S.I.C. Vol.XVIII. Pp. 170 & 177.
(2) Ibid. Vol. XI. P. 17.

> but French and German would supersede Greek. There is no present demand for Greek at Wye. Particular attention would be paid (as now) to botany; there would also be classes in chemistry."(1)

The Milton Abbas school, in Dorset, indicated two classes of boys, six in each class, studying botany during two weekly lessons of half-an-hour each. Mr. Stanton said of it:

> "The education given was chiefly based upon the study of the classics; but every week the whole school read and committed to memory selected pieces of English poetry or literature. The head master also encouraged the study of botany and geology and had himself collected and classified some valuable specimens of the fossils of the neighbourhood."(2)

Helston Grammar School, in Cornwall, where Charles Kingsley was reported to have had excellent opportunities for pursuing his botanical and geological hobbies, made no mention of these studies and showed ten boys, out of fourteen, taking physics only. At Loughborough Endowed School all the pupils learned botany and agricultural chemistry was taught, too, so that the students knew something of plant make-up and the plants in the locality were identified by them.

Although the above instances are intended to represent but a sample of the information contained in the volumes of the Taunton Commission, the impression given is one of inadequacy. Not only is it obvious that there were very few masters in any way qualified to teach the natural sciences,

(1) Op. cit. Vol. XI. P. 115.
(2) Ibid. Vol. XIV. P. 92.

but also there were few schools in which these sciences were treated at all as if they were living studies. 'Natural history' was used as an all-enveloping term; botany was rarely taught and both zoology and animal physiology were hardly mentioned. Coupled with the inefficiency of the teaching and the poor standard of many of the schools - these were points mentioned repeatedly by the Assistant Commissioners in their reports - and the story, from the point of view of biologists, was a sorry one.

The Report of the Commission voices some of this:

> "Of the witnesses whom we ourselves examined on this point almost all who were not schoolmasters desired the adoption in schools of some branch of natural science, though as a rule they did not aim at the deposition of any existing subject; they thought natural science should have its due place, without interfering with the other studies. They judged it desirable for various reasons, as a means of cultivating the faculties of observation; as an important agent in mental discipline; as providing useful knowledge capable of being applied to the purposes of life, and some recommended it on all these grounds."(1)

One of the witnesses, the Rev. J. S. Howson D.D., Principal of a proprietary school, Liverpool College, where botany and zoology were taught, stated his belief that, next to mathematics, botany, zoology and natural history were subjects which, in the hands of a "..... thoroughly good naturalist" would prove to be most valuable in forming the basis of a scientific education.(2)

(1) S.I.C. Vol. I. P. 33.
(2) Ibid. Vol. IV. Q 2746.

However, from the remarks made by the Commission, it seems reasonable to assume that the majority of grammar school masters were still obsessed with the classics. Mr. Bryce, an Assistant Commissioner, wrote:

> "In Shropshire, Worcestershire, and Monmouth, those grammar schools which have not sunk into parish schools, have preserved a distinctly classical character. Latin is taught to every boy, Greek to all who remain long enough in the school; arithmetic and even mathematics are looked upon as subjects of quite inferior importance; modern languages are little attended to; chemistry and physics are scarcely heard of; ....."(1)

Mr. Giffard observed, of the grammar schools in his districts in Surrey and Sussex:

> "I do not find that in the grammar schools where the classics have been abandoned any fair substitute for them has been provided. Modern languages, mathematics, the natural sciences, music and drawing, are nearly unknown to them."(2)

Mr. C. H. Stanton reported in much the same vein concerning science teaching in the schools he had inspected in the south-west of England:

> "There is one study almost completely neglected in all schools, high and low, at least the exceptions are so few that they are easily told. This is the study of physical science and kindred subjects ....."(3)

The Taunton Commissioners, in their Report, were in favour of introducing some natural science teaching into the schools:

> "The best starting point would probably be found in the outlines of physical geography. ..... This

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(1) Ibid. Vol. I. P. 133.
(2) Ibid. Vol. I. P. 137.
(3) Ibid. Vol. VII. P. 26.

> would be followed by some branch of science which would not tax more than the faculties of simple observation. The examination of objects, their parts and uses, and the distinguishing of the parts of resemblance and difference with a view to their exact identification and classification, contribute an exercise of great importance as well as interest to young boys, and for this purpose descriptive botany or in some cases zoology, is, perhaps, the most suitable and convenient. But when boys reach the age to be taught natural science with scientific precision the subjects best adapted for teaching above all others are experimental physics and chemistry, inasmuch as they constitute the common platform of all the rest. They have generally been preferred in schools, and particularly in those in which natural science teaching has proved successful."(1)

In part, this statement was, and is, true. The biological sciences have always lagged behind physics and chemistry and depended upon discoveries made in those spheres for their own advances. However, the Commissioners were not considering biology for its own intrinsic worth, for they felt that natural science was, when taught alongside the classics, mathematics and modern languages, useful for university and professional training,

> "..... or directly to the business of life."(2)

and, in this context, biology was merely an exercise in which the senses were to be trained for later use in the cause of utilitarianism.

Jealous of the reputation and the future of the classics though, the Taunton Commissioners found:

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(1) S.I.C. Vol. I. P. 35.
(2) Op. cit. P. 36.

> "..... we have good reason to know that natural science may so quicken the intelligence and increase the mental power of boys as greatly to contribute to their advancement in other studies. In the City of London School, where there are upwards of 600 boys, all the boys are taught natural science; and while some of them through means of this instruction have carried off distinctions in several of its branches at the University of London and South Kensington, it has not been found to prevent them from achieving the highest honours in classics and mathematics at the Universities of Cambridge and London."(1)

The Commission recommended that schools were to be graded according to the ages at which parents would consider allowing their children to remain under instruction - a stratification that was as much a social one as anything else, but one that took account of ability and vocational intention - and the Endowed schools were to form the nucleus of secondary education with their endowments re-organised so as to allow any particular school to cater more exactly for the special needs of the population in its own particular area. There was to be a general administrative re-appraisal of educational needs and a central Authority formed, under the Charity Commissioners; the schools were to be allowed to charge fees according to their grading. Their educative bias was to be towards that elusive quality, a liberal education.

But these recommendations were not adopted. There were no local authorities to act upon any directives a central authority might make and there were no central directives because of a deep mistrust of the interference

(1) Ibid.

by government in education. The reformers spoke with many voices; a profession pathologically conservative was not to be rushed into novelties. In general the schoolmasters believed that the education they had themselves received at their Universities was the best and most fitting form of preparation at the secondary school level and thus the classical training and tradition of the grammar schools was not to be lightly cast aside. The ideals of the Taunton Commissioners were, perhaps, in advance of their times; class interest and preference were strong.

On reading the volumes of the Taunton Commission there are many more instances of schools professing to teach physics or chemistry, or branches of those subjects, than there are making kindred claims for the provision of instruction in the biological subjects. If the Assistant Commissioners, who made great efforts to inspect their areas accurately, could despair of the teaching of the physical sciences, then the paucity of biological teaching is not to be wondered at.

I have stressed the domination of the Grammar School curricula by the Classics. Because of this, the introduction of new subjects into the schools, and particularly the introduction of the sciences, was obviously slowed by the lack of adequately trained teachers. A.D.C. Peterson, in his book 'A Hundred Years of Education', mentions this when he discusses the place of the sciences in the Grammar and Public Schools in the decades after 1850,

> "..... many of the new subjects were included, as a face-saving measure, before nearly enough was known about methods of teaching them;"(1)

T. H. Huxley was well aware that this was only one of the barriers standing in the way of his professed aim to introduce the sciences into English school curricula. In 'T. H. Huxley Scientist, Humanist and Educator.', Dr. Cyril Bibby writes as follows:-

> "Himself a teacher to the finger-tips, Huxley was vividly aware that the profession was one demanding deep thought and high skill. ..... It is not surprising, therefore, that he sought to awaken teachers to the implications of their task and to encourage proper training and professional organisation. His diaries record meetings at the College of Preceptors, visits to the training colleges in Battersea and the Borough Road, and a speech for the Teachers' Training and Registration Society in aid of the Bishopsgate Training College for Women (now Maria Grey College). We find him also speaking in connexion with the loan exhibition of scientific apparatus at South Kensington, advising the Society of Arts on syllabuses in domestic science, concerning himself with a scheme to teach teachers the laws of health, and serving as President of the National Association of Science Teachers.
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> From its inception, one of the stated aims of the School of Mines had been the training of science and technical teachers, but under the influence of the mining engineers and geologists it had contented itself with a few gestures. In 1853 it was resolved to admit members of the College of Preceptors and certificated schoolmasters to courses at half-fee, and a year later it was agreed that the precedent set by admitting two students from Battersea should be extended to training college students in general, but not much more had been done. But Huxley, working with schoolmasters on the British Association's committee on science teaching, had deepened his understanding of the needs of teachers and become increasingly

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(1) A. D. C. Peterson. 'A Hundred Years of Education.' 1952. P. 128.

discontented with the inadequacy of their methods."(1)

Typically, he decided to train himself for the job and, in 1869, gave a course of demonstration lessons in science to schoolchildren in London, from which course his popular textbook on 'Physiography' came into being.(2) In 1870 he gave a course of biology lectures to schoolmasters and, with assistance from other biologists, continued these for some years and, writes Dr. Bibby,

> "..... the methods devised for these schoolmaster courses quickly spread to universities and colleges all over the land.(3)

When considering science teaching in the grammar schools after 1860 what information there is can be gleaned mostly from the reports of examining bodies. The Science and Art Department of the Board of Trade was formed as such in 1853 and was incorporated in the Education Department which was created in 1856. The Department was formed to encourage scientific teaching by giving grants to schools and scholarships to students so long as the Department's regulations were complied with. Its examinations could be taken by schoolchildren and from 1859, by teachers who, if they passed could then qualify for grants which depended upon the number of their own pupils passing the appropriate Science and Art Department examination. It was not until 1880 that the Department attempted to insist that examinees

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(1) C. Bibby. 'T. H. Huxley - Scientist, Humanist and Educator.' Watts 1959. P. 138.
(2) Op. cit. P. 140.
(3) Ibid.

in science should have done some practical work in the sciences of their choice, so that many of the candidates had only a purely theoretical knowledge of their subject. In 1859, natural history was included in the examination syllabus; one candidate took zoology and physiology and failed, two others took botany and one of them passed.(1)

T. H. Huxley was the examiner in zoology and physiology from the start of the system after 1859 and, in 1861, the natural history syllabus was split up into animal physiology, zoology, vegetable physiology and economic and systematic botany.(2) As the numbers of students taking these examinations increased, so Huxley noticed an improvement in the standards of the answers (3),

	1864	1868	1869	1870	1872	1873	1874
Animal Phys.	479	1182	2227	3705	5194	6834	6845
Veg. Phys. / Veg. Anat.	121	112	144	400	436	713	
Syst. Bot.	70	73	90	140	390	481	1214
Zoology	174	298	303	114	173	181	
Biology							232

(4)

After the 1870's, when School Boards were establishing Schools of Science and Science Classes to extend the scope of elementary education, some of the Grammar Schools did the same, either having classes in science subjects within their general programme or organising a part of the school

(1) Science and Art Department Report. 1859-60.
(2) G. Bartley. 'The Schools for the People'. 1871.
(3) R. M. McDonald. Op. cit. P. 55.
(4) Science and Art Department Reports.

with a special syllabus. In these ways, grants could be obtained from the Science and Art Department and B. S. Cane, in an article in the 'British Journal of Educational Studies' shows that, in the session 1898-9 there were 134 science classes in grammar schools catering for 6,324 students and 28 Schools of Science which dealt with 1,768 pupils.(1)

However the same author puts the contribution of the grammar schools to science instruction into some sort of perspective when he comments:

> "It is clear that the leading independent and grammar schools - with notable exceptions - gave very little attention to scientific and technical subjects before 1900. Their curriculum emphasized Religious Knowledge, Latin, Greek and Elementary Mathematics; towards the end of the century, more attention was given to History and French. The large number of endowed schools taught less Latin and Greek and more English and French than the Public Schools. Nevertheless, the less traditional approach of the endowed schools did not give much attention to the Sciences, and only Chemistry received a modest support. Although several hundred local grammar schools accepted Science and Art grants, the majority conducted just a few 'science classes' - mainly Elementary Mathematics and Chemistry. Only about fifty of these local schools were 'schools of science' by 1898, but this step did not entail excessive specialization in scientific or technical work."(2)

Elsewhere Mr. Cane suggests that, in the science classes at least, the grammar schools may have shown a bias towards a physical course of mathematics, physics and chemistry rather than the biological course as laid down in the regulations and which consisted of some geometry,

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(1) B. S. Cane. B.J. Edn. Studies. Op. cit. P. 59.
(2) Op. Cit. Pp. 61-62.

physiology or biology, botany and chemistry.(1) Miss McDonald castigates the sort of science teaching that went on in the Science Schools in this passage in her thesis:

> "Nowhere was education so completely replaced by 'cramming' as in the large Science Schools. The Science and Art Department subjects, originally devised for evening students, were consequently drawn up for the teaching of adults and without any thought of the slowly developing mind of a child or of the importance of regarding any subject introduced into a school as a means of mental training or development than as a means of acquiring knowledge. The syllabuses were absolutely unfit to be used in schools, even if merely because they broke up science into a series of apparently independent blocks of knowledge and gave a completely false conception of the relations of things."(2)

The examinations set by the College of Preceptors were first held in 1853 and were taken mostly by pupils from private and proprietary schools and, by the beginning of the twentieth century, very large numbers of candidates were entered for them (In the two years from 1897 over 3,000 schools entered examinees) (3). Of these, only 173 are known to have been grammar schools; the examinations allowed of a system of options and so it was easy to obtain a certificate without taking a science (4), but natural history and zoology were included among the subjects that could be offered. In 1864 there were 1,300 candidates of whom 16.6% offered natural history and, in 1866, there were 651 candidates, 15.4% of whom took natural history.(5)

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(1) Ibid. P. 61.
(2) R. M. McDonald. Op. cit. P. 118.
(3) B. S. Cane. Op. cit. P. 58.
(4) Ibid. Pp. 58-59.
(5) McDonald. Op. cit. P. 61.

Miss Bremner notes that the College of Preceptors' zoology examination paper for 1859, as well as that set by the Science and Art Department in 1863, was based upon a study of animal classification alone. Very similar were the syllabuses for the Cambridge Local Examinations and the London University Matriculation Examinations in the fifties and sixties, and she writes:

> "While this kind of zoology had become generally established as a school study by the 1860's, it could hardly be called popular, for the numbers following courses in the subject were small even compared with physiology and botany classes, the other two provisions in biological science struggling for existence at this time."(1)

She reveals its paucity with some tabular information which shows that in 1863 only 41 candidates took zoology, 210 were examined in botany and 344 sat the Science and Art Department Examinations in physiology. In 1865 these three subjects were taken by candidates for the College of Preceptors' Examinations, whilst, by 1880 the lists of the same examining body showed only 70 candidates in zoology, 74 in botany and 125 in animal physiology. In 1878, the Cambridge Local Examinations had 315 students presented in zoology and 470 in botany.(2)

The Cambridge Local Examinations began in 1858 and those of Oxford started in 1857 and there were two grades

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(1) J. Bremner. 'Some Developments in Teaching Zoology.' Op. cit. P. 71.
(2) Ibid.

in both consisting of Senior and Junior examinations. These examinations were taken by many grammar schools, as well as by private and proprietary schools and biological subjects were included at both levels. B. S. Cane examines the statistics of the Oxford Local Examinations Delegacy for 1880, 1890 and 1900 and shows that there were 166 candidates examined in Botany at the Junior level in 1890 and 442 in 1900 (the corresponding figures for chemistry are 214 and 588 respectively; further, there were 129 candidates taking that subject a decade earlier.), whilst, at the senior level there were 63 candidates in botany in 1890 and 181 in 1900. Physiography figured at both levels.(1) The 1893 Report of the Cambridge Local Examinations Syndicate complained of a lack of practical instruction in zoology at the higher level and stated their belief that the science teaching in general was purely theoretical.(2)

It is important to reflect upon the effects of the University examinations syllabuses upon the schools. Although London University tended to encourage modern subjects in the grammar and public schools which took its Matriculation examinations, there was no biological science in the examination syllabus from the start of the system in 1835 until botany was introduced in 1890. It would be logical to assume, therefore, that the biological sciences

(1) B. S. Cane. Op. cit. P. 56.
(2) R. M. McDonald. Op. cit. P. 118.

would hardly figure at all in the syllabuses of the schools taking this examination. Further, grammar schools gained their prestige according to the successes of the students they sent to the Universities and their courses and their traditions were often much bound up with classical courses at Oxford and Cambridge. Cane writes as follows about the grammar and other secondary grade schools at the end of the nineteenth century:

> "It is not surprising that the Sciences were not widely accepted by the schools as subjects for the curriculum. Honours courses in Science at Oxford and Cambridge were still much less popular than similar courses in Classics, Mathematics and History. The conscientious attempt of H. E. Armstrong to introduce the discipline of Science into school work had not convinced many Heads that Science could provide more than a training in the memorization of useful facts. The fact that the Sciences make a special claim on educational time and funds would not endear them to Heads and Boards of Governors. In this light, Morant might well be hailed for his insistence on the inclusion of some Science (including practical work) in all secondary school programmes."(1)

The Bryce Commission issued its Report on secondary education in 1895. The Commission found that, although the Endowed Schools Commissioners and the Charity Commissioners had, between them, made over a thousand schemes for the reform of individual schools, there were still many grammar schools which were either too poor or too small, or both, for efficiency. The Bryce Commission was appointed to examine the state of secondary education because of administrative multiplicity and confusion - various types

(1) B. S. Cane. Op. cit. P. 62.

and grades of schools existed and were under the control of different authorities - and lack of co-ordination. In advocating State intervention at the secondary grade,the Commissioners reported:

> "It is now pretty generally agreed that besides the literary and humanistic course of instruction, based upon the languages of classical antiquity, which tradition has established among us, and whose incomparable value no thoughtful man denies, ample provision must be made in schools for scientific teaching, beginning, if possible, with natural history and the other sciences of observation, and working up into chemistry and physics."(1)

Thus the supposition that, after an early period of natural history training, chemistry and physics were the only worthwhile sciences for the secondary school pupil was continued. The effect of this reasoning is still visible in the modern grammar school where early specialisation is the rule and only the intending biological or medical specialist gets more than a smattering of this type of knowledge hidden under the term 'general science'. Further, it was the supposition that the biological sciences, being factual, observable, interesting and, in their simplest data, 'easier' sciences that led to biology being formed into the 'nature study' lessons that were intended to give the younger secondary school pupils their first introduction to scientific logic and techniques.

In 1918, the Thomson Committee reported that, in the

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(1) Report of the Royal Commission on Secondary Education. 1895. P. 284.

Public and Secondary schools, science teaching was:

> "..... in general confined to the elements of physics and chemistry; botany and zoology are, as a rule, taught only to those boys who intend to enter the medical profession, while geology, as far as it is taught at all, is taken in connection with geography, or informally as part of the activities of the school scientific society."(1)

In considering science courses for pupils aged between 12 and 16, the Committee wrote:

> "We consider that the conventional curriculum is in great need of reform, in respect of two important points: (a) the choice of subjects to be included and (b) the manner of treating them. At present the curriculum up to the age of 16 in a large number of boys' schools consists of nature study in the lower forms, followed by a laboratory course in at least one branch of physics and in chemistry; in very few boys' schools is there any attempt to give a knowledge of the main facts of the life of plants and animals ... no boy should leave school with the idea that Science consists of chemistry and physics alone."(2)

Accordingly they advocated that, in the stage of their secondary school career following the age of thirteen, pupils should have had the opportunity of knowing somethings of the biological facts of existence.

> "We have already laid stress on the point that some knowledge of the main facts of the life of plants and animals should form a regular part of the teaching in every secondary school. Systematic work in zoology, including dissection of animals and the use of the compound microscope, belongs to a later stage of school life, but the main facts as to the relation of plants and animals to their surroundings, the changes in material and in energy involved in their life and growth should form part of a well-balanced school course.

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(1) The Thomson Committee on the position of Natural Science in the Educational System of Great Britain. 1918. P. 11.
(2) Ibid. P. 93.

> There is a considerable measure of agreement among our witnesses to the effect that the course might include the main anatomical features of the higher plants, the elementary physiology of plants, especially their relations to the soil and to the atmosphere, together with some quite general knowledge of animal metabolism."(1)

The topic of Nature Study was grist to their mill. This study had been anticipated in the object lesson teaching mentioned both in sources concerning elementary and secondary school teaching and it had arisen quite early in the nineteenth century; more will be said of it in the next chapter. However, the Thomson Committee noted:

> "There is general agreement among science teachers that the best preparation for the study of Science at secondary schools is a course of nature study up to the age of 12. This course should be of as practical a character as possible and should aim at arousing an interest in natural phenomena and developing the powers of observation. Full use should be made of the opportunities afforded by the school garden to make the pupils acquainted with the spirit of scientific investigation. ..... From the evidence we have received we have come to the conclusion that at present the teaching of nature study is far from satisfactory and demands immediate attention. In some schools it is quite admirable, in many however it is worthless and is frequently given by those who take but little interest in this subject."(2)

We have seen that the life sciences in the seventeenth and eighteenth centuries were largely devoted to classification of organisms, and this was largely true of the history of botany and zoology in the nineteenth century as well. It has been noted how this emphasis on the problems of nomenclature, classification and anatomical relation-

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(1) Ibid. P. 53.
(2) Ibid. Pp. 60-61.

ship was reflected in the examination syllabuses of the Universities and other examining bodies and hence was found, too, in the small amount of teaching of these subjects that went on in the secondary schools. That this teaching was arid, boring, drearily factual and probably unpopular was evident. However, after the 1850's, the biological sciences gained a new and lively impetus and were directed along more exciting lines as a result of Darwin's theories and the championship of T. H. Huxley and his educational experiments. The result was a turning-away from the older methods and the works of the Continental educationalists were studied, their theories dissected and some of their methods adapted. Miss McDonald attributes some of this common-sense attitude to Professor L. C. Miall. (See Pp. 226-7) Professor Miall, Professor of Biology at Leeds, seeking to stimulate practical work in biology in schools, published a book on object lessons, but this book was more often used as the sole means of instruction in schools rather than as the aid to teaching that the Professor intended.

This chapter began with some criticisms of the state of education as it was provided by the grammar schools and continued with information that showed that this criticism was mostly justified. I would suggest that biology has always been but poorly represented, in whatever guise, in this secondary stage of education and, even now, is not invariably found in all grammar schools. Something has been said of the re-introduction of the study of Nature and, in the next chapter, concerned with elementary education, these threads will again be taken up. There has been, to a certain extent, an attempt to insert a simplified approach to the observation and study of nature in secondary education. However, the grammar schools are considered to be the custodians of academic studies, especially in the sciences, and in them the term 'nature study' has been much more restrictively used.

CHAPTER VI

THE ELEMENTARY SCHOOLS

That there was an ever-growing demand and need for education by all classes of the community has been stressed previously. This demand was as great at the elementary stage as at the higher levels, but the provision of schools for the poor was much more inadequate than for any other stratum of society. By the end of the eighteenth century the petty schools had given way to the dame schools and the common or day schools, and, in all of them, the teaching was probably only rarely efficient. The feelings of the upper classes towards those less fortunate were expressed in two predominant attitudes. There were those who, fearful of revolution and worried by the sentiments exposed by the discontent which culminated in the mob riots in London and Manchester in 1795-96 and again in 1816 and 1819, demanded that the poor be kept ignorant and in their lowly position in life; there were others who saw in education the means to equip the lowest classes sufficiently to combat ignorance, dirt, immorality, to fight indolence and irreligious tendencies and to limit their discontent; there was no desire to raise the poor above their 'station in life'. This was exemplified by Hannah More, who wrote:

> "My plan for instructing the poor is very limited and strict. They learn of weekdays such coarse works as may fit them for servants. I allow of no writing. My object has not been to teach dogmas and opinions, but to form the lower class to habits of industry and

virtue. I know no way of teaching morals but by infusing principles of Christianity, nor of teaching Christianity without a thorough knowledge of Scripture. ... To make good members of society (and this can only be done by making good Christians) has been my aim. ... Principles not opinions are what I labour to give them."(1

In 1805 in a postscript to his pamphlet 'An Experiment in Education', the Rev. Andrew Bell wrote truthfully, but much to the dismay of his supporters, as follows:-

"It is not proposed that the children of the poor be educated in an expensive manner, or even taught to write and to cypher. Utopian schemes, for the universal diffusion of general knowledge, would soon realize the fable of the belly and the other members of the body, and confound that distinction of ranks and classes of society, on which the general welfare hinges, and the happiness of the lower orders, no less than that of the higher, depends. Parents will always be found to educate, at their own expense, children enow to fill the stations, which require higher qualifications; and there is a risk of elevating, by an indiscriminate education, the minds of those doomed to the drudgery of daily labour, above their condition, and thereby rendering them discontented and unhappy in their lot. It may suffice to teach the generality, on an economical plan, to read their bible and understand the doctrines of our holy religion."(2)

Philanthropy was the key to the efforts that were made to supply some form of elementary schooling for the children of the poor during the eighteenth and much of the nineteenth centuries, for the State took no part in providing elementary education until 1833, and then only in the matter of making available some money for the erection of school-houses.

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(1) Hannah More. Reprinted from 'The Mendip Annals' and appearing in 'Hannah More' by M. G. Jones. C.U.P. 1952. P. 152.

(2) A. Bell quoted in 'Lancaster's Improvements and Bell's Experiment' Ed. by D. Salmon. C.U.P. 1932. P. xlvi.

Benevolent charity began to supply a number of schools and so ensured that some of the poor were properly instructed in the twin arts of humbleness and gratitude to their betters. The first charity schools were established in 1698 by the Society for Promoting Christian Knowledge, and this national organisation succeeded in stabilising in their schools a common type of instruction, even though the schools themselves varied much in other ways.

Philanthropy attempted the rescue of the poor almost a century later when the effects of the Industrial Revolution were producing great hardship, the lower classes being in a miserable and neglected state and their children employed under pitiful and cruel conditions. Robert Raikes, by teaching in schools on Sundays from 1780 onwards, revived an essentially medieval practice. These schools became popular, a Society for the Establishment and Supply of Sunday Schools was formed and, under its aegis, local committees of clergymen and nonconformists were appointed to look after them and members of the upper classes, like Mrs. Sarah Trimmer and Hannah and Martha More, became their 'visitors'. With the support of the clergy it was not surprising that successive Governments found the Sunday Schools to be favourable influences since, with religious instruction, reading and manual work forming their curricula, the schools proved to be socially benign. Even many of the manufacturers gave them their benison, albeit somewhat cynically, for Sunday instruction did not interfere with child labour in their factories and the Sunday Schools were hardly hot-beds of insurrection. In 1787, it was estimated that something like one quarter of a million children were attending these schools; in 1833 the numbers had increased to one and a half millions; by 1851 two and a half millions and by 1898 seven and a half millions of poor children were receiving Sunday schooling, a worthwhile state of affairs even though that instruction became increasingly catechetical and non-secular in its subject-matter.(1)

> "The success of the Sunday Schools is an event of enormous significance in the history of the country. They were the chief instrument for humanising the poor, and for two generations they were the chief means of giving secular instruction to the new working class in the factories."(2)

Even so, they proved inadequate for the numbers of children needing some sort of schooling. Again it was philanthropic effort, stemming from the religious reformers, which attempted to fill the gap. In 1798, Joseph Lancaster a Nonconformist, and, at about the same time, the clergyman Andrew Bell started their monitorial systems of day schooling. This system of teaching was not as new as each of these protagonists would have had their supporters believe and had previously been in use in this country at Manchester Grammar School and at Winchester. However, differences of opinion and the intervention of Mrs. Trimmer

(1) F. Smith. 'A History of English Elementary Education 1760-1902.' Pp. 59-60.
(2) Op. cit. P. 63.

caused the separate development of the two types of school and a growing rivalry between them. This led to the foundation of the 'National Society for Promoting the Education of the Poor in the Principles of the Established Church' in 1811 and of the Nonconformist 'British and Foreign School Society' in 1814.

The systems proved to have mixed blessings. Although a great number of children could be accommodated in their buildings and kept occupied by their monitorial methods, the instruction given in both types of school was always catechetical, sectarian, superficial and, above all cheap.

In Lancaster's 'Improvements' he includes a list of textbooks used "not as the most excellent, but the one (sic) I have been able to find, well adapted for their moral and religious improvement." Among these were "'Barbauld's Hymns', 'Pastoral Lessons', 'Trimmer's Introduction to the Knowledge of Nature (and) the Use of the Scriptures.' And 'Martinet's Catechism of Nature', or rather of Natural History."(1) Unfortunately, it was this quality of cheapness that was to be imposed as a raison d'être in future attempts at State intervention in education. However scathing my comments above, there is evidence that one school, the British school at <u>Harp Alley</u> in London, was perhaps atypical by sending, in 1837, approximately 130 boys on a visit to the Zoo, 30 to the British Museum and above 20 to an Astronomy lecture. Another, the Society's

(1) Joseph Lancaster. 'Lancaster's <u>Improvements</u> and Bell's <u>Experiments</u>' P. 2 and P. 103.

Central School taught:

> "Scraps of history, geometry, natural history and natural philosophy ..... by attaching them to spelling lessons."(1)

A private philanthropic venture of a different sort was that due to the industrialist Robert Owen, who opened a school at New Lanark in 1816. Birchenough writes about the Infant school establishment as follows:

> "The school was attended by children from one and a half to six years of age. They were divided into three classes ..... Great emphasis was laid on physical training and an education in contact with realities. Instead of teaching the three R's, he proposed to direct the interest of the children to nature and the objects around them by means of conversation ..... Children from two to four years of age were occupied with games, singing, object lessons, conversation and story lessons, and were also taught the alphabet. Those from four to six had lessons in reading, geography, natural history, singing and drawing."

From six to twelve years of age further liberal instruction was given and natural history was included amongst the subjects to be studied.(2) James Buchanan and Molly Young were the teachers in the school and they used pictures of animals and "natural objects brought in from garden, field and wood ..... and amusement ranked high as a motive."(3) Unfortunately Owen's steadily increasing anti-religious attitude became more pronounced and, in 1817, his Quaker partners somewhat altered his school, although natural history was still taught there in 1833.(4) Birchenough's

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(1) Birchenough. 'History of Elementary Education.' U.T.P. 1938, P. 275.
(2) Ibid. P. 257.
(3) Smith. Op; cit. P. 90.
(4) Ibid. P. 93.

account of Owen's school shows how much the latter had been influenced by Continental educationalists and, in 1818, Owen visited Pestalozzi and de Fellenberg in Switzerland, saw their 'naturalistic' attitude to educational theory at work and sent his two elder sons to complete their education at Hofwyl.

The influence of both Pestalozzi and de Fellenberg (and of other teachers and writers who practised on the Continent) on English elementary education was marked, although, at first, their theories were slow to be assimilated. In part this was undeubtedly due to the smuggaccep-tance in England of the monitorial systems of Lancaster and Bell as a cheap method of teaching the masses all they needed to know; in part, too, the effects of the Napoleonic wars cut down travel and so slowed the influx of ideas and, more important, of first-hand observation.

The real basis of Pestalozzian teaching lay in the ideas of 'sense experience' whereby children used their God-given senses to appreciate the things in their environment and, from this factual observation and learning, proceeded to abstract connotations. In a sense, there was nothing new in those ideas for they are to be found in the works of Vives and Comenius (See Discussion. Pp.265-6) and, to an extent, in the educational writings of John Locke and of Rousseau, but Pestalozzi was able to practise what he believed successfully. In their book 'A Short

History of Educational Ideas', S. J. Curtis and M. E. A. Boultwood paraphrase some of the ideas contained in Pestalozzi's educational theories that are relevant to this study. In discussing the planning of a graded series of lessons the writers say:

> "Each study should begin with observation of the object or the external physical manifestation of the topic - which should be a normal representative specimen, or series of specimens. If it is unavoidable, the real specimens may be replaced by pictures - <u>but never merely by words</u>. The teacher helps the pupils to name the object, to investigate and name its parts and properties, and, after due consideration of this description, to formulate a definition representing their distinct idea of the object. The teacher's function is to train pupils in habits of accurate observation, not in the memorising of words. However true the teacher may know those words to be, they have no reality or truth for the pupil unless based on his own perceptions.(1) (See Discussion for quotations from Pestalozzi's works).

There are in this, of course, the seeds of the 'Object Lessons' which so bedevilled the introduction of the sciences into the elementary stages of English education as the object lesson became an invariable feature of science subjects, especially natural history and nature study, so that, even now, it is possible to see a nature study lesson conducted along the lines of an object lesson. One further piece of paraphrasing of Pestalozzian ideals will serve to illustrate this origin. Hugh Pollard in 'Pioneers of Popular Education' writes:

> "Pestalozzi concluded, therefore, that Number, Form and Language were the three pillars on which the educational edifice rested and, in the light of his conclusion, decided that children should be taught:

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(1) S. J. Curtis and M. E. A. Boultwood. 'A Short History of Educational Ideas.' U.T.P. 1953. P. 331.

(1) to consider each object that was brought before them both as a separate unit in itself and as a member of a family of related objects;

(2) the size and proportions of the object;

(3) the words which applied to or described the said object. In other words, children should be instructed in the threefold principle of counting, measuring and naming. This threefold activity formed the basis of all knowledge, and the chief purpose of education lay in cultivating and strengthening the growth and union of its three component parts."(1)

Whatever the factual validity of these particular ideas of Pestalozzi's there can be little doubt that they were misapplied to science teaching in English elementary schools later in the century and it is to this point that I wish to return when considering the start and growth of nature study teaching in these schools.

The Rev. Charles Mayo was, for almost three years, chaplain and teacher at Pestalozzi's establishment at Yverdun. Fired with enthusiasm, he opened a private school at Epsom to introduce his master's methods and then moved it to Cheam in 1826. He introduced History, Geography and Nature Study there, as well as a form of physical training, Music and Drawing - all of which had been features of Pestalozzi's school at Yverdun - and spread the new gospel by his public lecturing.(2) Both Mayo and his sister, Elizabeth, who taught at the school, were prolific writers,

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(1) H. M. Pollard. 'Pioneers of Popular Education 1760-1850.' Murray. 1956. P. 35-36.
(2) Ibid. Pp. 181-182.

publishing such titles as 'Lessons on Objects as given to children between the ages of six and eight in a Pestalozzian School at Cheam, Surrey' (1831), 'Lessons on Shells' (1832), 'Model Lessons for Infant School Teachers and Nursery Governesses' (1838), among other titles. The thirteenth edition of the first book, 'Lessons on Objects', was published by Seeleys in London in 1853 and was divided into several series of lessons, of which the first three were mostly concerned with common household objects like glass, water, blotting paper, salt, milk etc. Lesson XVII dealt with a fir cone and the parts, like the scales, seeds, fibres, and so on, were first considered and described with their 'qualities' listed. Thus, the inside was 'tiled or imbricated', the surfaces were inflammable and the stalk was odorous. A glossary described 'imbricated' as "derived from Imbric-<u>are</u>, to cover with tiles"(1). Other nature lessons in that series dealt with a leaf, a fruit, fur, an oyster, spices, a seed, and there were others about the senses of sight and hearing. A lesson on the nutmeg described its qualities as:

> "..... sapid, hard, oval, dingy, brown, dull, opaque and dry. Its surface is uneven. It is vegetable, natural, inanimate, foreigh, pungent, conservative, pulverable, agreeable to the taste, aromatic, odorous."(2)

and these qualities were to be elicited by the teacher

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(1) 'Lessons on Objects.' 1853. P. 61.
(2) Pollard. Quoting 'Lessons on Objects.' pp. 70-72. Op. cit. P. 183.

from the class by judicious questioning. Both the Mayos became interested in the Home and Colonial Infant School Society, a body which founded a Model School and Training College for teachers with which Miss Mayo became actively involved. H. M. Pollard writes about the Model School as follows:

> "Indeed this experimental venture, by reason of being the first attempt on the part of a British reformer to show how effectively Pestalozzi's pedagogical principles could help poor children, clearly marked a step forward in the history of infant education. In contradistinction to the monitorial institutions of its day, moreover, it strove at all times to show that the acquisition of knowledge was an agreeable, fascinating and stimulating occupation. Thus, during the initial stages, its pupils spent much of their time learning letters from cards, practising sounds from various combinations of syllables, listening to stories (usually simple anecdotes from the Bible) and playing with wooden blocks of various colours. Gradually, too, they learnt to draw, to form letters, to read and to write. And, whilst all this was in progress, they exercised their senses by handling flowers, vegetables, shells, stones, etc., until they were able to distinguish with facility not merely the size and weight of the said objects but likewise their shape, colour and smell. Then, proceeding from the known to the unknown in the approved manner, they learnt to add, subtract, multiply and divide. Later still they began Nature Study and Geography - starting, needless to say, by investigating the immediate neighbourhood. And finally they studied History, Gymnastics and Singing."(1)

When one considers this contribution of Elizabeth Mayo's towards infant education in the light of the times in which it took place it is, indeed, remarkable.

Equally insistent on the use of object-teaching was Samuel Wilderspin who, in 1820, was put in charge of a

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(1) Pollard. Op. cit. Pp. 185-186.

school that had been founded by a committee, amongst whom were Lord Brougham, Zachary Macaulay and James Mill. The school was in Spitalfields and it was there that Wilderspin appreciated, by having to interest, discipline and teach young children, what had already been stated by Pestalozzi, de Fellenburg and Wehrli in Switzerland, namely that the experiences gained by them through the use of their senses about things and natural surroundings were very powerful and important educative forces for the very young.

Speaking before the Infant School Society (founded in 1823 and for which Wilderspin worked and travelled the country starting schools) he said, on July 16th, 1824:

> "The incidental acquisition of useful knowledge, which cannot fail to accompany this course of early tuition, though in itself a circumstance of no mean value, is but of small account, in comparison with that moral culture, with those habits of self-government, and with those feelings of mutual kindness, which form the characteristic tendencies, and indeed the grand recommendation of the whole system."(1)

In his book, 'Infant Education', Wilderspin spoke of the use of pictures of horses, zebras, cows and sheep, tigers, kangaroos as means of learning names which were used in the schools of the Society in the fashion of object lessons.(2) He wrote:

> "To give the children general information, it has been found necessary to have recourse to pictures of natural history, such as of birds, beasts, fishes, flowers, insects, etc., all of which tend to shew the glory of God."(3)

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(1) S. Wilderspin. 'Infant Education' 3rd. Edn. 1825. Pp.43-4
(2) Ibid. Pp. 55-56.
(3) Ibid. P. 103.

and at the Quaker Street school in Spitalfields picture and object lessons were given in natural history twice each week.(1)

As mentioned above, Wilderspin was indefatigable in touring the country, lecturing, opening and inspecting schools on behalf of the Infant School Society. In 'Early Discipline', he writes:

> "From London I went to Kidderminster, where I opened a School, which is very efficient. The master of it has devoted much of his time to Entomology among other things, and has formed a collection of insects with great diligence and taste. On these he often converses with the children, who listen to him with the greatest delight. Their knowledge of the genera, species, etc., is very considerable; and I particularly observed the accuracy with which the names were pronounced. I spent some hours observing their progress with much pleasure, and was put to the blush by their attainments in this interesting science."(2)

Another of the Infant Society's schools was in Leeds and Wilderspin commented upon it as follows:

> "At Leeds I lectured in the Infant School, which was organized by a person sent from Stockport by myself, and who had been there about two years. To this establishment a museum is attached, containing quadrupeds, birds, insects, and minerals. A lady presented also a handsome pair of globes. The master is a clever man, and the children display more than ordinary knowledge; but this has given rise to the declaration, 'the children are taught too much.'"(3)

In this same book of Wilderspin's there is mention of a school for boarders, Alpha House School, at Alstone, near Cheltenham, where Mrs. Charles Cuff and Miss Wilderspin were in charge. At this school object lessons were given

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(1) Ibid. Pp. 264-265.
(2) S. Wilderspin. 'Early Discipline.' 1834. 2nd Edn. Pp. 45-46.
(3) Ibid. Pp. 99-100

and natural history and botany were included in the syllabus.(1)

Although a keen follower of the methods of the Swiss educationalists there were occasions when Wilderspin became more ambitious in the standard of his teaching as exemplified by his books. Frank Smith, in 'History of English Elementary Education', gives a good illustration of this. Wilderspin posed the question, 'To what class does a flower belong that has only one stamen?' and then wrote the appalling answer:

> "The class monandria; and those with two, diandria; with three, triandria; with four, tetrandria; with five, pentandria; with six hexandria; with seven heptandria; with eight, octandria."(2)

In certain of the books he produced there were specimen lessons, some of which were concerned with botany and zoology; in one, having listed forty lessons on scripture and more than fifty on natural history, as well as object lessons, Wilderspin added,

> "I should hope that any moderate person would consider these quite sufficient for infants under six years of age."(3)

Philanthropy was all very well, but there was another method tried of providing schooling for poor children and this was the school of industry in which children worked part of the time in order to help pay for their keep and teaching. The first of these had been set up by Thomas

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(1) Op. cit. Appendix. Pp. 6-7.
(2) F. Smith. Op. cit. Pp. 95-96.
(3) Ibid.

Firmin in 1675 and they were advocated by John Locke. In these schools instruction alternated with productive activity by the boys and girls in gardening, carpentry, sewing and spinning and from the proceeds of their work their maintenance was extracted. These schools did not vanish completely during the eighteenth century and the Minutes of the Committee in Council for Education makes some mention of their counterparts in the nineteenth century. Most of them were schools in country areas and their economy was constructed upon the basis of agricultural labour and the children were given instruction during part of the day. Seymour Tremenheere, writing in 1843 of the Rev. W. L. Rham's school at Winkfield, Berks., said:

> "..... the garden work would seem to invite familiar lectures on the simple points of natural history, which would lend a new interest to labour."(1)

Of the school at Ockham, near Ripley in Surrey, opened in 1836, one year after that at Winkfield, Tremenheere reported:

> "The scientific acquirements of the master enabled him to add ..... (lectures on) ..... the human body, geography, electricity, the elements of chemistry, singing, etc. A small chemical apparatus, an arranged geological collection, a box of specimens on the materials of manufactures, etc., various contrivances for illustrating natural history and philosophy, enable him to give a very useful turn, and a practical application, both to his lectures and to his lessons, to the more advanced classes of his school."(2)

William Allen, a Quaker who was also the leading figure in

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(1) Minutes of Committee in Council on Education. 1842-43. Pp. 545-6.
(2) Ibid. Pp. 548 & 549.

the British and Foreign School Society from its inception, kept a boarding and day school devoted to farm work and gardening at Lindfield, near Cuckfield in Essex, from 1825. Seymour Tremenheere said of it:

> "The school hours are about five on an average, daily. The more advanced boys have an opportunity of learning something of land-surveying, mapping, and other matters especially useful to the grade of farmers' sons and superior mechanics such as the elements of botany, the use of the thermometer, barometer, rain-gauge, etc."(1)

Chemical analyses of soils and manures were conducted, there was a magic lantern to aid the lectures in vegetable physiology and the day boys were encouraged to attend these.(2) Ealing Grove School, which was opened in 1833, under the patronage of Lady Byron, was an attempt to copy de Fellenberg's establishment at Hofwyl. Practical horticulture was the main feature of the curriculum and the students were taught trades of which those of glazier, carpenter, metal-worker and cobbler are listed by Hugh Pollard.(3) Writing of one class of boys whose average age was twelve and a half, Tremenheere reported:

> "They are practised in composition, as well as in writing from dictation; the subjects of the former exercise being their lessons on objects of natural history, etc., of which they write the substance."(4)

and he also reported that, amongst the apparatus held by the school were picture cards illustrating natural history(5)

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(1) Ibid. P. 551.
(2) Ibid.
(3) Pollard. Op. cit. P. 205.
(4) Ibid. P. 558.
(5) Ibid. P. 557.

The state of English elementary education in the nineteenth century is admirably illustrated by G. A. N. Lowndes when he describes it in this passage from 'The Silent Social Revolution.':

> "A coiner of epigrams - unfamiliar with the chequered history of public education - might indeed be tempted to remark that they have been endeavouring to purchase an educated democracy on the instalment plan; that for the first forty years of that century (1833-1870) they paid the premiums to men of goodwill wherever they might be found who showed themselves ready to undertake the building and maintenance of voluntary schools; but that in 1870 when voluntary initiative had failed to provide a school place for more than one child in two in London or one in three to five elsewhere, the State itself had to enter the field and pay larger instalments in the form of Education Acts. For an Education Act is in a very real sense an instalment in the education of a whole people."(1

Several Bills were introduced in Parliament for the relief of the poor and to provide educational facilities for poor children in the early years of the nineteenth century. In 1807, Samuel Whitbread's Bill to establish parochial schools was rejected by the Lords. In 1818 Lord Brougham suggested that the whole question of the distribution of educational endowments should be enquired into and that redistribution of these would provide a monetary source to make available a nation-wide educational system. In 1820 Brougham presented his Parochial Schools Bill to Parliament whereby the cost of schools was to be borne by manufacturers, maintained by rates and by fees

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(1) G. A. N. Lowndes. 'The Silent Social Revolution.' O.U.P. 1937. Pp. 3-4.

operated on a means-test basis with further aid coming from redistribution of endowments, but there was a great deal of opposition and the Bill was withdrawn. However, in 1833, with the return of the Whigs in a spirit of reformatory zeal and with the middle classes represented in increasing numbers in Parliament after the Reform Bill of 1832, the desire to promote some measure of educational reform was slowly translated into practical efforts for the provision of elementary education.

Yet the spirit of laissez-faire was by no means dead in education and the Bill introduced by the Benthamite, Mr. J. A. Roebuck, before Parliament in 1833 was defeated. This Bill was a most ambitious one; had it been accepted all children between the ages of six and twelve would have attended school, either privately or in State schools. These were to be infant schools, or industrial schools and there was to be provision for evening schools for young people and adults and teacher-training schools, too. Local committees would have been elected to look after the schools of their own particular areas and the whole system was to have been under the care of a Minister of Cabinet rank. Again, school fees would have been chargeable but most of the money was to have been raised by re-applying endowments and from taxation.

The effort was almost in vain for a grant of £20,000 only was voted for the erection of school buildings for the education of the poorer classes, a measure that seemed to satisfy the Commons for at least a little while.

But there were vociferous critics, not least among them the pertinacious writers in the 'Edinburgh Review'. Lord Brougham and others started the Society for the Diffusion of Useful Knowledge in 1826 and this issued a large and continuous flow of articles and data intended to 'popularise' science in response to a need that was unquestionably felt for factual and informed writing about scientific discoveries. The issue of the 'Penny Magazine' in 1832 and of the 'Penny Cyclopaedia' in 1833 and the 'Quarterly Journal of Education' in 1831 further reflect that interest of many of the working classes in the acquisition of knowledge. The weekly Penny Magazine was catholic in its choice of subject matter but the material contained in it was sound, if perhaps rather too academic, and ranged from articles on history, geography, zoology and botany to discussions on literature. However, there was some criticism of the published works of the Society and the belief is not unfounded that much of the material they issued was of little real use to the artisans for which it was intended.

> "..... the Society's early publications were a 'Library of Useful Knowledge' and a 'Library of Entertaining Knowledge' appearing in monthly numbers. Filled with miscellaneous scientific and cultural information, ranging from Lepidoptera to 'Autumnal Customs in Kardofan', these set out to meet the requirements of men like the cutler, admired by Brougham; to provide intellectual fare of a kind to solace those whose lives were given to manual labour."(1)

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(1) Simon. Op. cit. P. 160.

Reflecting this interest in the sciences, there were a large number of books published, especially in the nineteenth century, which sought to give easy explanations of the facts of botany and zoology, etc., and many of these were specially applicable to learning at an elementary level. They ranged from the more erudite four volume work of Samuel Humphreys, 'Nature Display'd - Being discourses on such Particles of Natural History as were thought most proper to Excite the Curiosity and Form the Minds of Youth', published in 1740, which contained discourses on botany, entomology, ornithology, mammals, fossils, astronomy, physics, an account of life in the seas and some articles on such scientific instruments as the telescope and microscope, to other works written in a rather more chatty style and often in dialogue form. William Manor published 'A Circle of Arts and Sciences' in London in 1808, a book that ran through the facts of such topics as agriculture, algebra, archaeology, arithmetic, botany, mechanics, music, optics, physiology and zoology in four hundred and seventy-six pages by using the questions and answer method. In 1821 the Rev. J. Joyce produced 'Scientific Dialogues' in which conversations between a father and his children and a tutor and the children were used to furnish data which was mainly physical in context; one of the dialogues was dedicated to the Edgeworths and another to Anna Laetitia Barbauld and John Aikin. The Edgeworths, father and daughter Maria, were keen disciples of Rousseau and themselves published books which advocated the acquirement of knowledge through observational methods and stressed the value of utilitarianism in education, as witness the title 'Practical Education' that they published in 1798. Mrs. Barbauld produced a popular series of stories for children ('Early Lessons', 'Hymns in Prose for Children') full of religious moral-pointing and kept a private school which was opened by her husband, a Dissenter, at Palgrave in Suffolk, soon after their marriage in 1774. The school prospered but was given up in 1785.(1) Maria Edgeworth wrote 'Early Lessons' in 1824 and the book was constructed in story fashion with lessons on minerals and 'common things' in it as well as some natural history in the form of information about insects and flowers. 'Parables from Nature' was published in 5 series from 1855 to 1870 by Mrs. Alfred Gatty and, as the title suggests, was an account of some aspects of natural history heavily loaded with moral-pointing. Mrs. Gatty had studied seaweeds and zoophytes for many years and published a book on seaweeds and a school book based on the parables in 1872.(2)

The common desire for education was reflected, too, in the formation of the Working Men's Association which was started to promote universal education as an individual

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(1) D.N.B.
(2) D.N.B.

right. The Chartists, also, were active in demanding educational reform. Professor W. H. G. Armytage, giving some sources of the history of technical education in the British Journal of Educational Studies, writes,

> "William Lovett, a former co-operative shopman and co-secretary with George Skene of the British Association for Promoting Co-operative Knowledge, was drawing up petitions as early as 1829 for the opening of the British Museum and other exhibitions of art and nature on Sundays ('My Life and Struggles' (1876, p. 64)). As a chartist he urged signatories to give a penny a week to found schools with playgrounds, gardens, museums, laboratories, workshops and baths. See H. V. Faulkner, 'Chartism and the Churches' (New York, 1916), 46-51."(1)

Lovett opened a day school in London in 1848 and taught physiology there and natural history was also taught. He wrote a textbook called 'Elementary Anatomy and Physiology (for schools and private instructors)' which was illustrated with coloured plates and advocated that the classrooms of infant schools should have pictures in colour of natural history and zoological subjects. It also contained lessons on Diet, Intoxicating Drinks, Tobacco and Disease. Lovett believed that geology, zoology and astronomy were subjects specially valuable in broadening man's insight and intellectual horizons.(2) Jean Bremner, whilst discussing the pioneering work of George Combe (1788-1858) in attempting to introduce the teaching of physiology into schools, has this to say of Lovett:

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(1) W. H. G. Armytage. 'Some Sources for the History of Technical Education in England.' Part II. B.J. Edn. Studies. Vol. V. No. 2. P. 164.
(2) Simon. Op. cit. Pp. 260-264 and Educational Times No. 42. March 1851.

> "This belief ..... (Combe felt that physiology was imperative to the betterment of standards of hygiene and thus useful for health and happiness) ..... he shared with other Utilitarians of the period, notably William Ellis, founder of the Birkbeck schools for the working classes, and William Lovett the Chartist, who, from 1842, taught Physiology and Anatomy in several London schools."(1)

In the same article, Miss Bremner mentions that Combe was instrumental in a petition to the Privy Council in 1853 that physiology should be taught in the common schools.(Ibid.)

There were then, during the first third of the nineteenth century, many voluntary efforts made to ameliorate somewhat the miserable condition of the poor by providing some form of education for them, and these efforts were either governed by ideas of the utility of education for poor people or prompted by considerations of expediency. Thus the philanthropists, the reformers, the Nonconformists and the Church of England were engaged in combatting the problems caused by economic changes, poverty and the increasing population.

In 1839 the Committee in Council was established "to superintend the application of any sums voted by Parliament for the purpose of promoting Public Education." Dr. J. P. Kay, (later Sir James Kay-Shuttleworth) was appointed as the first Secretary of the Committee and as such was pitchforked into the battle with the Church, a body that had strenuously opposed any secular attempt to cripple or

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(1) Jean P. Bremner. 'George Combe - The Pioneer of Physiology Teaching in British Schools.' School Science Review. Vol. XXXVIII 1956. Pp. 48-49.

limit its age-old power over the control of education. Its views may be simply expressed - a school existed essentially in order to instruct the young in religious beliefs and principles and any other type of instruction, however needful it might be from the points of view of health, the earning of a living or a raising of the standards of general information or awareness, was only of secondary importance. The claims of science had barely penetrated this barrier of assumption and later, when T. H. Huxley militantly championed Darwin's 'heresies', the furore was loud, bitter and prolonged.

Kay was an informed man who had travelled widely, both in England and on the Continent. As a doctor he knew the conditions of the poor and this knowledge was substantiated by his work as a Poor Law Commissioner. Realising that any system of education demanded, above all, trained and competent teachers he opened, privately, a training school for teachers at Battersea in 1840. He knew how useful similar establishments had proved at Zurich and Vaud, where botany and zoology were taught, and he had visited Wehrli's Seminary at Kreuzlingen, Thurgau, where natural history and gardening were included in the training programme so that the school could make some attempt towards supporting itself.(1) To help pay its way the Battersea College also introduced gardening and a certain amount of agriculture, the teachers and students went on nature walks in order to

(1) Mins. 1842. Pp. 241-250.

introduce habits of observation and Nature Study was included among the subjects taught there.(1) The College had a practical curriculum and the pupil-teachers and others who trained in it were found to be so much superior to the child monitors of the monitorial schools that the Government made a grant of £1,000 to the College in 1842. It was copied, too - St. Mark's Training College (National Society) was founded in 1841 and, by 1845, the Church of England had opened twenty-two such Colleges in England and Wales.(2)

The Inspectors of the Committee in Council sent back their reports and their hopes about education. Sometimes, in their travels about the country, they found attempts to make schools pay for themselves by the introduction of horticultural pursuits. In some schools the boys would have their own small plot of land, seeds were provided and, after cropping, the cash proceeds would be returned to the school; the Minutes of the Committee in Council contain many examples of these gardening efforts. Thus, at Withyam St. John, in Sussex, in 1844, horticulture was carried on and the landowner supporting the school had enclosed seven acres of common land for that purpose.(3)

Training Colleges soon had their own 'Model' schools for training in teaching practice. The infant school of

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(1) Pollard. Op. cit. Pp. 254 & 256.
(2) Barnard. Op. cit. P. 119.
(3) Mins. 1844. Vol. II.

this type at Norwich taught natural history and made use of pictures and objects to support the teaching.(1) The Chester Training School, (a National School), used Jones' 'Book of Nature' for its pupils (2) whilst, at Pudsey, the master was spoken of as being "intelligent, with a love for entomology, ornithology, etc." but the school was in a bad condition due to the neglect of its previous master.(3) At Falmer, in Sussex, the Rev. John Allen reported that the children were taught some knowledge of grammar, geography, history and natural history (4) and, of a school at St. Neot's which contained girls and infants, Mr. Cook reported favourably about the instruction given to the children in natural history.(5)

The village school at King's Sombourne was famous in the 1840's because of the stress it placed on the inclusion of science teaching in the curriculum. The Rev. R. Dawes, who kept it, saw to it that the children were instructed about the articles they consumed and "the nature of the products of the parish which they themselves and those about them are helping to cultivate." The school had a library that contained books about religion, travel and natural history.(6) Equally well-known, and several times noted in the Reports of later Royal Commissions, was the

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(1) Mins. Op; cit. P. 168.
(2) Ibid. P. 647.
(3) Ibid. P. 315.
(4) Mins. 1845. Vol. I. P. 69.
(5) Ibid. P. 185.
(6) Mins. 1844. Pp. 64 and 102.

school at Hitcham, in Suffolk, which Professor J. S. Henslow organised when he had been presented with a neglected living there. Botany was the main subject of the curriculum and it was presented on observational lines. The children dissected flowers, collected and classified them and were given theory lessons about the local flora and, also, lectures were given by Professor Henson about floral groups, geographical distribution of flowers and the economic importance of many plants.(1)

By 1847 the Government grant for Education was £100,000, in 1850 it had risen to £125,000 and by 1859 it exceeded £798,000; although still inadequate, State aid to education was thus firmly established and it was increasing in amount. An Education Department was created in 1856 with a Vice-President in the Commons as a member of the Government. In 1858, Sir J. Pakington moved that a Royal Commission be appointed "to inquire into the present state of education in England, and to consider and report what measures, if any, are required for the extension of sound and cheap elementary instruction to all classes of the people."

The Report of the Commission which resulted from this plea, the Newcastle Commission, was published in 1861 and contains some interesting statements about the conditions of teaching that existed in the schools of the elementary

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(1) J. Bremner. 'Some Aspects of Botany Teaching in English Schools in the Second Half of the Nineteenth Century.' School Science Review. Vol. XXXVIII. 1956. Pp. 376-378.

grade at that time. The Rev. Brookfield, for instance, defined some of the standards that he used when inspecting the schools; a "fair school" was considered to be of the "average creditable kind, but with nothing to boast of". The Reverend expected a first class of about fifteen pupils to be able

> "To read a page of natural history - about an elephant, a cotton tree, or a crocodile - with tolerable fluency and with scarcely a mistake. They would answer collateral questions upon this, not well, but not preposterously ill; ..... they would write out a short account of any object named to them which they had seen or read about, - an animal, a tree, a flower, - intelligibly, and not without thought and observation, but with trifling errors of grammar and of spelling;"(1)

Mr. Brookfield stated what he would expect to find in a school that he would term 'excellent':

> "..... a class of the same number (fifteen), but perhaps a little older (twelve and a half, or thirteen), who would fill a slate with an extemporaneous account of flax, or sugar, or a river, or a brewery, or a flour mill, or a zoological garden, showing good observation, memory, reflection, faultless spelling, rarely deficient grammar, and writing that might awaken, not the envy, but the approbation of a Government department;"(2)

Another Assistant Commissioner, Mr. Cook reported:

> "The elements of physical science, the laws of natural philosophy, and the most striking phenomena of natural history, form subjects of useful and very attractive lectures in many good schools. These subjects have been introduced within the last few years with great advantage to the pupils."(3)

It may have been that there were classes in some schools that would fully justify Mr. Brookfield's rating

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(1) Royal Commission on Popular Education. 1861. Vol. I. Part I. Chapter IV. Pp. 234-5.
(2) Newcastle Commission. Ibid.
(3) Ibid. P. 237.

of 'excellent' but, from what is known about teaching standards and methods in general around the half-century it is probable that good memory, spelling and hand-writing would be more likely to be found in those days of rôte learning. The attitude of the Commissioners is well reflected in their agreement with the observations of a Mr. Fraser, who reported to them:

> "Even if it were possible, I doubt whether it would be desirable, with a view to the real interests of the peasant boy, to keep him at school till he was 14 or 15 years of age. But it is not possible. We must make up our minds to see the last of him, as far as the day school is concerned, at 10 or 11. We must frame our system of education upon this hypothesis; and I venture to maintain that it is quite possible to teach a child soundly and thoroughly, in a way that he shall not forget it, all that it is necessary for him to possess in the shape of intellectual attainment, by the time that he is 10 years old. If he had been properly looked after in the lower classes, he shall be able to spell correctly the words that he will ordinarily have to use; he shall read a common narrative - the paragraph in the newspaper that he cares to read - with sufficient ease to be a pleasure to himself and to convey information to listeners; if gone to live at a distance from home, he shall write his mother a letter that shall be both legible and intelligible; he knows enough of ciphering to make out, or test the correctness of, a common shop bill; if he hears talk of foreign countries, he has some notion as to the part of the habitable globe in which they lie: and underlying all, and not without its influence, I trust, upon his life and conversation, he has acquaintance enough with the Holy Scriptures to follow the allusions and the arguments of a plain Saxon sermon, and a sufficient recollection of the truths taught him in his Catechism, to know what are the duties required of him towards his Maker and his fellow man. I have no brighter view of the future or the possibilities of an English elementary education, floating before my eyes than this. If I had ever dreamt more sanguine dreams before, what I have seen in the last six months would have effectually and for

> ever dissipated them. In such inspection of schools as time and opportunity allowed me to make, I strictly limited myself to testing their efficiency in such vital points as these; never allowing myself to stray into the regions of English grammar, or English History, or physical science, unless I had previously found the ground under the children thoroughly firm, and fit to carry, without risk of settlements, a somewhat lofty and more decorated superstructure."(1)

It would be easy to decry this report for its short-sightedness its pessimism and the suspicion that the passage contains the implication that this was the very most that could be afforded for the lower class and which would keep them in a state of obedience. However, in the light of the times and the beliefs in which it was written it is, most probably an honest report and one in keeping with the facts. It also contrasts with a plea made by Mr. Moseley, written in 1845, in which he suggests that nature study would prove valuable to children in rural districts:-

> "..... in respect to the infinite variety of animal and vegetable forms which are assembled within the reach of his immediate observation; the birds which frequent that region, the domestic and wild animals, some of the tribes of insects, the commoner plants which grow around him, and the different kinds of trees. It is not proposed to burden the child's mind, in respect to any of these matters, with scientific distinctions or a hard nomenclature; all that is sought, is a knowledge of them in their ordinary relations; such a knowledge as he acquires in respect to those other things with which he is most familiar."(2)

In presenting its recommendations, the Newcastle Commission did so by stressing that elementary education should be both sound and cheap and the Report commented

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(1) Op. cit. Section III Pp. 243-244.
(2) Mins. 1845. Vol. I. P. 235.

upon the unsatisfactory state of it:

> "One other point deserves attention; it relates rather to the kind than to the amount of the instruction given in our public elementary schools to the children attending them. The children do not, in fact, receive the kind of education they require. ..., we have seen overwhelming evidence from Her Majesty's Inspectors, to the effect that not more than one-fourth of the children receive a good education. So great a failure in the teaching demanded the closest investigation; and as a result of it we have been obliged to come to the conclusion that the instruction given is commonly both too ambitious and too superficial in its character, that (except in the very best schools) it has been too exclusively adapted to the elder scholars to the neglect of the younger ones, and that it often omits to secure a thorough <u>grounding</u> in the simplest but most essential parts of instruction."(1)

The Commission gave a more detailed and factual account which showed that mere numbers alone gave no fitting commentary upon the state of education at the elementary level:

> "We are bound to observe, however, that a very delusive estimate of the state of education must result from confining attention to the mere amount of numbers under day-school instruction. We have seen that less than three years ago there were in elementary day schools 2,213,694 children of the poorer classes. But of this number, 573,436 were attending private schools, which, as our evidence uniformly shows, are, for the most part, inferior as schools for the poor, and ill-calculated to give to the children an education which shall be serviceable to them in after-life. Of the 1,549,312 children whose names are on the books of public elementary day schools belonging to the religious denominations, only 19.3 per cent. were in their 12th year or upwards, and only that proportion, therefore, can be regarded as educated up to the standard suited to their stations. As many as 786,202 attend for less than 100 days in the year and can therefore hardly receive a serviceable amount of education, while our evidence goes to prove that a large proportion, even of those whose attendance is more regular, fail in obtaining it on account of inefficient teaching."(2)

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(1) Newcastle Commission. Vol. I. Part I. Chap. VI. Pp. 295-296.

(2) Newcastle Report. 1861. Vol. I. Part I. Chapter VI. Pp. 294-295.

Whatever else the Report of the Newcastle Commission achieved, it opened the era of payment by results and so emphasised the need for sound instruction in reading, writing and arithmetic as to cause the slow infiltration of any form of science into the curricula of schools of the elementary grade to be almost halted. The Commission reported that grants should be paid to schools in the form of capitation grants after inspection and that these grants should be supplemented by local ones from the rates. Robert Lowe, however, disregarded these recommendations in the 'Revised' Code of 1862 by which grants were to be payable on the basis of attendance and on the passing by the pupils of examinations set in the three R's. Six standards were laid down in reading, writing and arithmetic for the benefit of the Inspectors of schools. As a result of that Code the cost of the Government grant to the schools fell from £813,441 in 1862 to £636,806 in 1865.

The Taunton Commission of 1868 found that many of the so-called Endowed Grammar schools had become elementary in standard by the time their Assistant Commissioners had begun to collect their information. The school at <u>Beachampton</u>, in Bucks., claimed to have 20 students taking natural history but had sunk to the status of an elementary school. Mr. Bryce visited an elementary school at <u>Bispham</u>, near Blackpool, and found 20 boys and 12 girls present. Of this establishment, he wrote:

"But the characteristic feature of the school was one which I had least expected to find in such a place. The small and wretched room was filled in every available corner by stuffed beasts and birds; geological diagrams hung upon the walls: shelves were leaded and drawers filled with collections of fossils and minerals. In answer to my look of surprise, the headmaster explained that he was an ardent naturalist; he had collected all these things himself, and used them in his teaching, giving a lesson to the whole school four afternoons in every week. The children, he believed, liked natural history, and profited by it; many who seemed dull at other subjects took kindly to it and rambled abroad under his directions to make collections for themselves of plants and of such fossils or specimens of rock as could be picked up along the beach."(1)

Frank Smith gives his impression of elementary education in the 1860's when he states:

"A study of the inspectors' reports in the 'sixties leaves a clear impression of uniform mediocrity in the schools. No experiments were proceeding. There was no more talk of industrial education. School gardens had gradually disappeared. Clergymen like the Rev. R. Dawes could no longer shape their schools into something effective and vital throughout the whole village. There was apparently no more singing, or drawing, or science. ....."(2)

In addition to enquiring into the state of the Endowed schools, the Taunton Commission included amongst the volumes of their Report some tabular data concerning 'non-classical' schools, some of which were endowed, but most of which gave only some rudimentary instruction. Occasionally, there were claims made by the managing authorities in completing their returns that natural history or some science was taught in their schools and object lessons are sometimes mentioned in connection with them but there

(1) S.I.C. Vol. IX. P. 692.
(2) Smith. Op. cit. P. 274.

is no factual material to expand upon these claims.

Between 1862 and 1897, further changes were made in the Revised Code to widen the number of subjects for which grants would be made: in 1871, special grants were available for each scholar who passed examinations in specific subjects, amongst which were included the natural sciences; by the Code of 1875, animal physiology and botany appeared on the specific subjects list.

The table, shown beneath, gives the numbers of children who took these two subjects whilst attending either voluntary schools or the state-aided elementary schools:

	Voluntary Schools		School Board Schools	
	Animal Physiology	Botany	Animal Physiology	Botany
1875	822	58	144	-
1880	12353	976	12372	877
1885	9073	1116	13784	1488
1890	7038	912	8804	918
1895	5012	636	11091	1847

(See also Appendices 5 and 6.) (1)

The increase in the number of children learning animal physiology in those years is noteworthy. In 1870, each Standard in a State elementary school had its own syllabus in animal physiology, for instance - in Standard IV the build of the human body and the names and positions of the internal parts were prescribed for study, whilst in the next Standard the children were taught about the

(1) See the Minutes for the years mentioned in the table.

constituents of blood, muscle and bone and instructed on the circulatory system and about respiration - in Standard VI the alimentary canal was a topic added to their syllabus, along with information about the sense organs and the working of the muscles and nerves. As noted above, the Code of 1875 divided the sciences taught in the schools into physiology and botany, as well as allowing chemistry, physics and some agricultural teaching for grant-earning purposes.

A prime mover in this sort of science teaching was T. H. Huxley. His textbook, 'Elementary Physiology', had been published in 1866; in 1875, with H. N. Martin, he published 'Practical Elementary Biology'; his book, 'Physiography', was published in 1877 and, in the same year, an article 'On Elementary Instruction in Physiology'.(1) Huxley was a keen advocate of the teaching of physiology at the elementary level as well as at other grades of teaching (see P. 150) and, like Matthew Arnold (see P. 21), he believed that nature study held a very important place in the training of young children. In his address, 'On the Study of Biology', written in 1876, Huxley said of physiology:

> "What really has to be done is to get into the young mind some notion of what animal and vegetable life is. ..... Hence the general truths of anatomy and physiology can be taught to young people in a very real fashion by dealing with the broad facts of

(1) C. Bibby. Op. cit. Pp. 277-279.

> human structure. Such viscera as they cannot well examine in themselves, such as hearts, lungs, and livers, may be obtained from the nearest butcher's shop. In respect to teaching something about the biology of plants, there is no practical difficulty, because almost any of the common plants will do ...."(1)

Huxley's evidence before the Devonshire Commission, in 1870, illustrates his thoughts about the teaching of biological material in schools. In answering the question "If scientific teaching were introduced into elementary schools, have you considered which of these branches would be the more important ones to introduce; it would be, I imagine, impossible to introduce all?" he responded:

> "I think it would be extremely undesirable to attempt too much. My great fear of what educational reformers are now doing is that they are going in for too much. I should myself like to see the teaching in elementary science diminished rather than increased in range. I should like to restrict it in the first place, at any rate, to mathematics, to physical geography, elementary physics and chemistry, and to botany and human physiology in elementary day schools. ..... Botany I recommend because it is the only branch of natural science which can be taught at first hand conveniently; you cannot teach zoology conveniently, but flowers and plants are always to be had and you can teach botany properly. Human physiology I recommend the teaching of for its practical importance, and it may be taught thoroughly and well."(2)

Other witnesses beforethe Devonshire Commission were also desirous of seeing botany and physiology teaching established in elementary schools. For instance, Thomas Thomson, M.D., F.R.S., who was examiner in botany for the Science and Art Department, suggested that botany was the

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(1) T. H. Huxley. 'On the Study of Biology'. Op. cit. P.290
(2) Devonshire Commission Report. Vol. I. P. 26. Qq. 355/356.

first science that children could profitably be taught and recommended it because of the availability and the ease of obtaining the necessary specimens for practical work.(1) Mr. Iselin, Inspector of Schools for the same body, advocated the teaching of animal physiology and physical geography (2) and the Rev. F. Watkins, Inspector of Elementary Schools, stated that botany and physiology were suitable subjects for the purposes of elementary instruction.(3) The Rev. Canon Norris, who, in the Minutes of the Committee in Council for 1856 had written enthusiastically of the need for instruction about the principles of nature for rural children (see P. 219), was surprisingly less enthusiastic about science teaching in his evidence before the Devonshire Commission. The Rev. Norris had been an Inspector of Elementary Schools, under the Education Department of the Privy Council, from 1849 until 1864 and, when asked if elementary science teaching would be advantageous in elementary schools he replied that he would deprecate any systematic instruction.(4) He was then questioned further about this statement (by Professor Huxley):

> -"May I ask how you would wish to employ them otherwise?"
> -"In humanity, distinctly, rather than in physical science, as being a far more important matter."

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(1) Ibid. Q. 4897.
(2) Ibid. P. 375 Q. 5922.
(3) Ibid. P. 590. Q. 8618
(4) Ibid. P. 583. Q. 8472.

-"In what form of humanity?"
-"Biography for young children is infinitely more important than chemistry."(1)

Whilst sympathising with the seeming humanitarian instincts of the Rev. Norris and agreeing that the academic treatment of the laws of chemistry in a nineteenth century elementary school (or a modern one for that matter) would hardly produce worthwhile, or 'important', results, this statement was still at variance with the one he had made some fourteen years previously.

However, there remained a growing body of opinion that some form of science teaching was necessary in the schools for younger children and this was expressed, after the Education Act of 1870, in that curious brand of instruction, believed to be scientific, called the Object Lesson. These lessons became very popular in elementary schools and this was in part due to the work of the London School Board.

In 1870, Mr. Forster's Education Act allowed the setting-up of School Boards throughout the country to provide elementary education with the aid of fees and rates in any situation where the denominational institutions could not cope with further expenditure (even though Parliamentary grants could be made available to them.) As a result, the London School Board was formed and T. H. Huxley was one of the members of it. Dr. Bibby describes the sort of conditions that existed at this time in some of the

(1) Ibid. Qq 8531 and 8532.

schools of London:

> "The Scheme of Education Committee (whose appointment was first suggested by Huxley at the Board's second meeting) was faced with an appalling educational position in the metropolis. Even the Home and Colonial School Society's 'model' infant school of 200 pupils consisted mainly of a single room divided by a curtain, the Jews' School at Spitalfields consisted of some 2600 children many of whose parents were described by the master as 'the refuse population of the worst parts of Europe', the George Yard Free School in Whitechapel had starving pupils, some of whom their teacher had seen fall off the form fainting through hunger, and great numbers of children simply ran about the streets."(1)

Not the least of Huxley's successes in committee was the recommendation that a graded course of object lessons should be given in the London Junior and Senior schools, a decision that affected elementary schools all over the country. In 1878 Dr. J. H. Gladstone produced a syllabus for object lessons in elementary science for the Board and reported it to the British Association, in 1879, as follows:

> "In elementary schools a knowledge of the facts of nature is generally given in two very different ways. In the Infant department there usually linger some remnants of that instruction by object lessons which was considered a valuable part of education before the Revised Code of 1861. In the higher standards of the Boys' and Girls' departments certain sciences may be taught as 'specific subjects', and receive encouragement by a Government grant.
>
> The London School Board has all along desired that this knowledge of nature should not be confined to the least and the most advanced scholars, but should be extended throughout the whole course of a child's school life. It covers the walls of its schools with natural history pictures, and other diagrams, it gives a preference to teachers holding science certificates, it publishes full instructions to the teachers in regard to object lessons, and it provides a box of simple apparatus, and loan collections

(1) C. Bibby. Op. cit. Pp. 155-156.

> illustrative of various manufactures, animal physiology, and mechanics. On May 7 it unanimously passed a resolution that, 'In the opinion of this Board it would be expedient to include the elements of natural science amongst the recognised subjects of class examination, under Article 19, c. 1. of the Education Code,' and on June 27 a deputation of the Board presented a memorial to that effect to the Lord President of the Council. .....
>
> Object lessons may be assumed to be given in all the Infant departments, and are regularly reported on by the Inspectors of the Board. Advanced object lessons, generally on natural history, are taught in many of the Boys' and Girls' departments, and there is little doubt that they will soon become much more general and systematic."(1)

There can be little doubt that, as a result of the London School Board's work, object-lesson teaching, which had been going on in certain schools since the 1820's and 30's, began to play an increasing part as a means of introducing the sciences to elementary school-children. As early as 1856, the Rev. J. P. Norris commented as follows about instruction in 'Common Things', in the Minutes of the Committee in Council:

> "I believe it would be well that lessons of this kind should become more general in our rural schools, even at the risk of displacing some of the instruction now given in what may be termed more scholastic subjects. ..... Instead of calling it 'the teaching of common <u>things</u>', I would rather call it the 'teaching of common <u>principles</u>', - of those principles which find their illustration and application in the 'common things' of every-day life. It is much to be regretted that some who speak with authority on these subjects should have discredited this sort of instruction by gratuitously confounding it with mere <u>fact</u>-teaching. So far as the two have been confounded in practice, our teachers have been much to blame. So far as the

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(1) J. H. Gladstone. 'Report of the British Association for the Advancement of Science.' Section F. 1879.

> confusion exists merely in the minds of those who advocate what they consider a more philosophical course of study for young ploughboys, the teachers may throw back the blame upon their assailants. Nobody can deprecate too strongly the practice of loading children's memories with isolated facts - curious fragments of knowledge about the outer world, unconnected with any of its laws. If the 'teaching of common things' means this - however useful such knowledge may be as a recipe for getting comfortably through life - it ought to be reprobated, for it damages the child's mind. But, if it means a course of instruction in which the study of some of the simplest principles of nature is made to take the place of the principles of language, or the like, as an instrument of education, its advocates may at least claim a patient hearing for their side of the question, without incurring the imputation of being materialists."(1) (See also P. 215 above)

In a letter to the Taunton Commission, J. C. Buckmaster pointed out that, following the 1851 Exhibition and the publicity given to the importance of scientific knowledge in a general education, some lessons on common things and on elementary science were introduced into elementary school teaching:

> "The value of classical learning as compared with science was fully discussed, and an effort was made not only to introduce the systematic teaching of science in some of our commercial schools, but under the name of lessons on common things a good deal of elementary science was taught in our primary schools. .....
>
> Whatever view others may take, the middle and working classes will estimate the value of education according to its practical utility in the business of every-day life. The study of almost any branch of science has not only a direct bearing on many of the practical affairs of every-day life, but also supplies all the conditions necessary to strengthen and discipline the intellectual faculties. If the object of a school life is to give a boy the power of acquiring knowledge and enabling him to think logically, what can be so suitable as the study of those natural laws and forces by which and through which the universe exists."(2)

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(1) J. P. Norris. Mins. 1856-57. Pp. 408-409.
(2) S.I.C. Vol. II. 1867.

It was, then, with these sort of promptings that the age of the object-lessons was ushered in to the elementary schools. After 1870 the number of state and voluntary schools had increased and so had the national bill for education. By its Code of 1882, the Government tried to encourage object lessons in infant schools - "simple lessons on objects and on the phenomena of nature and common life"(1) - and in senior schools elementary science became a class subject.

In their Report of 1884, the Royal Commission on Technical Education noted that the School Management Committee of the London School Board had already taken advantage of the 1882 Code and mapped out a syllabus. In the infant schools, object lessons were continued but these were replaced in the boys' and girls' departments by an elementary science scheme which embodied some natural history teaching. Standard I, in this science syllabus, was simply an extension of the infant school object-lesson teaching, but in Standard II the natural history portion consisted of a comparison of plants and animals; in Standard III simple principles of classification were to be introduced and this was continued in Standard IV when typical examples were dealt with; in Standard V the useful products of animal and plant life were to be taught, whilst, in the next Standard, health was the main consideration and, in Standard VIII animal and plant distribution provided the teaching topics. The syllabus was sufficiently broad so as to

(1) Mins. 1882. Article 106(b)

allow a certain amount of planning by individual teachers.(1)

In 1886 the Cross Commission investigated the state of elementary education. The tabular information given over-leaf is an extract from the replies of Headmasters to the Commissioners' questionnaire:- (See P. 222a)

Even allowing for the effects of local pride and the wish to satisfy that so often obscures the reality behind answers to questionnaires, it was obvious that some changes were beginning to take place in the amount of science teaching being performed, especially in the Voluntary schools. The Cross Commissioners felt that the lessons in the lower standards on common objects were important as leading up to the teaching of elementary science in the upper standards and that a more liberal curriculum was desirable in which science would play a still greater role. Their Report was published in 1888; between 1890 and 1895 there was a tremendous increase in the numbers of the schools that taught elementary science:-

	Total No. of Voluntary and School Board Schools teaching Elementary Science.	Total no. of children presented for examination in the specific subjects:	
		Animal Physiology	Botany
1890	32	15842	1830
1891	173	15050	2115
1892	788	13622	1845
1893	1073	14060	1968
1894	1215	15271	2052
1895	1396	17003	2483

(See also Appendices 5, 6 and 7 for further details) (2)

(1) Royal Commission on Technical Education. 1884. 2nd Report. Vol. I. Pt. III Pp. 393-4.

(2) M. E. Sadler. 'Special Reports on Educational Subjects. 1896-7' p. 65.

222a County	Type of School	No. of returns	Schools in which Natural Science is taught:- At all	Experi-mentally	Chldns. Expts.	Only Obj. Lessons	Apparatus provided*
Devon	Voluntary	271	7	4	4	7	Included Physiological diagrams and pictures. Microscope, seeds, flowers etc.,
	Board	109	2	3	-	-	
Dorset	Voluntary	177	2	1	-	1	Physiological models.
	Board	10	-	-	-	-	
Durham	Voluntary	251	7	6	4	4	Charts, diagrams and drawings for physiology, anatomy and botany.
	Board	29	7	4	1	-	
Glos.	Voluntary	388	8	3	2	1	Bones. Models and diagrams for physiology and natural history
	Board	32	1	1	-	-	
Kent	Voluntary	355	9	4	2	6	School Museum specimens.
	Board	39	-	-	-	-	
Lancs.	Voluntary	1106	58	38	18	16	Botanical specimens, bones charts etc.
	Board	28	7	7	3	-	
Leics.	Voluntary	196	1	1	4	-	Physiological maps and charts. Small museum.
	Board	24	1	-	-	-	
Lincs.	Voluntary	357	5	3	1	9	Animal and plant physiology charts. A few models.
	Board	60	-	-	-	1	
Staffs.	Voluntary	313	10	4	1	3	Microscopical objects. Physiological charts and diagrams.
	Board	25	4	2	1	1	
Yorks. W. Riding	Both combined	1405	18 19	12 18	9 17	17 9	Apparatus for physiology, microscopy. Museum. Charts, models etc.
London Greenwich	-do-	125	2	1	1	-	As above. Botanical preparations. Museum specimens.
			23	21	9	10	
Beds.	-do-	137	6	3	1	-	
			1	2	-	5	
Sussex	-do-	386	7	5	2	2	Physiology and natural history diagrams etc.
			10	5	2	3	
Wilts.	-do-	317	4	3	2	2	Diagrams.
			1	1	1	-	A few plants.
Warwick.	-do-	430	4	4	1	9	Charts, models, maps, etc. for physiology. Botanical specimens. Museum etc. (1)
			21	20	13	3	

* Only Natural History material etc. is included in this column.

(1) Cross Commission. 1886. Final Report.

The Code of 1880 had allowed natural history, amongst other subjects, to be included in the class subject list in which scholars were not individually examined. Michael Sadler noted, however, that the new subjects were not taken up to any great extent and that in the year ending 31st August 1882 natural history was taught in only eleven instances, domestic economy in eight, chemistry in two and agriculture in one school.(1) Of this period, Frank Smith states:-

> "Yet science and handwork could gain no entrance into the schools of the 'eighties. The fifty-one schools which offered elementary science as a class subject in 1884 had actually dwindled to thirty-two in 1890, and the small number of pupils who offered science as a specific subject showed little change throughout the decade. Moreover, science teaching, which was intended to correct the prevalent learning by rôte, was one of its worst examples."(2)

The increase in science teaching, as tabulated overleaf, in the 1890's was partly due to the Reports of the Cross Commission and their insistence that science ought to play an important role in elementary education and partly, as a Report of the Board of Education phrased it:

> "The attempt made in the Code of 1882 to encourage general 'elementary science' met with little success until the relaxation, in the Code of 1890, of the rule requiring English to be the first choice in 'class subjects'. From the date of this alteration the growth in the number of schools taking Elementary Science was remarkable ....."(3)

After 1895, object lessons were made compulsory for Standards I, II and III; in 1897 school gardening was introduced as a part of a general education rather than be-

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(1) Op. cit. P. 58. (See also Appendix 4).
(2) Smith. Op. cit. P. 323.
(3) Board of Education Report. 1910-11. P. 28.

ing used in a purely utilitarian manner and when, in 1900, the system of block grants to replace subject grants was introduced gardening still carried a separate grant; in 1902, for instance, the grant was earned by 4,359 children in 289 schools.(1) After 1903, observation lessons and nature study were included amongst the ordinary subjects of secular instruction.(2)

Birchenough makes some general comments about the object lesson:

> "The demand for instruction in science and for a more practical education resulted in increased attention being paid to object lessons and lessons on common things in the lower part of the school. ;.... But the instruction was commonly nothing but words. The presence of an object or picture was supposed to raise a hackneyed and rambling discourse to the level of a 'new method', and the performance of a few 'class demonstrations' to transform the memorising of a highly systematised and arid array of facts into a course of scientific training."(3)

G. A. N. Lowndes writes about the object lessons in the following manner:

> "These object lessons were strongly advocated by their Lordships, and from 1895 onwards a miscellany of objects of truly alarming variety began to find their way into the schools' museum cupboards. In the case of urban schools or the remoter rural schools a bird's nest full of assorted eggs was usually the pièce de résistance, but stuffed dogs and even alligators were not unknown. ..... Probably, however, few developments in education during the last decade of the nineteenth century exercised a greater influence in changing the attitude of children to their work."(4)

(1) Ibid. P. 12 onwards.
(2) Ibid.
(3) Birchenough. Op. cit. P. 307.
(4) Lowndes. Op. cit. P. 35.

Another comment is that of R. F. Shove, written in 'The School Nature Study Journal':-

> "Before the days of the pioneers ... (of school nature study) ... in the nineteenth century a subject known as 'Object Lessons' existed for the younger children. But these lessons usually dealt with disconnected topics, and though a feather and a spider, an onion and a buttercup probably formed part of the environment of the primary school child and specimens may have been provided for individual observation, yet continuous biological interest must have been lacking and further, the teacher's background of knowledge was probably very meagre. The teachers of 'Object Lessons' may have imparted useful information and aroused a certain amount of curiosity and wonder, but, as we shall see, their aims were far removed from those of the pioneers of Nature Study."(1)

These passages write the epitaph of the Object Lesson. On the one hand, although the idea of introducing sciences in this way by some actual 'contact' between children and the things of their environment was in direct contrast to the catechetical methods hitherto employed or to the book reading or chant-learning methods used in these and other subjects of school curricula, in practice the system contained the seeds of its own destruction. After the 1850's, as the object lessons increased in popularity, it was considered sufficient to bring more and more objects into the classroom until the children were faced with a multiplicity of things and rarely were they allowed to observe them properly in a true scientific manner. Hardly ever were their senses involved in appreciating leaves and twigs and animals (the latter most often dead and stuffed) and too often

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(1) R. F. Shove. 'The School Nature Study Journal.' No. 191. Vol. 48. April 1953. P. 19.

there was little or no scientific sense of continuity in the objects and the lessons presented to them. In short, the system of teaching the sciences was unscientific. The lessons were presented, marshalled and delivered, by many teachers, in the manner of a drill. It is worth noting that some training in the methods of science teaching only became compulsory for students in training colleges in 1904 and that it is compulsory no longer.

One of the pioneers of school nature study teaching was Dr. L. C. Miall and Miss McDonald studies his work in some detail:

> "The greatest influence in the teaching of natural history, especially in its early stages, was exerted by Dr. Louis Compton Miall, Professor of Biology at Leeds University. His book on 'Object Lessons from Nature' published in 1892, excited the interest and gained the approval of the schoolmaster as well as of the public and did much to place the study of elementary natural history, or Nature Study, as it was called, on a sound scientific basis i.e. of close observation of Nature. .....
>
> The whole burden of his argument was to prove that Nature Study per se was the best introduction to mature scientific explanation in whatever branch the pupil might eventually specialise. Some teachers, however, did not fully understand the way in which the subject should have been treated in order to produce the best effects. So for some years, nature study, in its early stages, remained too much a matter of books and too little a matter of personal observation and experiment; it was treated too much as formal specialised science, and its material was far too little drawn from the children's own surroundings. The plea for the wider use of nature study in early education was not to produce, or begin to produce, men and women of science, but to produce in children a keener and more intelligent interest in the things of Nature, which lay close to them and all around them. The aim was to create a certain tone and attitude of

mind rather than learned instruction."(1)

So great was the effort that was put into nature study teaching at the beginning of the twentieth century that a Nature Study Conference was held in 1902 in order to draw together interested teachers and show their pupils' work. The Conference directed attention to the types of work-schemes that could be undertaken in both secondary and elementary schools. At the Liverpool Girls' High School, the results of 'Nature Lessons' about buds and seedlings were shown, specimens from the childrens' gardens and the plants in an aquarium were exhibited; the development of tadpoles had been studied and silkworms, caddis larvae and newts had been observed. At Sexey's Trade School, Bruton, nature study was a compulsory subject for the boys and was used to "cultivate the powers of observation and expression" and there was one master whose full time was devoted to teaching it.(2)

Nature Study at the Combe Hill School, Westerham, was taught in order to "arouse interest in all natural phenomena and to foster the spirit of enquiry," and it was further reported of the teaching at this school that,

> "Brush-work is resorted to as a simple and effective means of representing the beauty of which they become conscious in the course of their study."(3)

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(1) R. M. McDonald. Op. cit. P. 124 and 126.
(2) 'Report of the Nature Study Exhibition and Conferences'. 1903. Pp. 34-35.
(3) Ibid.

At the Ruskin School Home, Heacham-on-Sea, the Report noted that it was the practice of the master

> ".... to tell the children as little as possible, to make them see and think as much as possible, and to supply them with a key to all future problems, for to train children to reason in one subject is to train them to reason in all."(1)

At this school plant life was studied in "field and garden", insects, birds and other animals were watched "on the spot with spade or note- and sketch-book in hand. Each child, if it so desire, may have its own little garden plot." Pets were encouraged so that the children could gain from them first-hand knowledge of animals which could then be correlated with the physiology lessons given in the school about their own bodies.(2)

The girls of the Streatham High School made, in the junior forms, observations on the life histories of plants and animals, manufactured nature calendars, performed some ecological surveys, and painted pictures of some of the animals and plants found in the school garden. At Dulwich Hamlet School, moths and butterflies were reared, and the Chiselhurst Board School, Orpington, had organised its lessons so that the children of each Standard could keep their own garden.(3)

The Puttenham National School, near Guildford, reported:-

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(1) Ibid. P. 36.
(2) Ibid.
(3) Ibid. P. 50.

> "The actual method employed is that of a monthly stroll for purposes of observation, and lessons on plant life of an experimental nature in school. Out-of-doors, in spring and summer, children are taught: (i) to recognize trees by their leaves, bark and general outline; (ii) to watch the buds open and their position on the branch; (iii) methods of fertilization by insects, wind, or self. Daily notes of anything striking to the child, which he may have observed for himself, are entered in exercise-books together with essays on the strolls, barometer and thermometer readings, and so forth."(1)

The Report contains many more examples of the work that many varied types of school, rural and urban, public and elementary, were doing. In Stockport, for instance, the geography of the town was investigated and visits to local coal mines and quarries revealed fossils which were eagerly probed.

By drawing attention to this work, however fragmentary some of it may have been, the Conference was responsible for a sort of crystallisation of the results of the efforts that were going on. Professor Miall held a course in Nature Study for teachers and lecturers at the Royal College of Science in 1904.(2) The course was designed in order to show how children could investigate objects from nature in a scientific manner and also to give information about such things to the students. Miss McDonald writes:

> "There were no lectures, no explanations were given in advance, and the practical work on which the lessons were founded were always taken first."(3)

Somewhat naturally, there were critics of the new

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(1) Op. cit. P. 52.
(2) Mc.Donald. Op. cit. P. 136.
(3) Ibid. See also Board of Education Report 1903-04. P.19.

ideas and idealism. A. W. Newton writes, in 'The English Elementary School':

> "Since 1906, I have seen a great deal of what is now called 'nature study', and of this there was very little in London in 1906. The term nature study is not used as the equivalent of science; nor is it the equivalent of botany and zoology, though the nature student is concerned almost entirely with plants and animals, mainly with plants. It is rather hard to give an accurate definition. The promoters of nature study, however, seem desirous that children should be encouraged to observe plants and animals for themselves, to record their observations in non-technical language, and to reason on these. ..... Endless objects are, of course, open to observation, and no one will deny that to direct childrens' observations into a proper channel is a worthy aim, or that there are teachers who can do this successfully. Nevertheless, we may doubt the utility of a great deal which goes on under the head of nature study. To begin with, it is a question whether observation should not be spontaneous rather than organised. A good deal is to be said for the view that we should abandon formal lessons on nature study, but provide school reference books, in which children may look up facts about which they are anxious, and find verifications of their own observations. Granted that observation should be organised and directed, it may be questioned whether this can be done by any person who has not strong innate interests in plants, or animals, or both. When the subject which our forefathers called natural history is distasteful to the teacher, as it often is, it seems unwise to make him deal with it. We cannot implant in him the instincts of the naturalist.
>
> .....
>
> The Regulations of the Board, as has been explained, do not actually impose nature study on any school. But custom is sometimes a harder master than law, and nature study lessons are often given, just as were the old object lessons, not because the teacher wants to give them, but because he thinks he should, and because other teachers give them. .....
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> On the whole, whilst I would not for one moment suggest that all nature study should be banished from elementary schools, I do maintain that no one would suffer if a great deal of it were to disappear. I believe that many teachers hold this view."(1)

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(1) A. W. Newton. 'The English Elementary School.' 1919 P. 131 and following.

There is, of course, a tremendous amount of truth in what Newton says. Even today, nature study lessons are taken by primary school teachers who have very little training, if any, in the subject and many of them feel obliged to do so even though they have no interest at all. That this is true of all subjects does not lessen the validity of the point. Because of the nature of the sciences, three things are vital in their teaching: first that the teacher be enthusiastic or at least interested in what he or she is teaching; second that the teacher should have some factual knowledge of the topic, and it is preferable that this should be first-hand knowledge, not material gathered from hasty book-reading; and, lastly, that the methods of teaching that particular science should be understood. Newton's reference to the children verifying their own observations from books seems pointless if the teacher cannot make them sufficiently enthusiastic, or channel their interest. It would be better by far if it were possible for elementary schools to have on their staffs one specialist to direct these studies throughout the school, rather than to have the class teachers all attempting to teach material about which they care not a jot, for nature study is, par excellence, a topic with its own intrinsic vitality and fascination and it is as vulnerable as any other to boring, arid and disinterested teaching.

The Board of Education attempted to put some of these points in its 'Suggestions to Teachers'; in 1905 observation lessons were lauded as a valuable means of teaching pupils to observe accurately, to enable them to compare and contrast factual material, to add to their general knowledge and their ability to use the English language with some facility and concern and to whet their appetites for the study of animals and plants. A series of extracts from the Board of Education's Handbook (1905) which serve to illustrate their beliefs concerning the necessity of teaching from real things, and of allowing children to make first-hand observations from Nature are given in Appendix 8. (See Pp.319-). These extracts contain a clear directive that the beginnings of what is called scientific thinking are to be inculcated so that nature study is not only a part of a liberal education but a means to an end of encouraging the processes of logical thought. However, as a result of Professor Piaget's work the chances of success, at the Junior school level, of developing logical thinking by any training would be questioned nowadays. Even so, the praiseworthiness of some of these statements is not to be questioned: Unfortunately the public elementary schools were not and, in general, still are not, engaged in teaching, as Professor Henslow was, from the book of Nature. It is easier, in the 1960's, to preach to the converted but it is surprising how often the children in the junior schools are believed to have been in thrilling and useful contact with Nature as a result of an occasional walk and a look at a nature table.

> "The essential things are two; to secure abundant personal first-hand experience for the children, and to give them many experiments; the teacher should choose his subject and build up his course to secure these fundamentals. ..... As the choice of subject is so wide, and as the spirit of teaching is everything, the subject should represent the individuality of the teacher. ..... It is only when a man has made a subject his own that he teaches it vividly and with authority. ..... Whatever the subject selected, if Nature Study is to have its full value in the school, it must be in virtue of the spirit in which the teacher goes to work; he must continually ask himself whether his teaching proceeds from the thing, whether it is designed to encourage observation and thinking in his children, to make their minds active and not merely receptive, whether it is experimental enough, whether it is first hand."(1)

In 1916, the Thomson Committee made some valid points about elementary school science teaching when the Committee reported:

> "In secondary education we have recognised two stages - a period of general education and the stage of specialisation. The elementary schools proper should, from their essential nature, never reach the second of these periods, which belongs to the schools of the secondary grade, to continuation classes and to technical schools. The elementary school, however, serves as a preparation for these subsequent stages, and both in its own character as providing general education and also in its function as a preparatory school it should include in its curriculum the teaching of Science in a simple and suitable form. This should normally include nature study and should be supplemented by instruction in elementary practical work."(2)

However, after the recommendations of the Hadow Committee in 1926, there was a reappraisal of the stages in schooling. The Report of that Committee recommended that there should

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(1) Board of Education. 'Suggestions for the consideration of Teachers in Public Elementary Schools.' 1905. Pp. 46 onwards.
(2) Thomson Committee. Op. cit. P. 107.

be a break in school life at 'eleven plus'; children younger than this would attend Primary School and their schooling after that age would form a secondary stage. This secondary education (in "Modern" and "Grammar" schools and "Senior Classes" etc.) was to be adapted so as to fit the aptitudes and needs of all the pupils who entered the post-primary age range. Thus, whilst Grammar Schools should provide a mainly academic curriculum in terms of literary and scientific subjects, the Modern Schools were to concern themselves with a "realistic" and practical education, in the main, for the benefit of the majority of children. As this scheme began to be implemented so there was a tendency for preparatory work in the natural sciences to become a feature more of the primary than of the secondary schools. In the latter, there came about a reliance on the teaching of general science (especially some rudiments of physics, chemistry and the applied sciences) since it was felt that this would prove useful to pupils whose abilities lay, not so much in abstract academics, but in mastering more practical skills. The result has been that many children after having had some nature work in the junior school never meet it again whilst those who go to grammar schools only receive some smattering of it as a part of a general or elementary science course in the junior forms. We have now become conditioned to the idea that nature study is really only suitable for young children.

In an article in 'School Nature Study', Kenneth Richmond writes:

> "In the field of educational theory and practice we seem to be witnessing the last stages of a double conflict - on the one hand between an old-established, literary tradition and the more recent emphasis upon a curriculum 'in terms of experience and activity,' on the other between a methodology which saw its first duty as the conveying of a certain body of information and one which conceives it to be nothing less than the nurture of personal growth. Though interrelated, the two conflicts are quite distinct and it is important that they should be kept so. The first affects the <u>content</u> of education. The second represents the much more fundamental difference between 'jug-and-bottle teaching', as it has been not inaptly called, and what is usually referred to as the 'child-centred idea'."(1)

In this article, the author goes on to discuss the place of Nature study in the schools and points out some of the fallacies and assumptions that have been made in advocating its inclusion in the school syllabuses. Because I consider the article to be a shrewd one I wish to include, at length, some quotations from it. Mr. Richmond points out that the observation of the environment is a tall order:

> "It is true of course that most people are fairly clear in their own minds that Nature Study is more or less synonymous with Natural History, but this is no more than a tacit understanding: there is nothing in the rules, so to speak, to prohibit its extension to the wider realm of <u>natura rerum</u>. It is no accident that the cult of nature walks has in many places led to the introduction of Local Studies which, as often as not, have nothing to do with Nature Study as such. If the metaphor were not so ludicrously inapt, we might say that the trouble about Nature Study is that it is neither fish nor flesh! Might we not do better to insist that Nature Study is concerned solely with the animal and vegetable kingdoms? No doubt, in thus

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(1) W. K. Richmond. 'A Critique of School Nature Study.' The School Nature Study Journal. No. 187. Vol. 47. April 1952. P. 19.

> limiting its scope we should lay ourselves open to new objections, but at least it would serve to define the territory which Nature Study occupies in its own right."(1)

The author states that, whilst it may sound desirable that children should know their immediate environment there is no reason why their nature study teaching should restrict them to this and so ignore places and things that are foreign to them. Thus, when first-hand observation is not possible, the 'aids' to excitement, whatever they may be, are particularly useful. He examines the three assumptions, now grown rather hoary, that Nature Study is really a force in moral training of desirable human qualities, secondly that the subject fosters 'intelligent observation' and, thirdly that children are naturally interested by the beauty of nature, and all of these he finds wanting in some respect. Of the first, he writes:

> "The belief that the natural environment exercises a wholesome moral influence on men's character and outlook has always been dear to the heart of the idealist. Like other beliefs, it is not open to intellectual proof, but though it is far from being exploded, we shall deceive ourselves if we suppose for a moment that the influence of two or three hours per week devoted to Nature Study can achieve any significance comparable with that which results from a permanent way of life."(2)

Concerning the ideas of transfer of training inherent in the concept of <u>teaching</u> intelligent observation, the author comments:

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(1) Op; cit. P. 20.
(2) Ibid. P. 21.

> "After all, does it really matter whether or not the 11 year old can identify correctly the commoner birds and flowers? Will he be any better as a person for being able to tell the difference between black and white poplar, or to recount the life-history of the stickleback? When we know that many adults freely confess their ignorance of such matters, why should we regard them as indispensable for the young? Questions of this sort may well rouse the wrath of any self-respecting teacher of Nature, who will in any case be quick to supply his own answers. The point is that, for better or for worse, we must fall back on the conviction that the values implicit in Nature Study are emotional and aesthetic rather than intellectual; and that they are best realised by appeals made to the learner during his most formative period. An oldster may be introduced to the secrets of the spider's private life and still look upon it as a horrid creepy-crawly. Not so the child, whose wondrous imagination lifts the learning process to a higher level of meaning."(1)

And of the last assumption Richmond says:

> "It makes it appear that the child is to the manner born so far as Nature Study is concerned. It is misleading in that it fosters the notion that the teaching of Nature Study is a soft option. ..... To evoke a sense of wonder, to excite the innocent eye was never exactly easy, even in the days when human invention did not loom so large in the child's imagination as it does today."(2)

In this article the author queries the assumptions that have been too easily accepted. Nevertheless I would question any supposition that human-beings, children or no, have little interest in natural things, although their feelings for the beauty of Nature may well be latent and an approach to Nature Study by appealing in a sentimental fashion to blasé young children could well wither and die in the Junior school stage. But if the specialist teacher is

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(1) Ibid.
(2) Ibid., P. 22.

equipped with enthusiasm and trained to teach, then I see no reason why young children should not begin to learn an objective approach to the things that surround them. What Nature Study can and should be able to achieve is some training in the uses of the senses but, whilst it may prove an admirable medium for this, it should not be assumed that this subject is the only one by means of which the senses can be used to appreciate reality.

Mr. Richmond's article provoked some immediate response in the columns of 'The School Nature Study Journal'. Thistle Y. Harris writes that Nature Study,

> "..... should afford children an opportunity of discovering a little of the interesting natural world in which they live. It matters very little, I think, what aspects of the environment the child studies, for most, if not all of it is of absorbing interest to him. It matters a great deal that he should be given the opportunity of learning how to investigate, of collecting evidence of this or that nature, to attempt to solve problems and to draw conclusions in the light of that collected evidence. It matters very little whether the field of investigation is geographicalorbiological - it is always the method of investigation that is significant."(1)

Miss Harris makes a further comment about this subject in answer to Richmond's statement that, in a modern world, children have a greater interest in mechanical things than they have in Nature. Miss Harris notes:

> "This, I think, is the essence of Nature Study - the interest and value of the commonplace. The emphasis can be, and, I think should be, not on the emotional and aesthetic (which are, I think, developed as a child takes satisfaction in his learning) but on

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(1) T. Y. Harris. 'The School Nature Study Journal.' No. 189. Vol. 47, October, 1952. P. 58.

the intellectual. For wrestling with problems of why and how in nature should develop a quality of reasoning ability of a high order. Not that Nature Study is alone in this. Other subjects can. And children, as Mr. Richmond points out, are interested in mechanics and should, therefore, have an opportunity of indulging such interests in a 'gadgeteer age'. Certainly they should. But they should not be denied the double opportunity of indulging both interests."(1)

In the same volume of that Journal, F. J. Speakman writes 'A Testament of Natural History' in answer to Mr. Richmond. In it, he comments:

"Mr. Richmond questions the aesthetic value of the study of nature to a child. It depends on what you expect. The response of an adult to the influence of nature is not that of the child. I have spoken of sympathy and tenderness in the child. But that same child, so tortured today by an act of cruelty, can tomorrow be calmly committing the most callous act of cruelty. It is our training that will change the latter.

..... Mawkish sentiment deceives no child; it is abhorrent to him. But love is never so. And the greatest need for any teacher of natural history, is love. .....

There is nothing either stupid or belittling in having such a sense of wonder, such a love of life. If it is childlike, then the greater pity that more of us are not more like children. .....

Mr. Richmond believes that in the modern machine-made world we are well-nigh defeated in our desire and our efforts to bring home the love of natural things. Nothing is farther from the truth. Never was the need so great, never I am sure the response so great. Of course, we cannot really give a love of nature, that must come from within, but if it is in us, then we can awaken it."(2)

Kenneth Richmond's article is an important one if it makes us begin to think again and question the reasons we have come to accept, perhaps uncritically, for teaching

(1) Op. cit. Pp. 58-59.
(2) Ibid. P. 51.

Nature Study. Whilst children in Junior and Infant schools find, in this field of study, ample opportunity for using their senses to make classifications and to begin to make some knowledgeable order out of their surroundings in this way and, whilst very young children find the world marvellous and both they and the Juniors have a very real interest in animals and plants (especially the former), these are not the sole reasons for Nature Study teaching at these levels. But, if education is really concerned with living and if that process aims at the production of a whole and informed person, it would seem that this particular group of experiences of reality that we call Nature Study must play an important part in the development, not only of the child, but of the man.

CHAPTER VII

EDUCATION FOR GIRLS

Until the end of the nineteenth century such training as girls received was at home in such useful arts as sewing and embroidery and, if their station in life warranted it, they might learn artistic pursuits like music, singing and dancing and household management. For a few, those with a vocation, there was the religious education of a convent, and for some the special private governess, always available for girls whose parents were rich and who believed that their daughters ought to be taught some accomplishments. Such a list encompasses the types of education available for girls until the eighteenth century private schools began to flourish.

Then, since marriage was to be the career of the daughters of wealthy and middle class parents, the schools concentrated on the polite accomplishments - studies that were genteel, 'graceful' and refined. Such private schools taught French and Italian, painting, sewing and embroidery, music, singing and dancing, the domestic arts, the art of conversation, all of which were useful to an upper class lady with pretensions to being able to continue a conversation and manage a home and a husband. However, such a list is not exhaustive.

The following advertisement spoke of other studies:

"Economical school for Ladies - In a most eligible situation, ten miles from town, is a school for young Ladies, formed on a plan, and conducted by methods peculiarly advantageous both to the pupils and their Friends, especially those who wish to give a truly solid education, and to save enormous and extravagant extra charges. - The price is only Sixteen Guineas a year, which includes board, and instruction in English, French, Needleworks, Geography, History, Natural History etc. The Principal will respectfully attend to every address, or letter left for S.K.P. at Mr. Cook's, Hosier, near Middle-row, Holborn."(1)

In 1797, Erasmus Darwin published 'A Plan for the conduct of Female Education in Boarding Schools,' which was, to employ a well-worn phrase, ahead of its time in the concepts of the ideas contained in it. Darwin wrote:

"Besides the acquisition of grammar, languages, and common arithmetic; and besides a knowledge of geography, and history, and natural history, there are other sciences, an outline of which might be taught to young ladies of the classes of the school, or of more inquiring minds, before or after they leave school, which might not only afford them present amusement, but might enable them at any future time to prosecute any of them further, if inclination and opportunity should coincide; and, by enlarging their sphere of taste and knowledge, would occasion them to be interested in the conversation of a greater number and of more ingenious men, and to interest them by their own conversation in return."(2)

He recommended the study of botany for young ladies and there can be no doubt that this was a popular subject in the private schools for girls. On October 6th, 1803, the 'Morning Post' carried the following advertisement:

"Charles Grant, Viscount de Vaux, Author of the History of Mauritius, and of some important Geographical and Astronomical works, and Maps, etc., now publishing, has settled himself and his family in a healthy situation, Elizabeth-Street, Hans-square, Brompton,

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(1) Morning Post. Mon. June 3rd. 1803.
(2) Erasmus Darwin. Quoted by Charles Foster, 'Erasmus Darwin and the Teaching of Science.' School Science Review. Vol. XXI P. 859. 1939.

> where his Lady, who is English, and his daughter, have an Establishment, on a Plan of Private Education, for Young Ladies, on reasonable terms, including French, English, Geography, History, the Elements of Astronomy, Natural History, etc. Entrance Five Guineas ....."(1)

The brothers John and William Thompson together kept the Grove Street Academy in Manchester; William taught botany at a school kept by the Misses Horne and Lloyd in Manchester in 1832. In that year, too, he advertised a course of twelve lectures on botany:

> "..... for young Ladies at his own House. ..... illustrated by fresh and dry specimens and drawings."(2)

Miss Greenberg found that, out of forty private schools for girls which specified the subjects which they included in their curricula, six offered botany and those schools were all situated in the north of England.(3) Mary Carpenter, (1807-1877) who pioneered reform schools, kept a girls' private school with her mother and sisters in Bristol from 1829 until the 1840's. She had definite ideas on the sort of subjects their school ought to teach to girls and attended lecture courses herself in such subjects as natural history, chemistry and geology in order to teach them to others.(4)

A Miss Whitwell kept a "Seminary for Teachers" near Reading, according to her advertisement in 1849, at which young women of 15-20 years of age could take reading, writing, arithmetic, ancient and modern geography and

(1) Morning Post. Thurs. Oct. 6th. 1803.
(2) Greenberg. Op. cit. P. 185.
(3) Ibid. P. 184.
(4) Ibid. P. 186.

history, chronology, botany and the construction of maps, for which the charge, including board, was £20 per annum.(1) Some other instances of Private schools for girls and notes on the Quaker girls' schools are included in the appropriate chapters.

In 1848, Professor F. D. Maurice was instrumental in the founding of Queen's College in Harley Street where lectures were delivered to young girls and women. So novel was this institution that the whole 'tone' of the lectures was regulated so as to ensure that the students were given no dangerous ideas which could cause them to become discontented with their status in society. Bedford College was endowed in 1849 and Girton was started in 1869 at Hitchin by Miss Davies, a keen champion of the educational rights of women, and moved to Cambridge in 1873.

The Taunton Commission investigated all types of schools in the educational system and pronounced itself concerned about the lack of adequate provision for girls and of the

> "..... inveterate prejudice that girls are less capable of mental cultivation, and in less need of it than boys; that accomplishments, and what is showy and superficially attractive, are what is really essential to them; and in particular, that as regards their relations to the other sex and the probabilities of marriage, more solid attainments are actually disadvantageous rather than the reverse."(2)

There were some rays of sunshine amongst the Assistant Commissioners' reports. Mr. Stanton noted,

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(1) Educational Times. No. 22. July, 1849.
(2) S.I.C. Vol. I. P. 546. quoted in Curtis, op. cit. P. 89.

> "..... the marks of conscientious and intelligent labour on the part of those that taught. Many of them were in the habit of attending lectures on natural science, physics etc., and showed a knowledge of these subjects, and of the elements of astronomy, which I rarely found in boys' schools."(1)

The Walthamstow Mission School, which had a large garden attached to it, had 50 girls as boarders, of whom thirty took natural history. Bedford College for Girls had two classes, totalling thirty-one girls, who were learning natural history (see above P 244). In addition, vegetable physiology and botany were taught there and specimens were used to illustrate the lessons.(2) The West Central College for Young Ladies had twenty-five pupils taking both natural history and physics.(3) Another proprietary school for girls was the North London Collegiate School which was first started and developed by Miss Mary Buss who began her teaching career in her mother's private school. The school had two gardens and one hundred and sixteen girls were said to take botany there and were divided into four classes.(4) In 1866 Dr. Hodgson delivered a course of 38 lessons on human physiology and health and the lectures proved very popular. In 1875 the botany course was extended and each student dissected plants for herself.(5)

Mr. Stanton said of the Milldown Endowed School of

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(1) S.I.C. Vol. VII. P. 71.
(2) S.I.C. Vol. V. P. 680.
(3) S.I.C. Vol. X.
(4) Ibid.
(5) 'The North London Collegiate School 1850-1950'. O.U.P. 1950. P. 44.

Blandford (1862),

> "..... The prominent branch of instruction in the school is always to be knowledge of the structure of the human body, of physiology and of the laws of health; ..... A good lecture was given then in my presence on the structure of the human tooth; but I am compelled to say I did not think the children by their answers intelligently appreciated it. They made but indifferent answers to a few general questions I put to them on the functions discharged by the lungs."(1)

The Red Maids' School at Bristol had lectures for the girls in natural history (2); Natural Science lectures were given at Cheltenham Ladies College, where another pioneer of women's education, Miss Beale had been appointed in 1858 as Headmistress (3), whilst at Liverpool the Blackburne House Girls' School taught physics, chemistry and zoology. (4)

Both Miss Buss and Miss Beale appeared before the Schools Inquiry Commission and gave evidence concerning the state of women's education and spoke of their beliefs and hopes of what it might become. Consider Miss Buss' answers to the following questions put to her by Lord Taunton:

> "In your opinion should the education of a girl differ essentially from the education of a boy in the same rank of life, with regard to the subjects which are to be taught?
>
> - I think not, but it is rather difficult to ascertain what is the proper education for a boy.
>
> You believe there is not such a distinction in

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(1) S.I.C. Vol. XIV. Pp. 163-164.
(2) Ibid. Vol. XV.
(3) Ibid.
(4) Ibid. Vol. XVIII.

> the mental powers of the two classes, as to require any wide distinction between the good education given to a girl and that which is given to a boy?
>
> – I am sure that the girls can learn anything they are taught in an interesting manner, and for which they have some motive to work."(1)

Miss Buss went on to state that, in her opinion, there were hardly any good schools for middle class girls in London, that there were very few good teachers and that the girls had as little motive to study as their parents had to keep them at school.(2) She thought that the education available for them was, in general, showy and superficial and based on accomplishments rather than sound learning. (3) Further, she declared herself in opposition to pure book-learning, but pointed out that the teaching of geology, botany, natural history and astronomy in the North London Collegiate school was conducted on catechetical lines. The botany teaching was made as practical as possible and was not only concerned with the structure and classification of plants, but with their physiology also. (4)

Miss Beale who, as noted previously was Principal of the Cheltenham College for Ladies, a proprietary establishment, was vehement about the defectiveness of rudimentary schooling apparent in the lack of knowledge shown by many middle class girls. The botany that was taught there was

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(1) S.I.C. Vol. V. 30th Nov. 1865. Qq. 11, 470 and 11,471.
(2) Ibid. Q. 11,527.
(3) Ibid. Q. 11,530.
(4) Ibid. Qq. 11,631-11,641.

based upon structural and physiological lines and Miss Beale felt that natural science not only widened the knowledge of the girls but was also important in "furnishing pursuits full of interest for life,"(1)

Miss E. E. Smith, who had been a teacher and was a member of the management council of Bedford College, when asked by Lord Taunton if she wished to add anything to the answers she had made to the Commission's questioning, responded,

> "I should like to press the importance of economizing the early school years, those before 14, so that reading, spelling, writing, elementary arithmetic, and a thorough knowledge of the rudiments of grammar, may be secured during them, and the later years be thus left free for something of higher culture. What ought to have been done before 12 is now too often only begun at 16. Another subject is the domestic arts, the necessity of teaching which to girls is often insisted on. Though girls should be at all times helpful and handy, I should deprecate making needlework and housekeeping the subjects of special instruction during the brief school years. I believe that a girl who has been trained to the thoroughness and accuracy which ensure well doing will address herself with success to the fulfilment of household duties when they devolve on her. I only wish further to insist once more on the great evil of girls spending 10 important years of life, 7 to 17, in learning <u>not</u> to understand French and <u>not</u> to play the piano; and then when a habit of labouring without result and of looking for none of the rewards of industry is formed, the world wonders why women are idle and frivolous, and why those who have learnt nothing cannot teach."(2)

In the chapter about the education provided in certain private schools, mention has been made about the Quaker schools and, in 1868, the girls at <u>Ackworth</u> took natural

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(1) S.I.C. Vol. V. Qq. 16,082, 16,102 and P. 739.
(2) Ibid. Q. 15,849.

history and Lindley's 'School Botany' and Hooker's 'Flora' were prescribed books; the girls at the Quaker school at Stoke Newington also had natural history lessons.(1)

These girls' proprietary and private schools mostly owed their existence to the growth of the movements that led to the emancipation of women. The Endowed Schools Act of 1869 allowed some endowments to be used to establish schools for the education of young women and Girls' High Schools were started at Birmingham, Dulwich, Bradford, Bedford and Rochester, for example. Since they were being formed at a time when there was a greater and greater popular recognition of the claims of the life sciences for inclusion in any liberal system of studies, and since the leaders of the movement believed that education should be both liberal and humanistic, the natural sciences the more easily gained admission to the schools' curricula.

> "The growing recognition of the claims of Natural Science, to which public attention was directed by the Report of the Royal Commission on Scientific Instruction, (1875), led to the gradual introduction of Natural Science, especially Botany, into Girls' Schools."(2

The curricula of these schools were modelled, not surprisingly, on those of boys' schools of an equivalent standard although there was generally less Latin and Greek teaching in them and Music, Dancing and such things as Needlework were included. Botany had two merits - not only was it

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(1) Campbell Stewart. Op. cit. P. 76.
(2) Report of the Consultative Committee on Differentiation of the Curriculum for Boys and Girls respectively in Secondary Schools. Board of Education. 1923. P. 32.

thought to be a study with some special aesthetic appeal to girls - but it was also a subject for which specimens could easily be found and studied. Large pieces of apparatus did not have to be provided and the girls in their walks abroad could so easily observe botanical specimens with dignity and decorum and from afar. Animal studies were presumably less popular with the pioneers of scientific instruction for women because of a distaste for anatomical and physiological work.

Miss Beale's Cheltenham College has been mentioned above; in the 1860's mechanics, hydrostatics and botany were taught there (1) and, by 1895, zoology, astronomy and geology were included in the syllabus. (2) At Sheffield High School for Girls, the Bryce Commission noted that botany was listed as being taught in the Middle School and it was taught, too, at King Edward's Grammar School for Girls, Aston, at Reading Kendrick's Girls' School and at the Camden School for Girls in London. (3) At the Sheffield Central Higher Board School, hygiene and physiology were taught whilst at the Leeds Central Higher Grade Board School botany was taught in the girls' department. (4)

Although the North London Collegiate school has been

(1) Ibid. P. 25.
(2) Royal Commission on Secondary Education. 1895. Vol. IX. Appendix B.
(3) Ibid.
(4) Ibid.

mentioned previously there are two statements about the education given there which Miss McDonald includes in her work. The first was written by one of the original pupils, and Miss McDonald writes:

> "One of the original 35 pupils of the school, Annie Martelli, wrote in 1900 at the time of the School's Jubilee:-
>
> 'I believe I entered in August 1850, at the age of 14... I always feel that the father of Miss Buss should have his proper share in the glory of the school. His talents were simply wonderful, and all of them were showered down upon us without stint for many years ..... In science he was equally at home and his delightful lectures in Botany, Zoology, Geology and Astronomy, each illustrated with profuse diagrams, were equal to those of any professor of the present day.'"(1)

Miss McDonald's other quotation is taken from a Mrs. Hatfield, who was there about 1900,

> "I was a pupil in a large London School at the turn of the century; if you had gone into that school in 1900, you would have found a new course in zoology and botany, a post-matriculation course, which was intended entirely for people going on to the University. In the main block of the school, no biology was taught.
>
> There was little human physiology and a certain amount of botany, taught, as far as I can remember, entirely in the classroom and with no experiments at all. I have racked my brains to think of an experiment I did then and cannot remember one. The only place where you would have found anything corresponding to our modern biology was in the Kindergarten. There, there really was (under the inspiration of Froebel) a very flourishing Biology course."(2)

In the 1870's some advances were made towards providing educational facilities for females: The National Union for

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(1) McDonald op. cit. Pp. 6-7, extracted from the Magazine of the School 1900.

(2) Ibid. P. 145, from 'Annual Report of the Assn. of Women Science Teachers.' 1938-39. P. 29.

the Improvement of the Education of Women of all Classes was formed in 1871 and this body, in 1872, formed the Girls' Public Day School Company for the purpose of providing for females a similar sort of schooling to that provided for boys in the Public Schools and the North London Collegiate College was one of the schools which acted as a model for the schools founded by that body. By 1900, the Trust had formed thirty-three of these schools catering for some 7,100 girls. (1)

The Association of Head Mistresses was organised in 1874 and the Spens Report notes that they,

> "..... were accordingly compelled even in the 'seventies to consider the congestion of studies. The more liberal education which they had received in the Women's Colleges, reinforced by the professional spirit which from the first marked their activities, enabled them to arrive at a working solution of the problems involved. The curriculum was made more educative and more flexible by the recognition of diversity of aptitudes in the pupils and by a corresponding arrangement of studies, while a common core of basic subjects was retained in the lower part of the school. The new High Schools for Girls were to a great extent unfettered by the traditions and prejudices which obsessed the endowed schools for boys, and the mistresses were more responsive to new ideas, more critical and more disposed to adapt themselves to changing circumstances."(2)

and the Report mentions how popular botany became in the secondary girls' schools. For instance the Report of the Consultative Committee on Differentiation of the Curriculum for Boys and Girls stated:-

> "In the teaching of Natural Science girls' schools up to 1904 were as a rule behind boys' schools, as the

(1) Report of the Consultative Committee on Secondary Education (Spens Report) 1938. P. 45.

(2) Ibid. P. 46.

> ordinary High School had no funds to provide expensive laboratories. Moreover girls at that time had not the same practical reason for studying Natural Science as boys had, nor did the influence of the grants of the Science and Art Department to the Organised Science Schools affect girls' education in the same way. ..... Botany was popular in many schools and was considered suitable for girls, the more so as it did not involve any expensive equipment." (1)

The Report of the Thomson Committee serves well to summarise the position of biological science teaching in those secondary schools at the turn of this century:

> "For many years little beyond descriptive botany was attempted. Botany is still the chief subject, but it is becoming more and more common to treat the plant as a living and growing organism, rather than as a specimen to be classified in a herbarium; the physiology of the plant and its relations to its surroundings have become more important than the identification of wild flowers. But a study of plant physiology is impossible without some knowledge of physics and chemistry, and partly for this reason, these sciences have gained increased importance recently in girls' schools."(2)

The Committee, too, pointed out that botany, usually after a preparatory nature study course, was the subject taken by most girls' schools rather than chemistry, physics or zoology, but they added that chemistry was more popular than physics.

The evidence points to the fact that the biological sciences more quickly gained a footing in girls' schools, in the nineteenth and twentieth centuries, partially due to the fact that these, and especially botany, were felt

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(1) Report of the Consultative Committee on Differentiation of the Curriculum for Boys and Girls respectively. 1923. P.33

(2) Thomson Committee. Op. cit. P. 68.

to be the more aesthetic and least mathematical of sciences in a time when it was thought that mathematics was a study less useful to and more difficult for women, and partially because these schools were recent foundations and, like the private schools before them, more receptive to the influx of new ideas. The movements advocating education for women all had some common basic concepts as to what should be taught to girls. It was considered that female education should be more liberal and humanistic than that which was traditionally accepted for boys; there were vocational considerations that made physiology and health education (in the twentieth century) very useful to them and women were becoming aware that they could and should be able to earn a living and so many of them later entered the traditional occupation of schoolteaching. Even so, it is only in this, the twentieth century that women and girls have been able to study science in schools to any great extent and the biological sciences still seem to be the most popular ones with them.

In closing this chapter it may be stated that the Englishman's refusal, in the nineteenth century, to allow his daughter with good grace to learn something useful in order to earn a living, was not necessarily shared by continental peoples:-

> "In nearly every country which the Commissioners visited they found, in most of the large towns, schools established for the training of girls in various

industries, and these schools closely resembled one another in character. In all of them the girls are taught every variety of needlework, including plain sewing, embroidery, the making of linen underclothing, and dressmaking. The special trades taught in these schools varied in the different countries. In all of them drawing is well taught, and is the principal basis of instruction.

..... In Belgium, and more recently in France, schools have been established for girls, with the avowed intention of qualifying them to earn their living at various industrial pursuits."(1)

(1) 2nd Report of the Royal Commissioners on Technical Instruction. Vol. I. 1884. P. 166.

DISCUSSION

In the foregoing chapters an attempt has been made to evaluate the ways in which certain biological nomenclature has been used in teaching circles practically from the time of Aristotle onwards, and to show that this terminological usage has gradually changed in order to encompass growing fields of knowledge in biology as classification and research have proceeded. Professor Herbert Heaton writes, in 'The New Cambridge Modern History':

> "While philosophers were interpreting the astonishing triumphs of science in their various ways, the organic growth of natural knowledge was continuing, its stages not always confirming the assertions of those who tried to extract the quintessence of scientific thought for use in other disciplines. Fundamental assumptions were called in question, and the tendency was towards less rather than greater determinism. The complexity of nature belied the more dogmatic utterances of an earlier period."(1)

Because of this complexity it is not possible to equate the older usages of the term 'nature study' with that in common use nowadays. In the times of Aristotle, Vives and Comenius this was a general term for the study of all natural phenomena, whilst now the province of nature study is really those biological forms of enquiry that can be performed by young children in a simple and, it is hoped, a scientific fashion. But this modern usage is really a vague one and the vagueness reflects the way this aspect of biology has grown within the last one hundred and fifty

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(1) H. Heaton. 'The New Cambridge Modern History.' Vol. X. Pp. 2 4-25. Ed. by J. T. P. Bury. C.U.P. 1960.

years.

In tracing the amount and the methods of teaching the biological subjects in English schools since 1660 it must be emphasised that this treatment has not been exhaustive. Research into the sources of data has been necessarily limited although, it is hoped, the examples chosen in the text are representative samples of the work that has been done during these centuries.

Since the chapters have been concerned with particular types of schools, it has been possible to discuss in each of them the nature of the biological instruction that was achieved in order to trace the growth of this subject teaching. In each chapter, also, I have attempted to discuss the many factors which could have affected this teaching. But now it is essential to review the educational background, for the schools did not develop in vacuo. Thus, not only have there been changes in the quantity of natural science teaching in English schools, but the quality of that instruction has varied, too. School biology has developed in relation to differing educational methods and, further, there has been a growing public interest in the sciences since the seventeenth century. These things have undoubtedly affected the teaching and content of school studies. In addition, it has been pointed out that Nature Study has inevitably outgrown its simple origins and has become almost confined to modern Primary and Junior Schools, hence demanding its own special methods of teaching.

In order to clarify my conclusions I have partitioned this Discussion as follows:-

I A Summary of the Biological content of the teaching in the Schools of Chapters I - VII.

II Notes on some of the methods adopted by schools in their teaching in the Nineteenth Century.

III Biological Teaching and the dissemination of this scientific knowledge during the period under review.

(a) The importance of Agriculture and

(b) of Horticulture

(c) Public Lectures

(d) Scientific Societies etc.

IV The functions of Biology and Nature Study in Schools.

I. The Dissenting Academies

Other authors have produced scholarly accounts of the Dissenting Academies and their growth and subsequent decline. In particular, the books produced by J. W. Ashley-Smith and H. McLachlan have proved invaluable as has the London University thesis of G. W. Thomas, and these and other writers tend to make out a convincing case to show that the Dissenting Academies (especially the later ones) were sources of science teaching in the seventeenth and eighteenth centuries. During that period the two Universities and the Endowed schools were practically devoid of science subjects in their courses. However, I can make no sweeping claims about the Academies' teaching of biological topics for these were less well represented in their curricula.

Upon reflection this is in no way surprising because the Dissenting Academies gave a specialist and professional type of instruction and so lectures on medicine and its ancillary science, botany, led the field in this respect, enabling men to prepare for medical careers. Important, though, was the Puritan attitude of enquiry of mind which, coupled with a hungry need these Dissenters felt to search for and understand the purposes of their Maker through study of his works, helped to introduce some aspects of the life sciences into certain of the Academies.

The Private Schools

In studying the forms of schooling that were available for boys and girls in Private schools over a period of almost two hundred and fifty years, there is a tremendous field to cover and we find a tremendous variation in them. It would be fair to state that a Private school was most often a transitory establishment and that those which outlasted the lifetime of their creators and first owners were rarities. These schools were continually being opened in answer to the demands of the middle classes, mainly, and, since they were not formed in a spirit of altruism but purely for the purpose of making a living and a profit for their owners, the schooling purchased by parents who sent their children to them must have been utilitarian. Apart from the parents who sent their children to private schools because they considered them to be 'superior' to anything else and those whose motives were simply to despatch their children from home and have them occupied at school, heedless of conditions and standards of instruction, there must have remained a great majority of parents who exerted an influence over the private schools' curricula because of their demands as paying customers. Inevitably there was created a rash of such schools in and around the cities and large towns of England and their numbers grew in the late eighteenth century and throughout the nineteenth century.

Many of them taught but a groundwork of subjects so that children might gain entry into a profession; there was often some specialised training for the army and navy and for commercial pursuits. In the case of girls' private schools the intention was to provide a general and polite education and only much later was this intention changed to that of equipping them with some means of earning a living. In Chapter II it has been noted that many of the advertisements published by private school owners made encyclopaedic claims for the instruction they gave. Large lists of subjects were given, even by men who kept a school on their own or with a minimum of staff, so that it is more than probable that such owners merely listed the subjects of which they had a smattering of knowledge. Further, the Reports of the Assistant Commissioners of the nineteenth century Commissions show that the actual teaching performed was very often worthless. When such first-hand, factual reports of schooling are lacking all that can be said about biology teaching in private schools must remain conjectural. Yet other writers have intimated that these schools had the opportunity to introduce modern subjects into their curricula and, indeed, their vogue was due to the fact that, in comparison with the Endowed schools, this was their raison d'être. As far as the teaching of biological studies is concerned this is how we must view them; in comparison with the Grammar Schools there were a number which, in the period under review, did teach natural history, botany, etc., and many of these have been mentioned in the text.

The Public and Grammar Schools

Natural history and botany, physiology and zoology were probably never included in the instruction to be found in the Public and Endowed Grammar schools of this country until after the 1850s. The reasons for this lack are to be traced in the origins and traditions of these schools. The study of the classics and the learning of their grammars had been prescribed by endowment or had become an accepted usage in both Public and Grammar schools, often for centuries. They were under no real economic pressure to alter their practices since the endowments were usually adequate enough to support the payment of the salaries of a master and usher even though the number of pupils attending might not be sufficient to warrant the ministrations of two teachers. In some of the smaller grammar schools, by the 1850s, the number of scholars on the rolls had fallen off drastically from earlier years, and often this was due to the competition offered by other establishments. Some of the Public schools, too, had suffered from a decline in attendance but here there was a stronger tradition in that the habit of attendance tended to be ingrained amongst the sons of the upper classes. There was, however, a growing volume of public criticism and concern which finally succeeded in bringing some measure of curricular reform in both types of schools and this criticism emanated almost wholly from the middle classes. Nowadays, biology teaching often forms a preparatory stage for further professional training at the University and similar levels. In the eighteenth century and for much of the nineteenth century such preparatory training for a medical career was not always considered necessary and the profession of Biologist was hardly known. It was small wonder that these schools did not consider Biology important enough from a material standpoint, at least, to include it in their syllabuses to any great extent.

The Proprietary Schools

A large number of the proprietary schools were nineteenth century foundations and they were formed by people who cared deeply about standards of education for their children. Many of the foundations were sectarian in nature and the parents who raised the loans to start them - Nonconformists, Catholics and Jews, for instance - knew very well how, in the past, their religious beliefs had been persecuted and plagued. The nineteenth century Grammar schools offered a haven for Church of England clergymen (as a perusal of the columns and advertisements in 'The Scholastic Register', 'The Educational Times' and 'Gibbs' Educational Guide' of the '50s, '60s, and '70s will show) and their religious bias or narrow classicism, or both, were not acceptable to those with differing religious and educational needs.

Unlike the privately owned schools, the Proprietary establishments formed a stable educational force and they tended to accept modern subjects and new theories in educational practices much more readily than their counterparts at the secondary stage. In the old traditions of Dissent the Nonconformist schools more readily admitted science (particularly natural history) into their curricula and the Quaker schools stand as models of this interest in, and enjoyment of, nature. This zeal still pervades the studies of many of the children who nowadays attend them. I would suggest that work in the natural sciences became so well established in the Nonconformist Proprietary schools because of religious influences which were humanistic in concept.

In all the grades and types of secondary education that have been discussed in these chapters, nature study had no place. The older ideas of studying nature as an entity had become pointless on the realisation of how vast such a topic was when translated into terms of learning factual data. When a growing volume of knowledge caused the study of natural things to be split into the sciences, and these further subdivided into specialist disciplines, the ideal of teaching children about 'nature' became an impossibility unless it was dealt with in the simplest of ways.

The Elementary Schools

At the elementary level of schooling this has been considered as practicable. Nature study, perhaps disguised as 'object lessons' or 'experiences gained by contact with the reality of nature', is a nineteenth century phenomenon. It grew and took shape in elementary schools as a result of the theories and practical attempts of Continental philosophers and educationalists like Rousseau, Pestalozzi, de Fellenberg and Froebel, but the reasoning that young children are but animals with only their senses with which to appreciate and so experience their environment is not new. The idea of gaining sense experiences in this way comes from writers like Juan Luis Vives and John Aimos Comenius.

Both were advocates of the study of nature as being profitable to children and quotations from their works have been included in the introduction to this account. Because

I believe that there are certain marked similarities to be found in the ideas of these two educationists and philosophers with those of their nineteenth century counterparts, I intend to examine their writings about the uses of the senses in the learning process and compare such passages with quotations taken from the works of Pestalozzi and Froebel.

In Book IV of the 'De Disciplinis' Vives wrote:

> "In all natural philosophy, the scholar should be told that what he hears is only thought to be true i.e. so far as the intellect, judgement, experience, and careful study of those who have investigated the matter can ascertain, for it is very seldom that we can affirm anything as absolutely true.
>
> First we must consider the easiest kinds of knowledge, viz., those things that are evident to the senses. For the senses open up the way to all knowledge. ....."(1)

The author continued by stating that a close and careful observation of natural phenomena was vital, a directive to student and teacher which is as valid now as it was when written. It is comparable to some statements made by Comenius, in the 'Didactica Magna':-

> "We arrive therefore at the following conclusion: men must, as far as is possible, be taught to become wise by studying the heavens, the earth, oaks, and beeches, but not by studying books; that is to say, they must learn to know and investigate the things themselves, and not the observations that other people have made about the things."(2)

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(1) J. L. Vives. from Foster Watson 'Vives on Education' C.U.P. 1913. Pp. 168 & 170.
(2) J. A. Comenius. 'The Great Didactic'. M. W. Keatinge. Black. 1896. P. 302.

and another quotation shows clearly the link that Comenius understood to be essential between the understanding of science and the use of the senses:

> "Science, then, increases in certainty in proportion as it depends on sensuous perception. It follows, therefore, that if we wish to implant a true and certain knowledge of things in our pupils, we must take especial care that everything be learned by means of actual observation and sensuous perception."(1)

Both writers state their opinion that science must be studied in an active manner; mere book-learning is not enough. The student must be so guided that the sense impressions he receives from being in contact with differing environments are built up logically so as to form a basis of sound knowledge.

Pestalozzi, writing in 'How Gertrude Teaches Her Children', discusses sense-impressions in the following terms:

> "When I now look back and ask myself: What have I specially done for the very being of education? I find I have fixed the highest, supreme principle of instruction in the recognition of <u>sense-impression as the absolute foundation of all knowledge</u>."(2)

Whilst pointing out that the stimuli which the senses receive from Nature and natural phenomena are necessarily confused and haphazard, he wrote in a Report on his methods published posthumously in 1828:

> "Sense impression of Nature is the only true foundation of human instruction, because it is the only true foundation of human knowledge.

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(1) Op. Cit. P. 337.
(2) J. H. Pestalozzi. 'How Gertrude Teaches Her Children'. Translated by Holland Turner. 1938 edn. Allen & Unwin. P. 139.

> All that follows is the result of this sense impression, and the process of abstraction from it. Hence in every case where this is imperfect, the result also will be neither certain, safe nor positive; and in any case, where the sense impression is inaccurate, deception and error follow."(1)

Writing in 'The Education of Man' about the observational use of the senses, Froebel comments:

> "The knowledge of every thing, of its purpose and properties, is found most clearly and distinctly in its local conditions and in its relations to surrounding objects. Therefore, the pupil will get the clearest insight into the character of things, of nature and surroundings, if he sees and studies them in their natural connection."(2)

In discussing environmental excursions, the author stated:

> "This direct and independent observation of the things themselves, and of their actual living connection in nature, and not the mere explanation of words and ideas which are of no interest to the boy, should awaken in him, vaguely at first but ever more and more clearly, the great thought of the inner, constant, living unity of all things and phenomena in nature."(3)

Thus, the idea of appreciating and learning through contact with natural phenomena and by means of a disciplined use of the senses has been constantly present, though grievously neglected, in educational philosophy. It is this idea which forms a thread linking the educational writings of the older philosophers with those of their more modern counterparts.

Only at the beginning of the nineteenth century were the first efforts made to establish a general system of

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(1) Ibid. P. 200.
(2) F. Froebel. 'The Education of Man.' Translated by W. N. Hailmann. 1887. P. 251.
(3) Ibid. P. 312.

elementary education; previous to this elementary schools for the poor had been provided in small numbers by private philanthropic effort and participation by the State did not commence until the 1830s. During that century, elementary schooling was really in somewhat of a state of flux; educational ideas of Continental origin were more widely disseminated than they could have been in previous centuries, and both the ideas and the experiments which resulted from them were reported in newspapers and books. In Chapter VI, I have pointed out that some experiments began in the teaching of the biological sciences in elementary schools at the commencement of the nineteenth century. The nature work that was carried on in Owen's schools at New Lanark and in the elementary schools organised by Samuel Wilderspin were new departures in this field. The schools kept by the Rev. Simon Dawes and by Professor Henslow, the elementary school at Bispham, and Lovett's physiology teaching and his common-sense in suggesting that infant classrooms should be bright and decorated with natural history pictures, etc., all were well-meaning and thoughtful attempts to replace the older methods of learning by chant and rôte and the schemes of catechetical instruction with something that was new.

Unfortunately, the desire to teach science and to give this instruction in a practical way by using things gathered from a child's environment - manufactured articles and plants and animals - brought into the classrooms, resulted in the Object Lessons.

There is, of course, nothing wrong with the notion that the classroom should become an extension of the 'outside' environment and that, by the judicious provision of material within it, the four walls should be made to reflect that environment and so offer an observational challenge to the children. However, there is certainly a great deal wrong if the classroom becomes a substitute for first-hand observation of natural things outside. The latter-day biology teacher, no matter at what level he or she is planning a course of lessons would, or should, demand that classroom work be only part of the instruction and that work in the field would offer a complement. But the nineteenth century object lesson teaching in English schools soon began to emphasise the objects themselves as reasons for the teaching to the exclusion of the principle that the things of nature offered a new and exciting means of allowing children to learn. The idea that education was concerned with living and that nature was an expression of the forces and problems of life was not grasped with the result that the lessons became more and more concerned with inanimate 'things', the properties of which were listed in the same old ways to passive and non-participating audiences. There is a photograph in G. A. N. Lowndes' book 'The Silent Social Revolution' which epitomises the nadir of this instruction. Rows of girls sit facing a teacher whose hand rests upon a stuffed dog. On two of the desks are models of dogs and over the blackboard is draped a picture of a dog and beneath it, lest there be any misapprehension, is written 'DOG'.

It is very easy and not constructive to deride the Object Lessons that were delivered. No doubt there were many children who gained some factual knowledge from teaching such as this, but the lessons became concerned with the committal to memory, without any real understanding or involvement on the part of the pupils, of masses of data and unsuitable vocabulary. As a means of teaching science, the Object Lessons were, perhaps, the most unscientific method that could be devised. Under this guise the nineteenth century elementary schools dealt with science in general and natural history and physiology in particular. Real and valuable practical work in science teaching did not appear, in the elementary schools at least, until there was a partial return to the basic principles from which the system of object lessons was evolved; this work began as 'Nature Study' only at the beginning of the twentieth century. In schools of the secondary grade, practical work in the sciences was only slowly established after the 1870s and then was more often found in the form of demonstration lessons conducted by teachers rather than practical work carried out by children at first-hand.

Mention has been made, in the text, of the paucity of biology teaching in English schools before the 1860s. Although it has been possible to make references to some natural science subject teaching in the Dissenting Academies and in occasional Private schools, such notes cannot be construed as representing a general systematic education in biological data, since the instances are scattered and the establishments that included such instruction in their syllabuses were few in number. Further, the nineteenth century marked a stage of great growth in biological knowledge.

II. Notes on some of the methods adopted by schools in their teaching during the Nineteenth Century.

Only in the last three decades, or so, have the biological sciences returned to the study of the mechanisms of living things. In the previous two centuries both botany and zoology had existed as classificatory studies and the natural historians, whom this country has produced in large numbers, were concerned with the collection, identification, classification and preservation of specimens The 'natural histories' they wrote are records of this active, erudite and essential zeal but the problems of the life processes with which twentieth century biology is concerned only became apparent after the research that was prompted by the publication of Darwin's evolutionary hypothesis, the experimental approaches of physicists and chemists and the development and training of those who were destined to become professional biologists. The result has been a return to the study of organisms as they live in their natural environments. These points are developed by A. R. Hall, who writes in 'The New Cambridge Modern History':

> "In the mid-nineteenth century the pursuit of scientific knowledge at last attained true autonomy and independence. ..... Emancipated from the limitations imposed by formal reasoning and dogmatic theology, an unquestionable force of certainty was claimed for scientific truths such as had never before been granted to any products of the intellect; ..... The formative period of modern science in which its character, its methods and its problems were established may be said to have ended about 1830; the modern age, with the technical ascendancy of science, to have begun about 1870."(1)

Hall continues by discussing the growth of experimental biology:

> "The progress of experimental biology, standing apart from the main line of natural history, took place mainly in France and Germany. The English contribution was a formative concept growing directly out of the study of natural history which deflected and enriched every branch of biology. The memoirs of Darwin and Wallace, read to the Linnean Society in 1858, in which the theory of evolution by natural selection was first expounded, followed by the publication of the 'Origin of Species', appeared as a cataclysmic break with all sound thinking."(2)

and, speaking of the mid-century popular interest in the natural sciences, Hall notes that a change became apparent, towards the end of the century:

> "..... Popular interest in science turned from descriptive natural history, astronomy and drawing-room marvels to the constructive sciences of elec-

(1) A. R. Hall. 'The New Cambridge Modern History.' Vol. X. P. 49.
(2) Ibid. P. 67.

tricity and chemistry. Positively, science meant knowledge and power."(1)

This story is reflected, not only in the changing volume of science teaching and in its content, but also, to a certain extent, in the methods that were used to instil some biological knowledge into children of all ages.

The teaching of botany was firmly based upon classificatory principles and, on the very rare occasions in which it was introduced into school syllabuses, zoological studies were confined to the consideration of certain selected animal types. In botany, any practical work that was attempted was usually restricted to the dissection of flowers to show the floral characters upon which the classification was based. The Quaker schools were, perhaps, exceptional in this respect since the pupils were encouraged to take 'aesthetic' walks, from which they must have gained some notion of the different types of plants that existed, in addition to learning a little about habitat relationships.

What may be termed 'book-learning' was a favourite method (and the earliest) of imparting scientific instruction and the Reports of both the Devonshire and Taunton Commissions are rich in the titles of books that secondary schools used. In the Reports of the latter Commission, one of the questions in the questionnaire that was sent out to Governors and Headmasters asked specifically whether natural history, physics or chemistry were taught by the use of text books, or by oral lectures, with the aid of

(1) Ibid.cit. P. 74.

objects or demonstration experiments, or whether the boys actually handled the objects or performed the experiments themselves. In the Reports of the Devonshire Commission it is common to read that Public schoolboys 'got up' some aspect of botany from a text book for examination purposes. As common was some statement that the private reading of the schoolboys was supplemented by occasional lectures. Rarely does the reader find in the Taunton Commission Reports, for instance, that grammar schoolboys were much concerned with the handling of natural history objects and specimens, or that experiments were conducted by them in botany and physiology.

In all the schools, secondary and elementary, the text books in most subjects were constructed upon catechetical lines. Professor R. L. Archer castigates one of them:

> "Here are the contents of a little text-book of 340 pages bearing the date 1821, which was presumably popular, since this is the eighteenth edition. It is styled 'An Easy Introduction to the Arts and Sciences.' It deals in catechetical form with religion, logic, morality, atmospheric phenomena, sound, earthquakes and volcanoes, the tides, metaphysics, jurisprudence, medicine, chemistry, botany, grammar, rhetoric, metre, mathematics, architecture, painting, sculpture, mechanics, chronology, astronomy, geography, history, mythology, natural history, mineralogy, pneumatics, hydrostatics, electricity, galvanism, artificial memory, and the drama ..... Only when he reaches mythology does the writer really launch out, this section occupying thirty pages, an amount beaten only by natural history with thirty-six."(1)

Whilst such a book ought to have been intended only for use at the higher levels of education, there were many in

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(1) R. L. Archer. 'Secondary Education in the XIX Century.' C.U.P. 1921. P. 87.

use in elementary schools that were written as large blocks of material to be memorised and regurgitated under the stimulus of the appropriate question. Mrs. Trimmer's 'The Teacher's Assistant' consisted of religious lectures written in a catechetical form to be read by the teacher. It contained both the questions to be put to the pupils about the subject-matter and also the answers they were to return. Her 'Introduction to the Knowledge of Nature' and Martinet's 'Catechism of Nature' have already been mentioned in the text (see P.184), as have some others out of the multitude in use. There was, for instance a monthly educational Journal 'The Practical Teacher', edited by Joseph Hughes, volumes I & II of which were published between 1881 and 1883. Amongst the contents were articles comprising an 'Anecdotal Natural History' by the Rev. J. G. Wood, some of which dealt with squirrels, camels, bats, cats, whales and elephants. Though not catechetical, the articles were certainly anecdotal. In the columns of this Journal, Theo. Wood conducted a series of 'Practical Lessons on Insect Life' and copious 'Science Notes' were included for the use of teachers and interested parents.

In 1856-57, Mr. Morell reported, in the Minutes of the Committee in Council, concerning the British and Foreign School Society's Training Institution at Borough Road, Southwark. He described how the students were given a series of lectures about Common Things "founded for the most part on the school reading books" which were intended to be used for elementary teaching. The First Year Natural History lectures comprised,

> "..... a systematic classification of Animals according to the system of Cuvier, and an outline of English Botany, besides special lectures on particular plants and animals, adapted to furnish matter for elementary collective lessons."(1)

When the teachers were taught from books and with little instruction in practical work, it is not to be wondered at that they, in their turn, continued to instruct their pupils in this fashion.

III. Biological Subject teaching and the dissemination of this scientific knowledge during the period under review.

(a) Agriculture

The overriding tone of this discussion has been critical, but throughout the period of educational history under review some form of biological teaching has been present in one or other of the different kinds of scholastic establishments that existed. It may be that biology was limited to specialist teaching of botany, anatomy and materia medica in such establishments as the Dissenting Academies and to a limited amount of botanical instruction provided by private tutors, yet the natural history sciences have long been stressed as being important by educational philosophers and reformers. It has been noted that very rarely can a case of practical usefulness be made for these studies, yet, in

(1) Mins. 1856-57. Pp. 759-760.

an aesthetic sense and as interesting hobbies and studies, such sciences seem always to have had a certain measure of popularity. But both gardening and agriculture are two branches of science which can be considered under each of these categories; for instance, in the years when the economy of this country was still more or less dependent upon agriculture the introduction of scientific techniques to farming operations had (and has still) important economic consequences. However, farming and horticulture have not only proved useful occupations but they have also been taken up out of interest, as hobbies, for intellectual amusement or for sheer pleasure. Gardening, of course, has become much more widespread as a pastime amongst all classes but both of these factors in the natural history background of Englishmen must now be further developed.

Writing of the eighteenth century, Professor A. Cobban reports:

> "Theory, in fact, still tended to hold experimental science back, but the practical interests, which scientists shared with philosophes, stimulated its progress. In the field of botanical studies interest was directed towards agricultural, and especially horticultural practice. Valuable work was done on pollination and hybridisation."(1)

H. J. Massingham, however, writing in 'The English Countryman', takes somewhat of a different view and, in mentioning that the preceding century had produced many new discoveries in natural history and the natural sciences,

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(1) A. Cobban. 'The New Cambridge Modern History.' Vol. VII. Ed. J. O. Lindsay. C.U.P. 1957; P. 90.

states:

> "The husbandry of the 17th century has been absurdly neglected to the advantage of the 18th, when the four high-farming kings, Tull, Townshend, Bakewell and Coke, are reputed to have revolutionized our agriculture. They did not, ..."(1)

The author then mentions that Barnaby Googe recommended the growing of turnips as early as 1577, that selection of oxen, cattle and new breeds of sheep was being practised before the eighteenth century and artificial grasses bred. The ploughing into the land of manure and the repeated ploughing of fallow land before sowing seed was yielding greater produce per acre, and:

> "Faggot and stone drains came into use and the proto-mole plough was invented. The 'drowner' with his neat irrigation system appeared in the water meadows. Catch-crops were undersown to barley or oats. New wheats were bred. Carrots, marrows, parsnips, artichokes, cabbage, fennel, hops, colewort, potatoes, teazle and mustard found their places in the rotations ..... Tobacco was extensively grown.
>
> ..... The herb-garden flourished; new roses were grown and grafting made swift progress. .....
>
> Hedgerow timber was planted both for shelter and browsing. The reclamation of the Fens was undertaken on a large scale by Vermuyden, Charles I and the Duke of Bedford. Practical country writers like John Evelyn, Speed, Gervase Markham, Worlidge, Blyth and Sir Hugh Platt fostered where they did not create the spirit of novelty and experiment."(2)

Lord Ernle, commenting on the period 1660-1700, writes:

> "Still more vaguely Stewart writers were looking for the aid of science. Its future benefits could not, of course, be foreseen. But the demand for an

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(1) J. H. Massingham. 'The English Countryman.' Batsford. 1942. P. 37.
(2) Ibid. P. 37-40.

> Agricultural College, the recognition of the work of the Royal Society, the study of such books as Willis' 'De fermentatione' or Glaubers 'Miraculum Mundi', in which an attempt was made to analyse the elements that contribute to vegetation, show that expectations had been aroused."(1)

Whatever the disagreements between authors as to which century was the more greatly concerned with scientific progress in farming, it may be stated that, from the period 1660 onwards, there was a great interest in farming and farming techniques. From 1700 until about 1760 farming was much more concerned with scientific methods of cultivation and stock-rearing and it was during this period that the experimental work of Bakewell, Tull, and Townshend etc;, became well known. The period after 1760, when agricultural science had become firmly established was also the time when there was a great increase in agricultural capitalism and, with a noticeable rise in the number of Enclosure Acts (there were 3000-4000 of these during the reign of George III), there followed an increasing poverty among agricultural labourers and a movement of the poor from the land into the towns and cities.

Even so, and despite recurrent hardships, agriculture has remained a major industry in this country and so some training in the accepted techniques of farming science was often thought to be worthwhile by some farmers and other parents when considering the education of their sons.

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(1) Lord Ernle. 'English Farming Past and Present.' 1932. P. 131.

Even in Samuel Hartlib's day that indefatigable writer proposed the formation of an Agricultural College and Abraham Cowley made a similar recommendation that agriculture should be taught to young gentlemen. Agricultural training was included in the Bethnal Green Academy of Sir Balthazar Gerbier and I have noted other instances of private schools where such teaching has been traced. An Agricultural College was started at Cirencester in 1845 and, at Wye College, agriculture was made the principal course of study and this establishment later became an Agricultural College.

In the chapter concerned with elementary education (see Chapter VI), mention has been made of the nineteenth century 'schools of industry', most of which were to be found in agricultural areas. In them, the children were given some sort of training in horticultural techniques. Whilst it was possible that such a training was considered to be an educative process it was also true that the profits accruing from the proceeds of the sale of what the children produced by their labour helped to pay for the education they received. However, the nineteenth century schools of this type were much influenced by the experiments carried on along similar lines by Pestalozzi, Werhli and others and bore little resemblance to their earlier counterparts of the seventeenth and eighteenth centuries.

Agriculture was encouraged, in the usual English way of giving grants on the result of examination. In 1846, Day Schools of Industry could obtain an annual grant not exceeding half the rent for a field garden for the instruction of scholars, a grant was available towards the cost of the first purchase of tools and there was a gratuity for the master.(1) The Science and Art Department conducted examinations in the Principles of Agriculture and grants were available to departments teaching that topic (in 1878, for instance, 1265 students were examined in this subject, a year later the numbers had almost doubled) but it was said that many who took Agriculture as a subject for this examination had never stirred out of London. The Statistics of the Committee in Council for Education show that this subject was taken by examination candidates in voluntary and board schools during the latter part of the nineteenth century.

Some teaching, then, of agricultural subjects and methods has been included within the syllabuses of a number of schools, private or otherwise, and, like medical studies, agricultural science has been taught when other aspects of the study of living things have been languishing. In a similar fashion to medicine, agriculture has proved a 'useful' topic and nowadays has become so specialised that it is restricted to rural schools, Colleges and the

(1) Mins. 1846. From 'Summary of Statistics, Regulations etc. of Elementary Education in England and Wales.' by M. E. Sadler and J. W. Edwards. 1833-1870. P. 434.

Universities.

(b) Horticulture

The study of Horticulture and the practice of gardening in schools, however, present slightly different considerations. Whether gardening is a purely British hobby and passion I should doubt, for a delight in growing things seems to be a human trait. Nevertheless, in this country the art of decorative gardening has been long established and men were making scientific attempts at horticulture before 1660. The Earl of Danby founded and endowed a Botanical Garden at Oxford early in the seventeenth century and published a catalogue of the plants it contained in 1648 at which time there were about sixteen hundred, of which one thousand were foreign introductions.(1) Large gardens were legion in and around London at the turn of the eighteenth century; in 1697 Leonard Meager wrote 'The New Art of Gardening', Stephen Switzer published 'The Nobleman's, Gentleman's and Gardener's Recreation.' in 1715 and in 1728, Batty Langley criticised the stiff formalism which was becoming habitual in the larger gardens, in his book 'New Principles of Gardening.' In the eighteenth century the planning of large gardens became almost an industry under the hands of Bridgeman, Lancelot Brown, and Repton. In the nineteenth century more attention was paid to the smaller gardens such as existed in the towns and lists of plants and bulbs for sale began to appear by

(1) H. Roberts. 'English Gardens.' contained in 'The Englishman's Country' ed.W.J. Turner. Collins. 1945. Pp. 234-5.

the 1830s and, with them, books about their cultivation. Roberts says:

> "Many owners of gardens, particularly of gardens of modest size, were concerned only with the cultivation of these relatively new flowers under conditions which best promoted the production of plants with fine showy blooms, regardless of the form and structure of the garden as a whole. They were plant and flower lovers, rather than garden lovers. Before the final quarter of the century was reached, this interest in individual plants and their cultivation had spread widely, not only among the devotees of specimen flowers and florist's varieties but also among those with more catholic tastes, whose main interest was in the healthy growth of individual plants, yet who also recognised as important the part which should be played by the garden's form and structure....."(1)

When Worlidge wrote in 1680 about the love of gardens that existed then in the British Isles, his words were as true as prophesy for the centuries that followed:

> "..... there is scarcely a cottage in most of the southern parts of England but hath its proportionable garden; so great delight do most men take in it."(2)

If the reader accepts the premise that the Englishman has always had a love for gardening through which he has attempted to express his aesthetic sensibilities, then the number of educational establishments which, as mentioned in the text, have had gardens attached to them is not surprising. True, not all of these gardens were necessarily intended and provided for the purpose of extending aesthetic awareness or for the study of botany (see the gardens of Tradescants' museum and those that were made by various public and proprietary schools); many were undoubt-

(1) H. Roberts. Op. cit. P. 246.
(2) quoted by Roberts. Op. cit. P. 208;

edly the means by which students, usually female, could be released into the fresh air during school hours. Yet horticulture and gardening form another tenuous link through the centuries with the natural sciences, keeping alive some definite contact of pupils with nature in a more or less organised way.

For instance, the Report of the Committee in Council of 1844 noted that the boys at the school of industry at Winkfield, Berks, (see P.194) were trained in horticulture and reported that this would the more exercise their intelligence. In the Report of 1898, an Inspector, T. G. Rooper, who visited the school gardens of the Boscombe British School, made references to the necessity of the childrens' learning the craft of gardening and also finding there illustrations for their natural science lessons. As has been mentioned, grants were payable to schools, in the latter part of the nineteenth century, by the Science and Art Department and under the Education Codes of the Committee in Council for horticultural teaching in the day and evening schools. The Report of the Board of Education for 1910-1911, speaking of object lessons and nature study teaching, commented:

> "Some (counties), like Leicestershire, Somerset, Cheshire, Nottinghamshire, have appointed expert instructors to organise the teaching in schools. Others like Kent, Warwickshire, and Surrey, have given bursarships to teachers attending summer courses at institutions where highly expert instruction can be obtained, such as the Agricultural College at Wye and the Horticultural College at Swanley. Others again,

> like Manchester and Huddersfield, have organised exhibitions where plants grown by the children are shown and prizes for the best results are awarded."(1)

Whereas I have discussed agriculture and horticulture as representing an ever present 'background' and sources of stimulation against which the more academic natural sciences have come to occupy places in school studies, Birchenough discusses them in terms of their actual value to teaching in elementary schools late in the nineteenth century:

> "Some further guidance was afforded by the Mundella Code of 1882, which for the first time sought to encourage the teaching of elementary science throughout the whole school. Teachers were to provide a progressive course of simple lessons on common objects such as familiar animals, plants and substances employed in ordinary life, ... In the upper part of the school a more advanced knowledge of special groups of objects was required. For example, children were to be led to study the animals or plants that have special reference to agriculture ..."(2)

The author continues, in a longer passage, to discuss the coming of Nature Study into the schools:

> "The poets had re-discovered in nature beauty, truth, God. In the cities men were looking more and more for some means of escape from the grimy monotony of bricks and mortar. In the country much thought was being given to some method of checking the rush to the towns, and of making rural life more attractive. ..... Isolated schools began to give more and more attention to nature work, to school gardening and to school excursions with markedly beneficial results. In 1900 the Board of Education sought to give direction to these tendencies by emphasising the importance of making the science scheme fit local conditions. Mechanics and chemistry were recommended as suitable for town schools; bee-keeping, poultry management,

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(1) Board of Education Report. 1910-11. P. 28.
(2) Birchenough. 'History of Elementary Education.' P. 308.

and lessons centred round agricultural processes as useful in rural districts, and so on."(1)

The school garden is now a necessary and vital part of biology schemes in any English school and it is exceedingly important that some such oasis of greenery should be available in town schools especially, where children can gain practical experience, not only of horticultural techniques, but of all the animals and plants that can exist naturally within it.

I believe that both agriculture and horticulture have helped to keep alive certain aspects of the life sciences in this country during the period under review; agriculture has always been an important occupation of a large proportion of the population of the country and the introduction of scientific methods of enquiry and techniques has helped to provide, albeit slowly over the years, a more knowledgable cadre of specialists in this field. The keeping of gardens, however small, I suggest has always interested even greater numbers of Englishmen and women and, whilst it would be foolish to claim that such an interest has led directly to demands for the inclusion of biological studies into schools when such a statement can never be substantiated, this has possibly led to a sympathetic understanding when such inclusions have been mooted. Throughout the chapters I have pointed out that the reasons for studying such things as botany, natural history,

(1) Ibid. cit. P. 309.

physiology, nature study, the natural sciences and so on, have occasionally been utilitarian, sometimes aesthetic, more often rooted in religious motives and also in attempting to provide an humanistic education and one widely concerned with living. If agriculture and gardening have helped to produce natural historians or men and women whose minds and eyes have become more keenly aware of natural things then they are important considerations in attempting to follow the growth of biology in schools.

(c) Public Lectures on Medical and Biological Topics.

However, important as they may be, such studies and pastimes are not the only evidence to suggest that the people of this country have been receptive to ideals of introducing natural sciences into English schools. In discussing them here I have underlined, as it were, a point which has been stressed repeatedly in the chapters concerned with schools and with teaching methods in them, namely that, from the seventeenth century to the twentieth century, there has grown up amongst the people an interest in science and scientific things. In part, Professor Cobban discusses this against the background of the eighteenth century, when it was fashionable for the aristocracy to patronise the scientists:

> "One achievement of the eighteenth century was not so much in making fundamental new discoveries as in extending the knowledge of discoveries that had already been made to a wider circle than before.

> The ordinary educated man could still understand scientific techniques and explanations, except in the higher branches of mathematics, without being a specialist. Experimental demonstrations could be performed and scientific theories comprehended in the fashionable salon. The beau monde mixed with the scientists;"(1)

A fitting commentary on the growing public interest in science is provided, first of all, by the number and the variation in type of the public lectures which were advertised from the seventeenth century onwards. Hans' 'New Trends in Education in the Eighteenth Century', too, contains examples of public lectures given in the sciences. Many were clearly intended for specialist audiences. For instance, John Quincy, who was an honorary M.D. of Edinburgh University, gave lectures at his London home on Pharmacy in the years prior to his death in 1722.(2) A certain Dr. Moyes gave public lectures in Manchester, York and other large towns and was known to have included Natural History amongst the lectures he delivered in London in the 1780's.(3) In 1762, James Arden gave a course of twenty lectures on 'Experimental Philosophy' in Manchester and the lectures were described as including some Natural History amongst other topics.(4)

In 1745 an advertisement in the 'Daily Advertiser' proclaimed that the Chevalier de Coetlogon, Knight of

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(1) Cobban. Op. cit. P. 88.
(2) Hans. Op. cit. P. 143.
(3) Ibid. P. 147.
(4) 'Manchester Mercury' 1762. quoted by D. M. Turner. Op. cit. P. 54.

St. Lazare and author of 'The Universal History of Arts and Sciences' would open an Academy in Holborn where he was to lecture on Theology, Philosophy, Politics, History and Medicine.(1)

Public lectures on medical subjects were advertised until after the beginning of the nineteenth century; Dr. John Taylor, a surgeon, travelled the country lecturing on the diseases of the eye in the 1740's (2) and George Wallis lectured in London from 1762 - 1798 on the theory and practice of medicine. (3) Mr. Wilson advertised in the 'Morning Post' of 1801 that he would begin his Spring course of lectures on anatomy, pathology and surgery at the Theatre of Anatomy in Great Windmill Street, but these lectures were obviously for medical students since practical anatomy was performed in the mornings.(4) Mr. Fox advertised his lectures about the structure and diseases of the teeth which were to be delivered at St. Thomas' and Guy's Hospitals in the same year. (5)

Also in 1801 George Shaw M.D., F.R.S., advertised a course of about twelve or fourteen lectures on Natural History to be read at the Leverian Museum and the lectures were to be given every Monday, Wednesday and Friday:

> "Those Gentlemen and Ladies who mean to attend, are requested to give in their names at the Leverian Museum, before the 13th instant.

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(1) Lysons 'Colectanea' Vol. 2.
(2) Hans. Op. cit. P. 150.
(3) Ibid.
(4) Morning Post. Jan. 8th. 1801.
(5) Morning Post. Jan. 24th. 1801.

Admission to the Course of Lectures, Two Guineas."(1)

A more specialised course of lectures was that described in the Morning Post of 5th April 1802, as follows:

"To Artists Professional and other Gentlemen.
Theatre of Anatomy, Blenheim-Street, Great Marlborough-Street - Tomorrow, the 6th of April, at Nine o'Clock in the Evening, Mr. BROOKES (Member of the Royal College of Surgeons, London, and formerly assistant to John Sheldon, Esq., F.R.S., Professor of Anatomy in the Royal Academy) will commence a Course of Lectures on the Human Bones, Muscles, and on Comparative Anatomy, particularly intended for the instruction of Artists, Professional and other Gentlemen. The Student will have the privilege of attending the Dissection Room, and of drawing the Muscles and Bones, from the dead Body, and the Skeleton etc. ....."

The advertisement continued by mentioning that dissections of animals could be performed by demonstration, that models would be used and that lectures would be given on anatomy, physiology and surgery. A Mr. Blair lectured on Anthropology and on Physiology, as witness his two advertisements:

"Mr. Blair's Lectures in Anthropology; or A Course of Lectures on Picturesque Anatomy and the Animal Economy, delivered on Tuesday evenings at the Bloomsbury Dispensary; wherein the structure and functions of the human body are familiarly explained; and illustrated by anatomical preparations, drawings, models, casts, and a living muscular subject, for the information of scientific persons, amateurs of Natural History, students in the liberal Arts and professional men in general." (2)

Two years later Mr. Blair wrote:

"Mr. Blair's Physiological Lectures (for the

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(1) Morning Post. Apr. 3rd. 1801.
(2) Morning Post. Jan. 15th. 1803.

information of Scientific and Professional Gentlemen, Amateurs of Natural History, Students in the Liberal and Fine Arts etc.) will re-commence next Tuesday evening, at the Bloomsbury Dispensary, No. 62 Great Russell-Street."(1)

A Dr. Garnett was active in delivering public lectures, too:

"On Wednesday, January 27, at Eight o'Clock in the Evening, at the request of several Gentlemen in the City, Dr. Garnett will deliver a Course of Lectures on Zoonomia; Or, the Laws of Animal Life. At Tom's Coffee House, No. 31, Cornhill."

The course of fifteen lectures was to cost one guinea for gentlemen and half a guinea for ladies.(2) In the same year Dr. Garnett began a course of lectures on botany at his home, 51 Great Marlborough Street. The prices for the course of not less than twelve lectures were as above and it was one,

"..... in which the Principles of Botany and vegetable Physiology will be familiarly explained, and the application of this Science to Agriculture and Horticulture pointed out."(3)

In 1809, P. Roget M.D. advertised a course of lectures on animal physiology to be held at the Russell Institution. The course cost one guinea and it consisted of,

"..... Philosophical Views of the Natural History of the Animal Creation and intended to point out, on the system of the late Doctor Paley, the marks of design and benevolence exhibited in the faculties and organization of different animals."(4)

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(1) Morning Post. Jan. 1805
(2) Morning Post. Jan. 19th. 1802.
(3) Morning Post. May 24th. 1802.
(4) Morning Post. Apr. 11th. 1809.

In 1811, Dr. Thornton gave public lectures on botany to aid "British Prisoners in France and the Distressed Manufacturers of the United Kingdom."(1) He held similar lectures in 1813 for the benefit of "Sufferers in Russia" and, in that year too, an advertisement declared:

> "A Course of Botany. Dr. Thornton proposes giving a Popular Course of Botany, compressed into Six Lectures, by means of most beautiful Transparencies of Flowers, brilliantly illuminated with Gas-Lights, in the Grand Saloon, 98 Pall Mall."(2)

It would be foolish to pretend that the audiences at such lectures as these were wholly composed of people who were passionately interested in natural science for its own sake. The beau monde and the middle classes often attended because it was fashionable to do so, just as many of them attended the lectures given by T. H. Huxley at the Royal School of Mines in later years with the same motive only to find that his lectures drew ever-increasing numbers of workmen who wanted to learn physiology and zoology and who had a thirst for knowledge that was hardly 'genteel'.

(d) <u>Scientific Societies and Mechanics' Institutes etc</u>.

At the close of the eighteenth century industrialists, professional men and others were becoming fascinated by science. Among the members of the Birmingham Lunar Society who were particularly interested in botany were William

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(1) Morning Post Apr. 10th. 1811.
(2) Morning Post Apr. 5th. 1813.

Withering and Jonathan Stokes, both of whom were, in addition, Fellows of the Royal Society. Dissenters were always well to the fore in showing an interest in Science and one such member of the Society was Joseph Priestley. Erasmus Darwin, R. L. Edgeworth and the author and campaigner against slavery, Thomas Day, took part in the meetings. Samuel Galton F.R.S. wrote a 'Treatise on Birds' and was both a chemist and a botanist. Erasmus Darwin founded the Lichfield Botanic Society and a Philosophical Society at Derby in 1784.(1)

There was a close connection between the Manchester Literary and Philosophical Society, founded in 1781, where it first met in an Unitarian chapel schoolroom, and the Manchester College of Arts and Sciences which was opened in Manchester in 1783 to provide instruction in the evenings for young professional and business men. This College at Manchester was partly inspired by members of the Philosophical Society. Other such gatherings of scientists and those interested in Science resulted in the formation of similar Societies in Bristol, Leeds and Newcastle.

Brian Simon summarises such movements when he writes:

> "The forward-looking industrialist of this age was often a scientist-innovator as well, abreast of and developing science in its practical applications. ...
>
> The advancement, dissemination and application of science was, then, the chief bond linking these

(1) B. Simon. Op. cit. Pp. 17-21.

groups, and they found a field of application not only in industry but also in civic affairs, in particular in public health. Matthew Boulton took a keen interest in the Birmingham Dispensary. Thomas Percival was described as 'a leader in every medical, hygienic, literary and educational movement in Manchester'; he was among those who persuaded Peel to bring in his first Factory Act. With the aid of other leading doctors he developed the Manchester Infirmary, with out-patients' department and dispensary, founded the Manchester Board of Health in an attempt to ameliorate conditions, concerned himself with other projects for sanitary improvement, and advanced propositions for smoke abatement."(1)

Yet other movements which resulted in the further dissemination of popular science were those which caused the formation of Mechanic's Institutes. Thomas Kelly, in an article concerned with their origin, points out that they were formed against a background in which the spread of lecturing about popular scientific subjects was marked. He notes, too, that such subscription lectures were mainly intended for middle-class men and their wives and writes:

"When we bear in mind the considerable middle-class element in the later Mechanics' Institutes it is clear that in some respects they did no more than provide a local habitation and a name for a good deal of activity that was already going on before."(2)

Whatever the intentions behind the Mechanics' Institute movement of providing systematic scientific instruction about the jobs their members performed for their living, the Institutes did give instruction in science to the lower middle-classes as well as the artisans and they did

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(1) Simon. Op. cit. Pp. 19-20 & 21-22.
(2) T. Kelly. 'The Origin of Mechanics' Institutes.' B.J. Edn. Studies. Vol. I. 1952-53. P. 19.

give rise to the nineteenth century system of technical instruction. Lectures on the natural sciences, including botany, zoology, entomology and physiology were given in many of them and in the mutual-improvement clubs, Athaneums and the Owenite Halls of Science that followed them in the 1830's and 1840's.

From 1660 onwards there were published various encyclopaedia's and dictionaries of 'Arts and Sciences' (see Hans. op. cit. Pp. 152-155) and the Society for the Diffusion of Useful Knowledge published the cheap and relatively short works of scientific and cultural information contained within the 'Library of Useful Knowledge' and the 'Library of Entertaining Knowledge' in the 1820's, and, in the 1830's the 'Penny Magazine' and the 'Penny Cyclopaedia'. The publication of these and of the 'Mechanic's Magazine' was the source of much controversy which does not concern us here, but during the 1830's and 1840's there was a spate of such didactic publications.

Two quotations taken from Mumford's historical account of Manchester Grammar School serve to show and underline the interest in natural history which has been a feature of different aspects of English Society during the period under review.

> "If, however, the studies of physical science and chemistry were little favoured by the classically educated boys of the Grammar School, the studies ancillary to the medical profession, and those which engaged the leisure of the wealthy, such as the Fine

Arts, Natural History, &c., secured more consideration. Botany, as an out-of-door inexpensive hobby, continued to be studied even by the humble members of the community. Thus George Caley explored the districts round Manchester very thoroughly and was employed for a short time at Kew Gardens under Sir Joseph Banks, (1743-1829)."

Caley then compiled studies of English plants whilst in the employment of Dr. Wedbury, was sent by Banks on an expedition to New South Wales and his collection of quadrupeds, birds and reptiles was finally purchased by the Linnean Society in 1818.(1) From the same source we read,

"The story of James Henry Clough (1734-1804), of Longsight, is also of interest. He was a handloom weaver and diligent botanist. Whilst watching the passengers alight from the Bridgewater Canal packet at Knott Mill, he was accosted by a gentleman ..... Congenial conversation sprang up, for the visitor was interested in the newly established Liverpool Botanical Gardens. So sound and so extensive was the botanical knowledge of the old weaver that he was invited to join the meeting to which the traveller was going. A few months later Clough was offered an important position at the Liverpool Gardens, and a sum of money was presented to him to recoup the expenses of his outlay."(2)

It has been possible to trace some of the motives which led to the inclusion of a relatively small amount of biological teaching, of one sort or another, in English schools. Often these were religious, only very occasionally is it possible to report that such motives were to be found in utilitarian concepts. An agricultural and growing

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(1) A. A. Mumford. 'The Manchester Grammar School - 1515-1915'. Longmans 1919. P. 220.
(2) Ibid.

horticultural tradition, a Dissenting zeal for enquiry into natural phenomena and a religious desire to understand the phenomena of Nature, all help to explain the production of natural historians of all classes and occupations for which this country is justly famous. But there were other reasons for the inclusion of biological topics in school studies.

IV. The functions of Biology and Nature Study in Schools

When the sciences were first being introduced into school curricula, such subjects as chemistry, physics, mechanics, etc., answered the need for useful studies from which a schoolchild could obtain information that would prepare him for the purpose of obtaining a job.

In the case of biology, however, there were two attitudes that were applied in recommending its inclusion. First, since the sciences were observational, logical and experimental studies and, since it was firmly believed that the processes applied to studying one set of problems and their solution could profitably be applied to any other set, it was postulated that the biological sciences offered a sort of general, preparatory training in observational techniques. Botany, of course, was the easiest to apply in this respect. Now in science there is a great deal of truth in this, for the use of a logical sequence of enquiry that we call the scientific method is as valid in one science as it is in any other. The fallacious assumption, however, that children who had been 'trained' to observe by classifying flowers and occasionally dissecting them to aid that classificatory process, could or would employ their sharpened wits the better to understand the more mathematical sciences, led to confusion in science teaching. The importance of involving children in a practical way with their studies was not fully grasped and so what biology teaching there was soon relapsed into an imitation of the older methods of learning from books and the committal to memory of lists of data. It should be added that it was not until well after the 1850's that the biological sciences (with the exception of physiology) became much more than classificatory studies.

On the other hand, there were some who agreed with T. H. Huxley and Froebel that science was only a part of an educational process which ought to attempt to instruct children about life and the living of it. In this respect, the sciences demanded a place because it was felt that school studies should offer a breadth and wealth of material that was, besides being useful in a purely material sense, of tremendous value in giving them a vision of the unity of life as well as in supplying them with a factual knowledge about matters which would certainly concern them in a scientific age. Such a concept was a liberal one, not only because it asked that children be introduced to a larger range of subjects, but also because it treated the educative process for all children in a causative fashion. The effect of such a process would be to create in children an awareness of all the stimuli - mental and physical - that surrounded them and affected them and so provide a training that combined the development of intellectual discipline with knowledge.

Now it seems to me that the twentieth century conception of Nature Study has always contained something of both ideals to which we have been able to add concepts of children's development, both emotional and intellectual, during the years of schooling. Research along these lines is enabling teachers to make a re-appraisal of what can profitably be taught in science to certain age-groups. Although the aims of nature teaching have not altered much the methods of attaining them are much more attuned to child-reality.

Kenneth Richmond has pointed out that what we call 'nature study' has arisen with confused terms of reference, as it were, and he writes of its amorphous qualities.(1) We have seen, in the first chapter, the confusion of terminology that has been applied to these studies and also how vast are the fields of enquiry that could be attempted.

I suppose that if we try to define what we mean nowadays by 'nature study' there would be some measure of

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(1) W. K. Richmond. Op. cit. Pp. 19-20.

agreement that such a topic would include a treatment of the lives of animals and plants considered in the light of their natural environmental niches and that the teaching should be both scientific and simple, taking in, as it would, the stages of development through which the children pass from the age, say, of five.

I suppose, too, that the scientific approach would be directed towards the progressive training of the childrens' senses so that the stimuli they received by handling and seeing and otherwise appreciating the things that surround them could logically be disciplined.

If we accept this, would it not be possible and reasonable to infer that, providing children can be trained in this way, we may send them on to a secondary stage of schooling readily equipped with a limited series of conditioned reflexes? Might we not infer, then, that such young minds are intended to receive a preparatory training in scientific method so that they may specialise in science later, if given a more suitable training in abstract thinking when they are mentally equipped to deal with it?

The assumption here is that science is something almost unnatural to human thought and that the training of a scientist is the only means of using the senses in a logical and commonsense way. When it is considered that intellectual control and the discipline of the senses are as much a part of the essential training of an artist and a musician as they are of a mathematician or a botanist the fallacy is apparent. The point about science teaching and nature work in the schools is put in 'Approaches to Science in the Primary School' when the authors of that volume state,

> "The present volume assumes that there is a general case for the education of the whole child - that is, for an education which makes the utmost use of his own springs of interest and of his spontaneous activities, in order to develop all sides of him.
>
> The special argument here is that the education of the whole child, if at all complete, will of its own nature embrace much of the education of the future scientist. And conversely that the education of the future scientist should begin as the education of the whole child. In other words: that the aims, procedures and attitudes of mind which we usually regard as most distinctive of the scientist are in fact strongly rooted in all of us and form part of our common human heritage."(1)

This is a point of view with which I am in agreement. I believe, with the authors, that children naturally gain experiences by active exploration, by experimenting, by asking questions, by collecting and classifying things and information and by using their imagination, a quality that these writers speak of as being "no less vital for all major scientific progress."(2) When these activities are disciplined the result is the production of what we like to call the 'scientific method'. I would add that the biologist has, therefore, no monopoly in this respect; all that he can claim is that the study of nature offers possibilities of sensory appreciation, usage and training as

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(1) E. Lawrence, N. Isaacs & W. Rawson. 'Approaches to Science in the Primary School.' Educational Supply Assen. 1960. P. 6.

(2) Ibid. P. 13.

good as any other, but that these are aided by a sympathy, a delight and an interest in living creatures which young children possess.

But if nature study was only concerned with the use of the senses in a passive way then its purposes could as well be served by bringing into the classroom as many natural things, living and dead, as possible. Indeed, some training of the senses can be achieved in this manner. I have heard more experienced observers than I intimate that a great deal of nature study work in the schools is still conducted in this way. An occasional nature walk does nothing to alleviate what is, in essence, an object lesson and it is not too cynical to observe that 'nature' is meaningless to children if they do not get their hands dirty. When large numbers of pupils are conducted from school to the seashore, a wood, a hedgerow or a park, for instance, and nothing is <u>done</u>, then the ramble is little more than a treat and a change; certainly it is neither nature study nor a scientific exploration.

Surely the essence of nature study for young children is not only that things can be observed but that things can be done? It is not enough to occupy the senses alone for the learning process is not purely an automatic response to sense-experience but begins within the child, and it is important that they should continue to ask 'why?' about the things they experience. Since we spend our lives gaining these experiences by asking questions and doing things to find the answers, a method which is the basis of any scientific reasoning process, it seems illogical not to utilise and encourage these in children when the activity and questioning are in full spate.

It would, be illogical, too, to expect children to repeat the sum of human experience. Practical nature study needs a great deal of directional influence and guidance from the teachers and it must always be adapted to the developing abilities of the children. Professor Piaget stresses this when he discusses, in an article in a U.N.E.S.C.O. pamphlet on Natural Science teaching, the almost complete lack of deductive and inductive ability in children of Primary and Junior school ages:-

> ".....: the same arguments (identical even in spontaneous verbal expression) are not applied at the same age to different notions (such as matter, weight and volume), but have to be rediscovered or reconstructed upon introduction to each new system of facts.! In other words, for the whole duration of primary education, formal logic does not yet exist: the most exact reasoning of which children of 7 to 12 years are capable consists only of concrete operations, i.e. of interiorised actions, connected with a definite equipment for manipulation and experiment. Hence the absolute necessity of using activity methods, since thinking proceeds from action and does not precede it."(1)

Thistle Harris is also concerned with this point when she writes in her book, 'The Teaching of Nature Study',

"Even in the primary school the intense curiosity

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(1) J. Piaget in U.N.E.S.C.O. pamphlet No. 111. 'Introduction to Natural Science in Primary Schools.' P. 36.

> that is characteristic of the nursery school child tends to be replaced by a docile acceptance of the teacher's authority. Some writers have suggested that the child's natural curiosity is subdued because schools do not make provision for the normal maturing concepts that come with developing experience. My own observations of practising teachers suggests that they try too hard to pass facts of natural history on to their pupils. Even when these facts are accurate and relevant the children have not always been able to assimilate them because they have not the experience to appreciate their significance. As potential scientists, however, children even of tender years can pursue an investigation along lines suggested by an understanding teacher. In doing this they can scarcely fail to arrive at some facts which are significant to them because these have grown out of their own experience.(1)

Miss Harris indicates her attitudes towards Nature Study teaching in the summary to her book, part of which I have included as Appendix 9.

At the very youngest level, in the Infant school, nature study ought to aim at increasing and widening the children's experience of natural things so that they can find out for themselves something about animals and plants and the forms, shapes and colours of these can be used to further the simple classificatory desires that young children exhibit. It is at this level, too, that teachers can begin to channel the interest that boys and girls show for living creatures into a real love for them which is not sentimental. The nature work may be seasonal in its planning and anecdotes and stories used to teach the youngest; nature study may form a part of a project or be taught as

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(1) T. Y. Harris. 'The Teaching of Nature Study'. Australian Council for Edn. Research. 1954. P. 3.

group activities, but the children should have first hand knowledge of other creatures apart from the familiar mammalian pets.

In Junior schools the work can become more experimental and ecological in simple, factual ways. When they can measure and count, the pupils can be shown some of the techniques of investigation and simple ways of expressing results, but it must be remembered that older children in such schools will still introduce elements of phantasy into their explanations and be unable to grasp abstract conceptions of their world. Whilst the more rural schools have a better choice of varied natural environments even brick walls have their own particular flora and fauna, aquaria can be constructed and maintained so that investigations into their contents can be carried out, things can be grown in pots and boxes in the classroom and experiments conducted there, and it would be a rare town where there is not some green space that can be used for biological enquiries.

I feel that the practical teaching of nature study needs the guidance throughout a school of the specialist teacher to whom the other teachers can go for help and advice with their nature work. If he or she is an enthusiast, all the better, for this is the first form of scientific enquiry with which children come into contact in schools.

It seems, then, as if we have travelled a full circle in considering nature study teaching in schools. Having commenced with the advocacy, some centuries ago, of the teaching of all natural phenomena, the schools have now begun to instruct children about natural things in a simple way which is much more adapted to the stages through which a child passes in his real understanding of the phenomena of his environment. Yet we seem to believe that such teaching is mainly the province of the schools for younger children and that specialisation in the sciences must immediately follow in the next stages of their school careers, when formal teaching and abstract concepts dominate the teaching matter. If it can be claimed that nature study is an important part of a general education and that the teaching of it can, and should, be practical and scientific, it does not seem reasonable that this study should be replaced by the more formal teaching of 'general-' or 'elementary science' in the secondary modern schools or in the junior forms of grammar schools. Whilst the laws of nature do not change the nomenclature applied to the study of them does so abruptly as one stage of schooling succeeds another, and it remains somewhat of a puzzle that whilst we consider that it is reasonable to teach nature study to a ten-year-old, that child may, at eleven, begin the formal study of the sciences and never study 'nature' again.

APPENDIX 1.

This extract, from a paper by the Rev. W. Tuckwell (Headmaster of Taunton College School) entitled 'The Method of Teaching Physical Science in Schools' is taken from Appendix II of the Sixth Report of the Devonshire Commission. The paper is dated 1869.

"The time to be given to science should not be less than three hours a week ..... The fifth year is given to botany. If a good book is used, if each boy works for himself with lens and knife, if 'Henslow's Schedules', or a modification of them, are regularly filled up; above all, if plates are not made to do the work of living plants, the pupils will at the year's end thoroughly understand the principles of Classification, will know the characteristics of at least all the British orders, and will be able with the help of Bentham or Babington to make out almost any English flower. The boys who have completed this course will be from 16 to 17 years old. Some of them will now be leaving school; those who remain will give the rest of their time to physiology. They will begin with human and will pass to comparative physiology, using in the first Professor Huxley's valuable little book; dependent for the second, of which no school manual exists, on the skill and method of their teacher. But whether at the earlier or the later age, they will pass out into the world unmeasurably superior to their contemporaries who know not science, with doors of knowledge opened which can never again be closed; with a fund of resource established which can never be exhausted; with minds in which are cultivated, as nothing else can cultivate them, the priceless habits of observation, of reasoning on external phenomena, of classification, arrangement, method, judgement.

"..... In botany the book for the boys' use is Professor Oliver's 'Lessons'; but the teacher will find great advantage from Le Maont's 'Leçons de Botanie'. An excellent modification of Henslow's Schedule is published by Professor Babington for the use of his Cambridge classes, and Lindley's 'Descriptive Botany', price 1s., is a most useful help. Every boy should be furnished with a small deal board, a lens, and a sharp knife. The botanical microscope which I exhibit, includes a lens fixed or moveable, a black glass stage, two dissecting needles and a forceps is made by Mr. Highley, of Green-St. Leicester Square. ..... Fitch's diagrams, designed by the Committee of Council on Education which cost £2 9s.

the set are a valuable help to the lectures; and for schools which have large purses or liberal friends, Dr. Auzoux's models of plants and plant organs, ranging in price from 20 to 100 francs, and 10 times the size of life, form a luxurious assistance to beginners ..... The same excellent modellist, whose catalogue is on the table, provides every organ necessary for the study of comparative and human physiology, ..."

APPENDIX 2.

An extract of the evidence given before the Schools Inquiry Commission by the Rev. William Tuckwell, M.A., Headmaster of the College School, Taunton. 16th November, 1865. Volume V. Part II Pp. 152-153.

Having stated that physics and chemistry should be studied and that such study should begin at the age of eleven, and having discussed the content of the lectures, the evidence proceeds:

Q. 10,467. - From chemistry you would proceed to what?

- To physiology. I should begin with human physiology. It is a question that I am not sure I have yet settled, but I have taken the opinion of all the best teachers at Oxford and Cambridge, and I am disposed at present to begin with human physiology. I find, as far as I have gone hitherto, and as far as I have learnt myself, that in studying the lower animals, the boy is embarrassed by his not having the highest conception of the organ that he proceeds to deal with. His appreciation of the nervous system of a leech is imperfect, because he has not yet realised the highest form of which the nervous system is capable, and therefore though in theory it sounds better to begin with a first modification of a system, and work it up to perfection, in practice I am disposed at present to think it best to begin with the highest possible manifestation of the functions and organs, and to go downwards.

Q. 10,468. - Do you think it will be practicable to give such an amount of instruction in a science like physiology, particularly human physiology, to boys who must have but very vague notions of the anatomy of the body? Physiology is really, we may say, the use or action of bodies; do you think that there may not be some difficulty about imparting information as to the use and action of bodies with such a very imperfect knowledge, as boys must necessarily have, of the bodies themselves?

- Of course you cannot produce a human subject in a lecture room, but you can produce a skeleton, and the boys obtain the most minute knowledge of the skeleton and of the skull in that way. You can get most admirable wax models of the principal muscles at a certain shop, on a small scale. You may get beautiful models of the eye and the ear, and the drawings that you can get of all the interior of the human body, the digestive organs and so forth, are only second, to actual demonstration; and lastly, there are a great number of points which you can illustrate by getting a hare or a rabbit from the market, cutting it up, and teaching the boys to handle and see for themselves. I am not, of course, pretending to make first-class physiologists, I am using the study as a means. My object in teaching physical science is twofold:- It is to give that mental training which I believe physical science to give extensively, and it is to open the doors of knowledge which boys will not of themselves open in after life.

Q. 10,469 - Do you propose any course of instruction in botany?

\- I hope to make it rather a resource than a subject. I do not quite see how to bring it in, but I have the books that Henslow composed, and I have a very nice botanical garden, which contains an entire collection of typical British plants, and propose next half year, on half-holidays and summer evenings, to take the boys through a course of classificatory botany, and of the natural system.

Q. 10,470 - Has it not struck you as possible, being in a rural district where you have abundant opportunities of collecting plants, that you might have peculiar facilities for studying botany, that classificatory botany might be a very useful instrument for training boys in accuracy of observation, and that the anatomy of plants, with the assistance of the microscope, would afford you excellent opportunities of giving really scientific information on vegetable physiology?

\- I had reserved vegetable physiology as one of the luxuries which a boy who had passed through the other course was to indulge in; I have not been able to get it into the course that I contemplate at present. As far as regards the names of the plants, many of the boys know them already; of course to name English plants is not botany; but the boys are encouraged to bring their plants to me, and to the botanical garden, and to compare them. In fact half the boys have acquired the knowledge of a great many plants and something of their habits, which they had not before I came to them. Botany is so far a difficulty with me at present that I do not quite see where to get it in.

APPENDIX 3.

This information is taken from Appendix II of the Sixth Report of the Royal Commission on Scientific Instruction and the Advancement of Science. (Devonshire Report) P. 31 and consists of two examination papers set in Botany at Clifton College in 1871.

Intermediate Examination. Feb. 13th 1871.

Botany IIIα and IIIβ

1. What is a "receptacle"? Sketch and describe its form in the geranium and strawberry.
2. Give the meanings of these words: perianth, polysepalous, aestivation, stigma, distractile connective.
3. Describe the structure of the stamen, and show how its parts correspond with those of the ordinary green leaf.
4. In what way are the floral leaves of the sweet pea arranged in the bud?
5. What forms of the calyx are found in the dandelion, daisy and gooseberry?
6. Sketch and name some of the chief varieties of the regular gamopetalous corolla.

Terminal Examination. Easter 1871.

Botany IIIα and β - Junior School IVα and β III

Examiner, Rev. G. Machoskie LL.D.

1. What is meant by the word "superior" with reference to the calyx and ovary? Give examples of a superior and an inferior ovary.
2. Describe the petals, the stamens, and the fruit in a Cruciferous plant.
3. Give, very briefly, the meanings of these words:-

Epicalyx	Introrse	Pome
Papilionaceous	Syncarpous	Achene
Polyadelphous	Dehiscence	Cone

4. What is remarkable about the calyx, corolla, and anthers in the dandelion or thistle?
5. Show how these three fruits differ: Strawberry, blackberry, and mulberry.
6. Describe the fruit called a "legume". Show how it resembles an ordinary leaf, and contrast it with the "follicle".
7. Name the principal forms of cells and vessels.

8. Distinguish between the exogenous, endogenous, and acrogenous stem. Give examples.
9. What action have plants upon the atmosphere?

Candidates are not expected to write upon more than six questions, and a few good answers will receive more marks than a larger quantity of inferior ones.

APPENDIX 4.

The Codes of the Education Department after 1870.

This information is extracted from 'Special Reports of Educational Subjects 1896-7' and the article 'Public Elementary Education in England and Wales, 1870-95' by M. E. Sadler and J. W. Edwards. H.M.S.O. 1897. Pp. 56-63

IX. - SUBJECTS OF INSTRUCTION IN DAY SCHOOLS.

The subjects of instruction in 1871 were:-

Obligatory - Reading, writing, arithmetic, and (for girls) plain needlework and cutting out
Optional - Specific subjects for scholars in Standards IV. - VI, but it was distinctly stated that drawing and music would not be recognised as specific subjects, and (for boys) drill.

Class subjects. These were first introduced by the Code of 1875, when a grant of 4s. per scholar above seven years of age was payable if the classes from which the children were examined in Standards II - VI, or in specific subjects, passed an examination in any two of: grammar, history, elementary geography, and plain needlework. A change was proposed in the Code of 1880 whereby "the choice of managers is no longer confined to these four subjects, but may extend to any others which can be reasonably accepted as special branches of elementary instruction, and properly treated in reading books, graded so as to suit the capacities of the children of various ages, in whose hands they are placed."

New subjects were not, however, taken up to any considerable extent. In the year ended 31st August 1882, natural history was taught in 11 instances, domestic economy in 8, chemistry in 2, agriculture in 1, and mensuration in 1.

By the Code of 1882, the recognised class subjects were English (which was compulsory if any subject was taken), geography, elementary science, history, and needlework. By the Code of 1895 object lessons and suitable occupations for Standards I - III were added to the list of class subjects.

"The wider range of class subjects allowed by the Code under the head of 'elementary science' is being gradually taken advantage of." - Committee of Council Report, 1895-6.

Under the Code of 1896, object lessons became obligatory in all day schools for older scholars, and, in that year, the list of class subjects was: English, geography, elementary science, history, object lessons for Standards I, II, III, suitable occupations, needlework and domestic economy (for girls only).

Specific Subjects. Extra grants were first offered in 1867 to schools which, inter alia, taught one or more specific subjects of secular instruction beyond reading, writing, and arithmetic; but it was under the New Code of 1871 that a special grant was first made for each individual scholar passing. The grant was of 3s. per subject per scholar passing an examination in not more than two such subjects. The scholars presented were in Standards IV - VI and the list of specific subjects was: Geography, history, grammar, algebra, geometry, natural philosophy, physical geography, the natural sciences, political economy, languages or any definite subject of instruction extending over the classes to be examined.

The Code of 1875 raised the grant to 4s. a subject and children who had passed Standard VI were allowed to take up three subjects. Under this Code, geography, history and grammar became 'class subjects' and algebra, Euclid and mensuration were joined together under the name 'mathematics', but, in 1883, algebra was again separated.

The Code of 1882 added english and physical geography, the latter under the title 'geography' to the list of class subjects and only scholars in Standards V - VII were allowed to be examined in specific subjects, when each scholar could take no more than two such subjects. The result of both changes was to lower the number of candidates presented for examination.

In addition to those already mentioned, the following subjects were taught under this heading: mechanics, Latin, French, German, animal physiology, botany, principles of agriculture, chemistry, sound, light and heat, magnetism and electricity, book-keeping, shorthand, domestic economy (for girls), elementary science, experimental mechanics, fruit culture, geology, history (advanced), horticulture, hygiene, manual instruction and applied drawing, natural philosophy, navigation, practical science, political economy, and social economy.

APPENDIX 5.

The following is an extract from 'Special Reports on Educational Subjects 1896-7' and the article in that volume, 'Public Elementary Education in England and Wales, 1870-1895' by M. E. Sadler and J. W. Edwards. The tabular information from which the following data has been taken is on Pp. 64 and 65 of the above and is headed "Table showing the Number of Day Scholars presented in the various Specific Subjects, 1872-95".

Year Ending 31 August.	Phys. Geog.	Animal Physiol.	Botany	Prin. Agric.	Chemistry	Physics. * (See below)
1872	1036	901	-	-	9	8
1873	658	725	-	-	14	70
1874	1088	660	45	-	41	115
1875	2087	966	58	-	26	11
1876	8553	5936	483	-	27	20
1877	18936	13032	913	-	-	-
1878	23126	15866	928	-	-	-
1879	29459	20506	1332	-	-	-
1880	34288	24725	1853	-	-	-
1881	34382	25886	1903	-	-	-
1882	34207	27683	2149	-	-	-
1883	22521	29027	2672	422	368	1329
1884	-	22857	2604	1859	1047	4497
1885	-	20869	2415	1481	1095	4095
1886	-	18523	1992	1351	1158	4285
1887	-	17338	1589	1137	1488	3408
1888	-	16940	1592	1151	1808	2955
1889	-	15893	1944	1199	1531	2745
1890	-	15842	1830	1228	2007	3476
1891	-	15050	2115	1231	1847	3639
1892	-	13622	1845	1085	1935	3501
1893	-	14060	1968	909	2387	3349
1894	-	15271	2052	1231	3043	4215
1895	-	17003	2483	1196	3850	4112

* From 1883 the figures given under the column 'Physics' were in fact divided under the titles 'Sound, Light and Heat' and 'Magnetism and Electricity.'

APPENDIX 6.

This tabular data has been extracted from various volumes of the Minutes of the Committee in Council, and refers to Specific Subjects under Article 21 of the Code of 1875 and succeeding Codes.

		Schools organised by:			
Year	Subject	Nat. Soc. and C. of E.	British, Wesleyan and other schools.	Roman Catholic.	School Boards
1875	Animal Phys.	534	288	-	144
	Botany	58	-	-	-
1876	Animal Phys.	2755	1535	1	1645
	Botany	237	174	1	71
1877	Animal Phys.	5001	3597	1	4433
	Botany	403	276	-	234
1878	Animal Phys.	5737	3790	-	6339
	Botany	382	244	1	301
1879	Animal Phys.	6560	4605	15	9326
	Botany	493	373	4	462
1880	Animal Phys.	7162	5126	65	12372
	Botany	577	397	2	877
1881	Animal Phys.	6710	4827	48	14301
	Botany	464	554	5	880
1882	Animal Phys.	7016	4608	5	16054
	Botany	524	521	-	1104
1883	Animal Phys.	5043	3463	23	13420
	Botany	387	499	2	760

APPENDIX 7.

This data is extracted from 'Public Elementary Education in England and Wales' by M. E. Sadler and J. W. Edwards. Pp. 22 and 16.

Number of Public Elementary Day Schools under Voluntary Management

Inspected during the Year ending 31st August	Church of England	Wesleyan	Roman Catholic	British Undenominational etc.	School Boards
1875	9449	Included under British etc. until 1878	598	2034	1136
1876	10046		623	2008	1596
1877	10472		659	1974	2082
1878	10910	572	693	1436	2682
1879	11264	577	737	1449	3139
1880	11416	569	758	1438	3433
1881	11589	562	789	1430	3692
1882	11620	567	812	1422	3868
1883	11703	559	817	1412	4049

APPENDIX 8.

An extract from the Board of Education's 'Suggestions for the Consideration of Teachers in Public Elementary Schools' 1905, Chapter VI, concerning Nature Study.

"With a subject so wide and undefined it is evident that the teacher should have a very clear idea of the object of his teaching; in this more than in any other branch of the school curriculum, the method by which the instruction is given counts for everything, the information imparted for very little. The one object that must always be kept in view is the training of the child's mind, first to observation on its own account, secondly to such a perception of cause and effect in nature as may lead the child in after life to reason about things instead of taking them for granted. The main factor which marks off 'Nature Study' from other school subjects should be that in it the instruction proceeds solely from the actual object, and never from description or reading. In practically every other subject, no matter how successfully the teacher makes the scholar look for the information he requires, the child has to take things for granted and must depend on the good faith of the teacher or of the printed book; in Nature Study comes the opportunity of proceeding by another method and teaching from the thing itself. The teacher should then be very jealous not to waste this unique opportunity, it is his one chance of teaching from the real; as soon as Nature Study is taught from the book and the blackboard it becomes worthless as Nature Study even though interesting or useful information is imparted to the scholars. Turning again to the object of the teaching it should be understood that observation means something more than merely seeing a thing, it should involve description, and this again often means measurement and a continuous record of the measurements. No opportunity should be lost of measuring or weighing, especially in dealing with living things that are undergoing regular change. This fosters the one habit of mind we are seeking, that of exact seeing; for the other - clear thinking - we must make use of experiment. An experiment is a question asked of nature, a particular cause is seen to be followed by a certain effect, we want the child to get into the way of thinking that all effects have their causes which can be discovered if the questions are properly asked. Again, experiments afford the best material for the exercise of the observation, since in the first place the arrangement of the experiment has to be grasped, then the experiment itself has to be watched.

Nature Study proper should begin at about the tenth year, and should be a development on more systematic lines of the observation lessons given in the earlier stages. The class may be large, in a small country school the whole of the upper girls and boys can be taken together, and it is very easy to make such slight changes in the subject from year to year, as will avoid the appearance of repetition.

.....

The class work is best conducted on catechetical lines, with continuous cross-questioning to ensure full and exact answers and to get behind mere verbal explanations. The teacher should be very chary of giving information; he should always try to extract it from the thing itself by asking questions. His aim should be to keep his children's minds active and to guide the inquiry. Note taking is of doubtful advantage, because scholars of the age of ten to fourteen will not have mastered the art of taking notes; and notes dictated by the teacher or copied from the blackboard do not represent any independent effort on the part of the scholars. The teacher may suggest a series of headings, leaving each pupil to fill in the notes. Notes should be in the form of sketches whenever possible, and if written should be brief. A sketch with a few written labels and recorded measurements forms an excellent summary of a lesson, and on it the scholar may be catechised later. Care, however, must be taken not to overdo the drawing so as to make Nature Study a lesson in pencil or brush work; rapid and intelligible diagrams only are wanted. The results of the lessons should be used for exercises in description and short compositions; observation is complete only when it can be reproduced in words. Compositions, again, afford the necessary means of testing the progress of each member of the class, a thing which is easily overlooked when teaching catechetically. .....

Without doubt the collecting instinct is the great motive power in natural history pursuits, and most naturalists begin as collectors. If collecting is repressed, interest is apt to be repressed also. But the habit of collecting may become a habit of destruction, and therefore the teacher should make the nature study class his opportunity for developing a respect for living things, for birds' nests and rare plants. Children should pluck flowers carefully, so as not to injure the plant; boys should be content with a single egg of each kind. A natural history calendar and a record on the schoolroom wall are useful; the former should be renewed each year and give the name and date of the first child to observe each of the commoner flowers or birds or insects. The second should give the name of the first observer of every rare plant, bird, or insect inside the parish. For teaching country children the art of classification and discrimination between species, it is a good plan to encourage each to make a dried and mounted collection of the local grasses, naming them from a similar collection on the school walls.

.....

School walks and excursions are now a legitimate part of the timetable, but to be educationally fruitful at this stage they require careful planning and preparation. With younger scholars the school excursion need not be confined to any definite purpose, but with older scholars the class should go out with some object in view, with two or three points to observe. An excursion may be planned, for example, to see how the kinds of plants change as one passes from clay to sand, the kinds of weeds that are associated with the different crops or soils, or how plants change their character, according as they grow in damp or dry situations. Much incidental matter for observation will crop up by the way, but the walk should be undertaken with a purpose, or very little will be seen by anyone. .....

Nature Study in a town school presents more difficulties if it is to represent the personal experience of the scholars. It is not possible to replace the wealth of material round a country child, but descriptions and reading must not take the place of first hand observation by the scholars. Experiments on the growth of a plant are just as possible, though not always so easy. In the schools of a large town, no matter how remote from the country, all our common food plants should be grown, e.g., wheat, oats, barley, turnips, potatoes, clover, peas, and beans, etc., etc. The smallest plot of ground, even pots, will suffice, and many lessons can be drawn as the growth proceeds.

The collecting instinct is perhaps most easily developed in smaller towns within touch of the country; the teacher can encourage his boys to spend their holidays to advantage in this way, provided he checks the growth of the predatory and destructive habits.

Whatever the subject selected, if Nature Study is to have its full value in the school, it must be in virtue of the spirit in which the teacher goes to work; he must continually ask himself whether his teaching proceeds from the thing, whether it is designed to encourage observation and thinking in his children, to make their minds active and not merely receptive, whether it is experimental enough, whether it is first hand."

APPENDIX 9.

This material is contained in the general conclusions and recommendations made by Thistle Y. Harris concerning Nature Study teaching in Primary schools in her book 'The Teaching of Nature Study', 1954 Pp. 84-85

General Suggestions for Nature Study Teaching

"In Nature Study teaching itself I suggest that the following points are important:

1. The work should be arranged on a whole school basis so that the children gradually build up an understanding of the basic concepts and principles that govern the natural world around them.

2. The work should be organised round the solution of simple problems within the scope of the child's experience but endeavouring to widen this experience and involving a close study of natural material.

3. The emphasis should always be on living material in situ, preferably in areas close at hand to permit of continuity of observation. The material selected for study should be commonplace for the same reason.

4. The work should be based on direct observation and on controlled observation (by means of simple experiments) and deductions should be limited to the data available from the observations. Later children will learn to amplify their own observations and to check them by reference to work already recorded in books.

5. The work should be of such a nature that children will be able to continue it, or other work arising from it, in their own time when they wish to do so.

6. In the main several short lessons are to be preferred to one lengthy one. This applies both to classroom lessons and to field lessons. Ten minutes out of doors will usually supply a fund of material for closer observation and discussion.

7. Organisation of classes into small groups, each working on an individual problem, is advisable. The value of the work lies in what the children discover for themselves and therefore co-ordination of the work of the groups with one another is not necessary. Encouragement of small groups to build up a composite record will begin the training of co-ordinated work on an organized basis and will prepare children for

undertaking class projects in which each child takes a definite part.

8. Recording in Nature Study should be for the purpose of developing greater accuracy in observation.

9. Incidental work, either arising from the main topic of study or independently of it, and associated reading, should be regarded usually as contributory to the main aim of the study. Incidental studies, of greater interest and of possibly ephemeral existence, may be adopted and the main topic rejected. Such occasions will be relatively rare.

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