EARLY SCIENCE IN OXFORD

XI

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BY

R. T. GUNTHER

VOL. XI

OXFORD COLLEGES AND THEIR MEN OF SCIENCE

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PREFACE

THE first volumes of this series were compiled to recall to memory the Scientific Instruments by which the early members of the University of Oxford have investigated the workings of Nature. A recommendation for the better preservation of these unique relics of the past was widely supported, and after a few years the University decreed the establishment of a Museum of the History of Science for their centralization and study. This slow but most gratifying beginning was materially assisted by the generous action of Dr. Lewis Evans in offering his superb collection of instruments to the University on the condition that the old Oxford Museum of Science, opened under the patronage of King Charles II in 1683, should be restored to its original purpose. The project was, however, strongly opposed by a small literary clique in the University, and as recently as last year the head of a College described the speeding up of such a proposal as 'revolutionary'. Perhaps it is: the traditional local policy has been one of destruction.

The present volume is designed to set out the achievements of the more scientifically minded Oxford men, College by College. It also includes a reprint of the inaugural lecture of Oxford's first University Reader in the History of Science, delivered in October 1934.

The Colleges of Oxford and Cambridge have been the principal nurseries of churchmen, politicians, and lawyers for so many centuries that it is less easy to think of them as training schools for the Civil Services and other Professions, and to write a history of Oxford from that point of view. But the study of Medicine, although restricted to a relatively small body of students, is of so venerable an antiquity that it is appropriate that the recent visit of the members of the British Medical Association to Oxford should be made an occasion for taking stock of the more important contributions of the Colleges to Science and Medicine in so far as this can be attempted in the space of a single volume.

On the occasion of a former visit of the British Medical Association to Oxford the growth and development of the Oxford Medical School up to 1904 had been the subject of an address by the President, the late Dr. William Collier. He then reviewed the history of the principal University institutions, departments, and benefactions devoted to the training of Medical Students.

We are now casting our net more widely both in space and time, with the view of collecting samples of the results, so far as Scientific and Medical studies are concerned, which have been obtained by the Colleges of the University from the beginning.

The College system which is the glory of our two ancient Universities, distinguishing them from all others, has been of slow growth. In the beginning Oxford and Cambridge were much what French, German, and Scottish Universities are to-day. The University supplied instruction in subjects, the names of which may still be read over the doorways around the quadrangle of the Schools below the Bodleian Library, although the teachers that professed them have long since had to leave their classrooms, retreating before recurrent floods of Bodleian books. The early students were free to live practically how and where they pleased, so long as they caused no great scandal; and they availed themselves of their freedom to the full, travelling far and wide from one University to another as pilgrims in pursuit of learning. 'In Paris they seek the liberal arts, in Orleans authors, at Salermo gallipots, at Toledo demons.' In the thirteenth century many an Oxford student used to continue his studies in Paris. Scholars were free to move about: a quarrel with the taverners of the town about the ale supplied was cause enough for a thousand Oxford men to remove to

Cambridge, or from Cambridge to Oxford. Outbreaks of plague made both Universities retire to Northampton or to Stamford, until a statute was passed to forbid any University to be established in England elsewhere than at Oxford or Cambridge. Scholars thirsting for higher instruction in science or medicine had often to go abroad, to Montpellier, Padua, or Leyden, where especial attractions were offered. On the Continent students used to wander with empty pockets and a single garment, and they often resorted to begging. On one occasion at the Chancellor's court at Oxford, Denis Burnell and John Brown, poor scholars of Aristotle Hall, were provided with officially sealed letters, testimonials, admitting them to beg for alms, and even as late as 1530 it was enacted that scholars of Oxford who should go about begging without letters under the seal of the University should be punished as sturdy beggars by whipping or by imprisonment in the stocks for three days and three nights. Discipline may have forbidden playing at ball, but on the whole it was not very severe. The first stage in increasing the severity of the discipline was the forbidding of any person to receive students as boarders, unless he were himself a graduate of the University. Thus arose Halls, under the governance of Masters of Arts. They were simply lodging-houses having no permanent endowment; but we trust that no Oxford Hall ever provided such Spartan fare as that suffered by Erasmus when he stayed in Paris. He there found hard beds, coarse and scanty food, severe tasks, no meat in midwinter, only a crust of bread, drinking-water drawn from a contaminated well, sleeping-rooms permeated with the smell of sewage, where, as he said, 'nobody lived without either dying or catching a deadly disease. . . . I got nothing from that place, except broken health and swarms of vermin.'

When conditions became intolerable, there were killings both of students and of citizens, and occasionally a migration, as on that historic occasion in 1229 when the students of Paris left their city in a body and settled in Oxford.

Such were the conditions of life before the foundation of the Colleges.

The needs of learning and of students were only too apparent to our first pious founders and benefactors.

The Colleges began, not as corporations for the advancement of learning, but as respectable refuges for poor students who were unable otherwise to pay for board and lodging at the University. Apparently intellectual tests were not always applied, and to become a scholar merely on the ground of poverty soon served as a direct encouragement to the lazy and incapable to throng to the Universities.

Notwithstanding the very varied conditions—in some cases almost desperate conditions—that obtained in a number of the Colleges at the time of their foundation, it is to the honour of almost every one of them that at least one of its scientific members should have come to win laurels in the temples of international Fame. So, too, when we enter a College, let us pay a tribute of remembrance of its work for civilization. Let us recall the sentiment that has been so perfectly expressed in the entry to Brasenose College.

THIS RECORD IS HERE SET THAT THOSE WHO PASS BY MAY BE PUT IN MIND OF FIELD-MARSHAL EARL HAIG AND ALL THE OTHER BRASENOSE MEN WHO DEVOTED THEMSELVES AT HOME OR ABROAD TO THE SERVICE OF THEIR COUNTRY IN THE TIME OF PERIL 1914–1918.

Thus will our History be seen through the Lives of Men. The greater College and University buildings are open for all to see, but for an intimate study of their life and letters through the ages we must dig deep—far below the surface of the architecture.

Beginning with the great activity of the ASTRONOMER PHYSICIANS at Merton College in the 14th century, whose work spurred on the King and Sir HENRY SAVILE to endow the Regius and Savilian Professorships of Physick, Mathematics, and Astronomy, we pass on to Balliol, renowned for association with Bishop TUNSTAL, JOHN EVELYN, and JAMES BRADLEY, prince among astronomers; and then to University College, the early home of LEONARD DIGGES, CARTWRIGHT, and JOHN RADCLIFFE. GLANVILL and the father of modern Geology, Charles Lyell, were at Exeter, the College best loved by Ray Lankester, who tried several at both Universities. The great Raleigh, Gilbert White, and Cecil Rhodes all came from Oriel. Queen's produced Floyer, Pennant, and Halley, and Halley produced Newton. Three Regius Professors of Physick, the founders of modern Astronomy, and the patriotic Duncans, refounders of the Old Ashmolean Museum of Science, all lent lustre to New College, which in our own time has been the nursing mother of Hatchett Jackson, Beddard, Bather, and Bourne, a notable quartette of Zoologists whose pupils have travelled far and wide. At Lincoln we think of John Wesley and Baldwin Spencer. Linacre, Recorde, Mayow, Millington, and Wren prove that All Souls could train other than lawyers. So did Sydenham, an erstwhile member of Magdalen Hall, which with Robert Plot, Tyson, and other naturalists for members, ranked far higher than Magdalen College before the regenerative days of Cartwright and Daubeny. The father of Statistical studies, William Petty, trained as an anatomist, was at Brasenose, the College of Ashmole, who scientifically speaking was among the least of our notabilities, though historically fortune has given him an honoured place, and his old Museum, after many vicissitudes and frequent lootings, is at last showing signs of flowering as the Oxford Museum of the History of Science. Christ Church shares many great names with Westminster School: few have been more prolific in discovery than Robert Hooke, father of Microscopy and of the Industrial Age. Fludd, Lower, and a long line of Regius Professors of Medicine, including Acland, founder of the Museum of the Natural Sciences in the Parks, have advanced medical studies both in the University and in the wider world.

Highmore, Jervis-Smith, and Moseley were at Trinity; Laud, Fludd, and Sherard at St. John's; Edward Poulton, President-elect of the British Association, at Jesus. All these last three were outshone by Wadham, nursing mother of disciples of the New Learning, where even the manciple was a man of science in the days of the foundation of the Royal

Society. The later College of Pembroke can also claim men of mark, Sir Thomas Browne, Smithson, and Higgins, each as worthy of remembrance as Dr. Johnson: George Rolleston and George Joyliffe belonged to the same society. Worcester College, appropriately enough, was the College of Dr. Wall of Malvern and Worcester China fame. An extra chapter is devoted to the work of citizens of town and county who were not originally members of Colleges. To give some idea of the life journeys and interests of our scientific alumni is the object of this volume.

The watchword of science is Progress. The essence of life is to be in constant ferment, lest it stagnate, and so science must be ever on the move. But it is not necessary in the struggle to advance human knowledge so that beauties of antiquity, the monuments of the past of mankind, should be irretrievably injured or destroyed, any more than that the beauties of nature should be devastated either by students of Natural Science or by those who would obstruct the course of discovery.

To those who have assisted in the work of reclaiming the Old Ashmolean as a Scientific Institution I offer my heartiest thanks. It is the last of the three great scientific foundations of the reign of Charles II, the others being the Royal Society and Greenwich Observatory. The Old Ashmolean has provided both with some of their most distinguished members, but it is still suffering from total lack of that initial endowment which both Charles and Ashmole were too impoverished to give. For the past twelve years my own resources have been devoted to the collection and preservation of rare or unique relics of our scientific past. I trust that others may care for their adequate conservation and exhibition in the future, for they are original documents for the history of Science.

The book might have been illustrated more fully; the reason I have not done so is simply that of expense. Several of the portraits will be familiar to some readers as occurring in other works. I would express my obligation to all who have helped in the selection, but especially to Dr. Chaplin of the College of Physicians, to Dr. A. Gibson, and to Sir Farquhar Buzzard.

Thanks are no less due to the British Association, Sir John Murray, Miss Bellamy, Miss Jackson, and Mr. Coxhill, to Oriel, Brasenose and Exeter Colleges, and especially to Dr. John Johnson and his staff at the University Press for the skill with which their work has been carried out. Appendix F is the result of the technical process of Messrs. Lund Humphries of Bradford.

It has too frequently happened that in the history of the physical sciences the transcendent lustre of one immortal name has cast into the shade all others. I now venture to express the hope that the light of later appreciation will so penetrate that shadow as to throw into stronger relief the figures of many Oxford men who deserve to share in greater measure than at present the fame of the accepted immortals.

R. T. GUNTHER

MUSEUM OF THE HISTORY OF SCIENCE,
OLD ASHMOLEAN BUILDING,
OXFORD.

23 *August* 1937

SIR HANS SLOANE

By Rysbrach, 1748

If the old Ashmolean Museum had been more wisely organized in the eighteenth century, the Sloane collections would have come to Oxford, and the whole history of British Museums of Science would have been altered.

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OXFORD AND THE HISTORY OF SCIENCE

An Inaugural Lecture delivered in the Examination Schools 25 October 1934

OXFORD AND THE HISTORY OF SCIENCE

IT is my high privilege and great happiness to have been allowed, during the past ten years, to assemble in the historic home of all the Natural Sciences in Oxford, collections that are acknowledged to be of unique historic value to the world, and particularly to our University. If space in the Old Ashmolean Building had not then been available, the greater part of these collections would certainly not have come to Oxford; some would have gone overseas, much would have been lost. My work of preservation has now been partially rewarded by the offer of the most noble and appropriate scientific gift of historic interest that any Science Museum in Britain could be offered. I refer to the offer by the RADCLIFFE TRUSTEES of the great astronomical instruments, best in the world when in their prime, which for a century and a half have stood in their ancient Observatory. I sincerely trust that the University may lose no time before accepting, saving, and publicly exhibiting these instruments, for the accommodation of which it will only be necessary to move a relatively small stack of little-used books from the Old Ashmolean.

The only other important Oxford collection of local scientific apparatus that is required to complete our Museum for the History of Science, is that of Dr. DAUBENY at Magdalen College. This collection has already been offered to the University by the College, and, so far as space has permitted, I have accepted their offer; but an essential part cannot be received unless a simple suggestion made by the late Lord BIRKENHEAD be adopted.

'The University', he said, 'has provided this magnificent building for a specific purpose. . . . Would it not be a noble and lasting memorial to demand the restitution of its spacious room to the purpose for which it was intended?'[1]

And this also is the wish of a large number of members of Congregation and the considered recommendation of a Committee appointed by the Hebdomadal Council of the University. Its accomplishment would immediately relieve the congestion of the collections already in the building and would thereby enable them to be put to full use for educational purposes.

Second only to the joy of bringing forth a Museum for the History of Science is the joy of now being the first Reader in that subject in Oxford. I appreciate the honour which the University has thereby done me all the more because in the month of my appointment I had already reached the age at which retirement from a responsible post is usual.

A more humble title would certainly have been a more suitable match for my limited powers and resources, but then our venerable University would hardly have been justified in adopting a less comprehensive description, so important has been her share in originating, developing, and perfecting so many and such diverse departments of natural knowledge. To me the very immensity of the subject is in itself a cause of distraction and embarrassment; for to compile the history of the manifold interrelations of the work of the men of science of Oxford alone during the past six centuries would be so colossal a task, as to overtax the powers of the united Professoriate of a single faculty.

But if we confine our attention to a fraction of that

[1] Lord Birkenhead's Address at the Unveiling of Memorial Windows in the Old Ashmolean on May 11, 1929.

whole history, it may become possible to reach the essence of some one aspect or subject of study, especially if we draw upon the wealth and whirl and diversity of modern life, as an incentive and a guide.

And let us not forget the pregnant words of Virchow: 'All scientific endeavour even in medicine is only of historical significance.'

This Readership then is a recognition that in the Universities, as in the special Societies, Museums, and Institutions of the World, increasing attention is being given to the History of Science; that this subject is being found to be as worthy of study as many another part of History; that through it, means may be found for the spread of culture, for seeing details in relation to the whole, and for a corrective to the evil of the growing tendency to specialization. The infusion of the historical spirit into all departments of thought is one of the most striking features of the intellectual side of the age. A more particular reason, recently emphasized by the President of the Royal Society, Sir F. Gowland Hopkins,[1] is that Oxford provides a unique and a natural centre for the study of this History, on account of the age-long participation of her alumni in scientific progress and learning, and of the prestige of her modern schools of science, medicine, and engineering.

The activities of your new Reader are badly cramped by lack of space and time. To the need for more space I shall return later. It is a pressing need that is remarked by all visitors to our Museum, and one which will, I hope, command the effective sympathy of every one here, for given that small amount of extra space which a Committee of the Hebdomadal Council has recently recommended, Oxford will have the opportunity of honouring herself by honouring her great sons

[1] Celebration of the 250th Anniversary of the Old Ashmolean, May 22, 1933. See also 'History in Science', *Nature*, June 3, 1933.

of the past, by conserving instead of destroying the history of their work.

The time difficulty is not less acute. Your Reader reached the retiring age twenty-three days after his appointment. An excuse for prolonging his tenure of office is that although a younger man can put more of the fire of youth into his talks, an older man has the compensating quality of a longer memory. What Histories of Science might not Methuselah have been able to relate had he survived but a few years longer?

Memories of essential matters have often been too short, and not only in Oxford. For instance, under the patronage of Frederick II the finest astronomical observatory in the world was erected for the great astronomer, Tycho Brahe, at Uraniborg. There James VI of Scotland visited him. Fifty years after Tycho's death an admirer, M. Huet, on a pilgrimage, found that the Castle of Uraniborg had been levelled to the ground: traces of walls were not easy to discover. The inhabitants, even the pastor of the Church, had never heard of the name of Tycho, or of Uraniborg. One old man only, who had been a servant in his family, and had wrought at the building, recollected these names!

If the more noteworthy of landmarks of the History of Science are so quickly lost and forgotten, is it surprising that in modern Oxford, undergraduate memories should be so short? or that the new experience of one generation should become the immemorial tradition of the next? only to be superseded by quite another belief in the third generation? Perhaps this explains why some Reformers and New Group Leaders have no use for History.

There is one other point. The ideal for a Professor is that he should be *teitama*. I am not quite sure whether the same quality applies to a Reader. According to the Dictionary, 'teitama' has three progressive meanings in Mangareva. 1. To be grown up. 2. To take care of the house, i.e. to be he-head of his house. 3. To be lazy, or idle.

For a time I hope to strike the happy mean. To take care of the House, i.e. your Museum of Science, and not to be too idle. Meanwhile the appointment of an old man may have its compensations. It is a great honour to the man, and the period before a successor is required will be brief.

But I can at all events recall some of the steps by which our present position has been reached.

Preachers of University Sermons in Oxford preface their remarks with a bidding prayer in which benefactors are held in grateful remembrance. May I crave your patience while I follow so excellent a precedent?

1. Firstly, do I remember the best of fathers, ALBERT GUNTHER, who more than any other single man in his time encouraged the enrichment of the national collections of scientific objects in the British Museum. No well-balanced history of Zoology in the nineteenth century can be written without reference to his work.

2. To THOMAS HARCOURT POWELL of Drinkstone I owe early encouragement in practical chemistry and practical mechanics, which none of my schoolmasters could have imparted.

3. To RAY LANKESTER, at his best when at University College, London, I owe the most enduring part of my scientific education.

4. I can never forget my early life at Magdalen College, nor my tutor, EDWARD CHAPMAN of Merton—not eminent as a man of science, but most lovable of men. To his tutorship I succeeded, though not equipped with his great humane qualities.

As science tutor at Magdalen an historic institution of unique interest came under my direction. The College Museum and Laboratory had been erected in 1848 by

Dr. Daubeny, one of Oxford's great and most loyal of sons, a man who by his vigorous enthusiasm, by his unremitting zeal for research, by his unselfish example, did as much and more to lay the foundation of our schools of science than any one of his contemporaries.

Unlike his friends, Lyell and Darwin, he did not leave his university to carve out an immortal name in the wider world. He lived all his life in Oxford, devoting himself to her needs, teaching, as occasion demanded, a variety of subjects, continually adorning his lectures with the fruits of his own researches, patiently suggesting investigations and amassing material in the hope of helping on the researches of others.

For thirty-two years, by his analytical researches when Aldrichian Professor of Chemistry, he advanced the sciences of Geology, Agriculture, and Vegetable Physiology. When Oxford needed a Professorship of Rural Economy no one could be found to fill it with more acclaim than Dr. Daubeny. For a quarter of a century he worked and lectured to large classes in the Old Ashmolean Building in a fine room that is again required to serve as one of the public rooms of the University. Among the audiences that there attended his chemical lectures we meet with such unexpected names as those of Pusey and Mark Pattison; of Tait, Whately, and Thomson, the future archbishops of Canterbury, Dublin, and York;—and at a later date the names of Ruskin and Acland. We may well believe that the good seed sown by Dr. Daubeny in these lectures at the old Museum, germinated in the fertile minds of many of his listeners, though in none perhaps with more happy results than in the case of his pupil John Bennett Lawes of Brasenose College, who transferred Daubeny's Oxford Garden Plots for Experimental Agriculture to his family acres at Rothamsted, there to found the famous Experimental Station. There in Hertfordshire Daubeny's method for the scientific treatment of agriculture has been continued through several generations, and, vastly extended, has come to acquire world-wide importance and renown. A further claim to the gratitude of posterity may be based on the leading part that he took in the foundation of the British Association; and his Presidency in 1856 was remembered in 1926, when another member of his College, the Prince of Wales, succeeded him in that office.

Just 100 years ago Dr. Daubeny became Professor of Botany and rejuvenated our venerable Physick Garden, stocking it with new and rare plants, providing new hot-houses, a new museum, and a real live teacher who lived on the spot and there entertained his friends and visiting savants. If it be good for heads of colleges and schools to live near the scenes of their labours, it is no less advantageous for the heads of institutions. But the town planning of Oxford has made this ideal less easy to realize than in Dr. Daubeny's day. Daubeny, as his library and life work show, well knew the value of historical studies. He wrote of the Agriculture and Plants of Ancient Greece and Rome, he published a History of Volcanoes and Earthquakes. That was the man whose epoch-making collections I desire to save from ruin and neglect.

In 1848, with the joint approval of the University and Magdalen College, Daubeny removed his physical, chemical, mineralogical, and geological collections from the Old Ashmolean and set them out in a new building, paid for by himself, between Magdalen and the Botanic Garden, erected and furnished to serve the threefold purpose of Lecture-room, Museum, and a modern Laboratory.

The move to the Botanic Garden gave him greater proximity to his botanical work, and—as he fondly believed—a sure repository for his valuable collections. Trustingly he bequeathed an endowment for its upkeep. Much of the chemical and physical apparatus that he moved, was older than his professorship, and dated from the second half of the eighteenth century. Much of this has been destroyed by workers in the laboratory. How important a part the Daubeny Laboratory had played in the history of Oxford science, I did not in my young days realize. I now know that it preserved the only material evidence as to the methods of a very important epoch in the history of Science in Oxford, including our only links with the work of Sir Humphry Davy, Faraday, and others of the great pioneers who immediately preceded and illumined the opening of the Victorian era. Were it to be assembled and properly, intelligently exhibited, as it might easily be, Oxford could boast a period collection of scientific apparatus, which added to those which we already show, would make a series unequalled in any other university in the world.

When we have it in our power to do a good job better than other people, surely that job is worth doing.

So far as my moderate powers go I have endeavoured to follow in Daubeny's footsteps.

My tutorial office gave me access to his geological collections. It grieved me to see them lying idle and unused. The opportunity came to me to continue and extend his geological work on Volcanic districts, and that of Lyell, in Italy, and especially to measure the changes in the relative level of sea and land which have taken place within the historic period. For this purpose I collected a library of books not accessible in Oxford collections. Lord Rosebery and other friends had given me special privileges and facilities which no one else can have again. Between the years 1897 and 1914, I surveyed the entire coast-line of Italy, amassing much unpublished historical and geological material in many vacations, till the outbreak of the War put a stop to my travels. Until the end of the War an essential portion of my material was housed with the Daubeny Collections next my private room. In 1920, with the intention of helping me to bring my twenty years' work to a finish, Magdalen College retired me from my tutorship and elected me to a Fellowship 'to *continue* and complete the investigations already commenced on the archaeological and geological changes of Level in the Mediterranean Basin'.

The College was doubtless influenced in its decision by a strong recommendation from the veteran geologist Sir Archibald Geikie.[1] Unfortunately, when I was within sight of satisfactory completion of my projected monograph the College evicted both myself and my materials from the room that I had occupied for years, and from the very building that Daubeny had furnished for such researches as my own. The stipend attached to this temporary Fellowship, which ceased in 1927, was poor compensation for the destruction of what I had hoped to make the most important work of my life and worthy of Daubeny and the College. I do not like to use the name vandalism in connexion with Magdalen, but I think it. The greater number of my former colleagues who took this remarkable way of dealing with a research, injuring the work of others as well as of myself, and one that promised results not only of historical but of great practical utility to mankind, have died, or are no longer with us. A few still remain, and it is from them and their friends that opposition to our Museum for the History of Science still comes.

But to turn to a more pleasant side of my subject. I have good cause to thank the University for having

[1] See Appendix A.

enabled me to make a new start in life as Curator of the Lewis Evans Collection. I also hope that the University and the College will now get together so as to help to save from the wreckage at Magdalen many objects of the greatest historic value both on account of their rarity, and association with the great men of Daubeny's generation. I am now, I believe, the only person living who is intimately acquainted with them. The ship is sinking and the time is short.

History of Science in Oxford

Members of all Colleges have made some notable contributions to the History of Science. I will but mention the work of several of my friends and pupils at Magdalen, with which I am naturally best acquainted. The History of Medicine has benefited by the scholarly contributions of Dr. J. F. PAYNE, himself a pupil of Daubeny's, and of Dr. H. P. CHOLMELEY. BURDON SANDERSON and Sir FARQUHAR BUZZARD, both Regius Professors, have always appreciated the value of the historic approach. To F. P. ARMITAGE, now Director of Education in Leicester, we owe a helpful History of Chemistry. Professor JOHN FULTON's work on Robert Boyle is known all over the world, and Dr. CHARLES SINGER, by his many and varied Studies in the History and Method of Science, has justly earned a unique position for himself. In 1931 he became President of the International Congress for the History of Science.

It was exactly twenty years ago that under his leadership a little band of workers were granted as an experiment the use of a bay in the gallery of the Radcliffe Camera, where books could be reserved for special studies in the history of Science. Dr. Singer paid into the fund of the Bodleian £500 for this concession.

By the end of the first three years much valuable work had been accomplished. Professor RAMSAY WRIGHT made a study of a Persian medical manuscript; Professor William Libby of Pittsburg prepared an admirable *History of Science*; Dr. E. T. Withington studied Greek medical writers; Miss Westland and Mr. Reuben Levy worked at Italian and Arabic medical manuscripts; Dr. J. L. E. Dreyer, the distinguished historian of Astronomy, edited the Opera Omnia of Tycho Brahe; Miss Joan Evans researched on medieval lapidaries; and Dr. Singer produced his *Studies in the History of Science*. Sir William Osler himself stated that he had found the science history room of the greatest convenience: 'it is most helpful to have easy access on the shelves to a large collection of works on the subject.'

The History of Science, as other history, has here repeated itself. Two and a half centuries earlier, literature and valuable manuscripts dealing with the science of an older day had been collected by Elias Ashmole. Much of it had been derived from quarters and persons of dubious reputation, from Dr. Dee, Lilly, and Booker, from the dens and purlieus of alchemists and astrologers. But none the less valuable as records of past science, and Ashmole knew it. This collection, augmented with what he described in his will as 'books of controversy relating to religion', did not reach Oxford until close on ten years after the opening of the Old Ashmolean building as a scientific institution in 1683. With the scientific library of Martin Lister, and the less scientific library of John Aubrey, Ashmole's books were housed, catalogued, and studied in a separate room for two hundred years. Charles Burman writing in 1717, affirmed 'that they let us into the secret History of the Affairs of their several Times: Discover the Springs of Motion, and display many valuable, though minute Circumstances overlooked, or unknown to our general Historian, and to conclude all, satiate our largest Curiosity'.

Without endorsing this last sentence, we can at any rate with truth acclaim the old Ashmolean Library as one of the most celebrated historical libraries in the world, quite as famous as the Physic Library, founded in 1737 by Dr. John Radcliffe. This, though primarily intended for modern works, has now also become a most valuable source for the study of certain periods of the History of Science.

Need for a Departmental Library

In Oxford, of all places, there ought to be no occasion for stressing the necessity of independent collections of books. It is a need that has been felt in all ages. Pious benefactors innumerable have bequeathed scientific libraries, rows of books, and single volumes for this very purpose, yet owing to the absorption of their gifts by larger units, the individuality which was the mark of the collection has too often been lost. Usually the books have got scattered among other volumes; whole collections have occasionally been transferred from the one institution to which they were given, to another which the donor distrusted, and in one case have even been sent away from Oxford to another University. This is not the way to encourage a study. In Oxford there are useful books in plenty, but I do not think I can point to any one collection that is wholly suitable for our purpose.

The Bodleian collections suffer from their immensity, lack of arrangement, and difficulty of access. The College collections, though containing many very valuable items for study and research, have mostly not been graded for rapid demonstration, but they have the great advantage that volumes can be lent out. The unsuitability of Library arrangements was realized by Sir

William Osler, and it was for that reason that he advocated a separate Science Room for special historical studies.

Had there been a permanent centre for historical studies such as the one which a Committee of Council has recently blessed, it is certain that Osler's wonderful collection of books on the history of medicine, collected largely in Oxford, would never have left England.

The teacher of the History of Science, as of Art, needs books ready at hand for reference and to show to his pupils. To avoid waste of time the chosen books must also be ready at hand properly arranged. An excellent principle of selection was the one devised by Sir William Osler himself. He separated from his main library a first section, or *Bibliotheca Prima*, comprising a small number of works chronologically arranged in illustration of the essential literature of the progress of science. This first section included sixty-seven authors only, beginning with Hippocrates and ending with the nineteenth century. As Dr. Francis has told us, Osler tried particularly to obtain the fundamental contribution in each subject, whether this was represented by a great Aldine edition like that of Aristotle, or a ten-page leaflet of Röntgen. To a second, and far larger, section he relegated the books of authors not classed among the original works of the pioneers.[1]

Modern books about Early and Oriental Science, Biographies, and Bibliographies he considered are best kept by themselves. But they must be visible. A student, by becoming familiar with a well-planned arrangement of select books on shelves, can learn a lot, far more than he can assimilate from alphabetical entries in card catalogues. Position is of the greatest importance, and a Librarian should always be able to give a reason for the position of every volume on his

[1] *Bibliotheca Osleriana*, 1929.

shelves. Books that are permanently moored in an incongruous anchorage are a loss to learning.

Museums, too, need special books of reference.

The Lewis Evans Library is particularly rich in books dealing with the Dialling and Mathematical Instruments in the founder's collection. But it must be extended as the scope of the collections widens. Chemical and Physical apparatus, Microscopic, Telescopic, and other Optical instruments all have their own appropriate technical histories, which are as essential as catalogues to the coin or stamp collector. We need literature dealing with the history of the separate Sciences; with scientific institutions, schools, or localities, with the lives and letters of individual men of Science. The biographical section should be fairly strong and may be helpfully illustrated with a collection of engraved portraits. For this adjunct we are greatly indebted to a generous gift of engraved portraits, duplicates from the Hope Collection.

But of all aids to study, however indispensable, none have ever appeared to me as stimulating to further study and research as the original writings and contemporary publications of bygone men of science, Association books especially, libraries formed and used, by workers themselves.

When the Old Ashmolean was built as an institution for the furtherance of scientific study, scientific researchers and benefactors equipped it with books of great historical value. Such were the Departmental Library of Dr. Plot, our first Professor of Chemistry, the Scientific Libraries of Dr. Lister and others, all of the greatest interest and value for illustrating science in Oxford of the seventeenth century. Similarly the Savilian Professors drew on the libraries of Savile, Wren, and Bradley. Most serviceable was the private collection, made a century ago by our Professor of

Natural Philosophy and Savilian Professor of Astronomy, STEPHEN RIGAUD, Oxford's last and most competent historian of Science; and for the preservation of this in its entirety, I have appealed. It is in the custody of the Radcliffe Trustees. It is the collection which above all others is most suited to our present needs. That such books may be put to real use, and not be treated merely as bibliographic samples or rarities is surely in the highest interests of all concerned. I earnestly request that the department of the History of Science shall be allowed both the shelf-space for, and the power to arrange and exhibit to students a library of its own.

The Three Periods of the History of Science—Palæosophy, Philosophy, and Neosophy

The History of Science may be divided into three great periods, which I designate by the words Palæosophy, Philosophy, and Neosophy. To the earliest period of *Palæosophy* belong those somewhat shadowy cultures that fade away into the mists of antiquity in Egypt, Chaldea, the East, and elsewhere, where all great achievement is associated with caste, and cannot with certainty be attributed to any individual. Everything is impersonal or deified.

To those who ask 'Of what good is all their bygone science?' many answers have been given. I would only add that it is not dead.[1] Palæosophers are still rampant in Equatorial Africa. In the Lewis Evans Collection we exhibit the books and compasses of Chinese Geomancers. The knowledge of such things

[1] The following quotation is but one of many recent instances that might be selected to illustrate our point:

'Every astrologist knew when this year began that it was going to be notable for disasters. The chief reason was an eclipse of the sun which took place on August 10, when Mars and Saturn were almost exactly on opposite sides of the sun.' *Daily Express*, Oct. 1, 1934.

is necessary to administrators and missionaries if they are successfully to harmonize the practices of centuries with modern custom. Even in partially civilized communities, such as our own, votaries in degraded form are always lurking, ready to revive the practice of Black Magic and discredited Medicine; and if we do not now burn witches, as was once customary, we fear their power sufficiently to shield ourselves either by amulets, or by laws and police protection.

In striking contrast is the succeeding or middle period of *Philosophy* of the Greeks. The early Greeks of Asia Minor, whose minds, as has often been said, were as clear as the skies under which they lived, undoubtedly derived inspiration from the perfect setting of their dwellings by a sea eternally young. Through their insatiable desire to question the true meaning of all natural phenomena, and to give rational explanations, these first masters of science have earned crowns of immortality. Such men were Thales of Miletus (b. 625 B.C.), Leucippus (fl. 435), Pythagoras, Plato, and Hippocrates. Later came Erasistratus, Euclid, Apollonius, Eratosthenes, Aristarchus, and Hipparchus—Philosophers, living under the enlightened rule of the Ptolemies. They have helped our minds to work by the clarity of their own. They no longer attributed discoveries and inventions to the Gods. In every case the name of the individual Philosopher is immortalized by his method and work. Archimedes has perhaps left the deepest impression on the popular mind, for he laid sure foundations upon which much modern science firmly rests.

This Hellenic Period of *Philosophy*, reckoned from Aristotle to Vesalius, lasted 2,000 years. It is subdivided into a first shorter period, when great advances in science were made, and a longer later period, devoid of notable advances, when much energy was consumed in discovering, reading, translating, glossing, and commentating on the texts of the Greek Philosophers, and of then re-reading, retranslating, and re-reading them again.

The effect of this intensive cult of early writers may be illustrated by reference to the History of Medicine. In the ordinary practice of any good physician before the days of Sydenham, when a patient came complaining of a pain, the remedy prescribed was not based on recently confirmed experiments and demonstrated arguments, but on translated words in ponderous tomes, the older the better. A physician would undertake what our literary friends call 'original research', that is, he would take down volume after volume from his shelves to find out what Hippocrates, or Galen, or Razes, or Constantine, or Avicenna had to say about the matter, and as commentators upon these authors usually had a great deal to say, the patient might die before the right page was reached. Such a reference library was so highly valued by one Elizabethan physician, Nicholas Gibbard, that he bequeathed his 'row of Books' to Magdalen College.[1] There they were scattered by college librarians, but collected by myself, you can see them there again in a row, an historic exhibit of the first importance. How unlike the method of Radcliffe, whose medical library consisted of a few bottles and a skeleton.

I think you will agree that without books there can be no History of Science of these 2,000 years. If your Reader is to refer to this Philosophy, he should have a selection of the scientific works of the greater Hellenic and Arabian writers, ready of access on his shelves, at least to show to students.

The third great period is the modern period in which we are now living. It resembles the Hellenic or Period

[1] *Annals of Medical History*, iii, p. 324, 1921.

of Philosophy in that great advances are attributed to particular individuals, but it is distinguished from it by the universal adoption of the Experimental Method. Adopting the old motto *Sine experientia nihil sufficienter sciri potest* of Roger Bacon who foresaw its coming, it was argued into life by Francis Bacon; it was based on sure foundations by those champions of experiment and observation, Vesalius, Gilbert of Colchester, and Galileo. To their Experimental Philosophy we give the shorter name *Neosophy*, and the world has still no more potent method of inquiry or advance. This Neosophy has changed our outlook more than any other form of wisdom, and every day we read of how it advances from strength to strength.

History records that the pursuit of Experimental Science used to be a hazardous adventure. Roger Bacon, its prophet, made many records; he 'was perhaps the first of the long list of the victims of ecclesiastical persecution'. Kepler was rewarded by ill health, worry, and poverty. Galileo suffered the mental agony of a charge of heresy. Priestley had his house burnt down by a mob. Lavoisier was sent to the guillotine, because the French Republic had no need of Science. Many took their misfortunes with extraordinary calm, as for instance Malpighi, who, when he had all his pictures, books, and manuscripts burnt through the negligence of his old wife (1684), was visited by Tancred Robinson. 'I saw him in the very heat of the calamity, and methought I never beheld so much Christian patience and philosophy in any man before; for he comforted his wife, and condoled nothing but the loss of his papers, which are more lamented than the Alexandrian Library or Bartholine's Bibliotheca at Copenhagen.'

These early Neosophers, martyrs of their new teaching and beliefs, would have had some reward, could they have read the pregnant address by the Bishop of Rochester, Dr. Spratt, to King Charles II. 'Of all the Kings of Europe, Your Majesty was the first who confirm'd this Noble Design of Experiments, by your own Example, and by a Public Establishment. An Enterprize equal to the most renoun'd Actions of the best Princes. For, to increase the Powers of all Mankind, and to free them from the bondage of Errors, is greater Glory than to enlarge Empire, or to put Chains on the necks of Conquer'd Nations.'

It is especially with the work of the Oxford pioneers of science who read Philosophy and who practised Neosophy that we require the use of books, both old and new. But let us never forget that 'Learning, as with water, is never more fair, pure and simple than at its source'. Experiment and instruments come first; only when these fail, is it to books that we must turn.

The Study of the History of the Natural Sciences may be recommended as a fascinating study, delightful because the fields are large and have not been exhausted by over-cultivation. The fields, moreover, are divided by inviting hedgerows and running brooks. In one such fertile borderland between chemistry and physics, were sown the seeds of Photography, at first but a hedgerow hybrid, now the most valued of all the beautiful arts of science.

Everywhere we find that the value of the historic approach is being more and more recognized, whether in the form of historical chapters to Science books, or of scientific appendices to History books. The recent Exhibitions of the Age of Charles II and of Elizabeth, Exhibitions of Persian Art, and the like, were not considered complete without contemporary scientific exhibits. The same lesson is more forcibly taught by the ever recurrent Centenary celebrations, whether of institutions, or of great men of old, Napier of Merchiston, Galileo, Newton, Faraday, Trevithick, and others. Every one is having his turn. Inventions too, such as Photography, or great scientific discoveries are similarly honoured. For the discovery of Quinine, Britain, as Sir Humphrey Rolleston has reminded us, has had more cause for thankfulness than any other nation; yet the disability and loss of life due to malaria still cost the British Empire £52,000,000 a year. In India alone malaria is responsible for 1,300,000 deaths.

Even in the up-to-date résumé of that most modern of the applied sciences, the science of Aeronautics, the miracle of flight, which was so admirably set forth in the recent *British Air Number* of *The Times*, the greater number of the articles began with historical introductions. The parachute, for instance, was traced back to the fifteenth century. As one of the advertisements tersely put it, 'The story of flying is a chronicle of creation—the building of something out of nothing'.

That the History of Science may also prove a fertile study it is necessary to pay heed to the lessons of the past. The pastures of our Alma Mater have not always been suitable for the healthy growth of her latest-born infant, and we would now suggest that some changes of diet might be tried with advantage to both mother and child.

The 'raw' materials for a healthy dietary are:

i. Dated and Documented Instruments for Experiment and Observation.
ii. Historical Collections of Specimens, including Chemical and Medicinal Preparations and Objects of Natural History.
iii. Books, papers, and reports about Men, Sciences, and Instruments.

In short, our needs are a *Science Museum* and a *Depart-*

mental Library, both as essential as a feeding-bottle to an infant, or a laboratory to a Chemist.

Losses and Depreciation

It is most distressing to think of the great number of important discoveries that are not, and never will be, represented by original instruments. If only a tithe of the care that is taken in publishing the results had been taken of the instruments of research, we should not now lack information as to the methods of some of our greatest men of science.

We have nothing original to show of the experimental work of Boyle, Hooke, Mayow, Lower, or Harvey. Historical evidence of the first class has been destroyed. Without such evidence the attribution of a discovery may cease to be scientific history, and may become a myth. It is for the want of contemporary material, evidence that the printed page can never give, that much of Bacon and Shakespeare, of Moses and Homer has ceased to be history and has become mythical. I need not stress the supreme value of original instruments or specimens. For example, no extant book by or about Roger Bacon can settle the question as to whether he could or could not have made and used a telescope. The claim to the invention of the compass cannot be decided by flowery passages about the 'guiding arrows' of Chinese Emperors. Instruments are easily destroyed. The average expectation of life of an old instrument is not great. After having been kept with all due respect for generations in the laboratory or by the family of the experimenter, they get cast aside unnoticed and so are lost to the world, a younger and less well-instructed generation having forgotten their importance.

In Laboratories they are particularly liable to mutilation or disfigurement. Even Professors, carried away in their enthusiasm for the work of changing, producing, or creating, and feeling a sudden call for some small additional apparatus, rush to the cupboard of old instruments, seize the nearest that can be readily dismembered, and unscrew or wrench off any portion that will serve their turn. Needless to say, restitution is never made and the amputated instrument, especially if dusty, becomes sufficiently degraded for the scrap-heap.

Many a time the author of a first discovery has himself mutilated his own invention in order to follow up another matter of quite secondary value. The original or type-piece has gone for ever.

Small and delicate apparatus is not the only thing to suffer from the hand of the Vandal. He is equally effective with big things. He had to work hard for his wanton and almost unbelievable destruction of the old Castle Mill. It was Oxford's oldest application of practical engineering science, harnessing the powers of nature to the need of man, built, or more probably found already at work, by Robert d'Oilli, the first Norman Governor of Oxford, who ordained that one half of the city wheat should be ground in it, and pay tax to himself. Renewals, like those of water in an ever-running river, had taken place in its thousand years of history, but the immemorial barrage of the water at that spot, and the venerable foundation of the mill should have been preserved as a notable civic monument.

So in our sphere of educational Science, we deplore, through the fault of others, the loss of the Historic Air-pump of Hooke and Boyle—for many reasons the greatest achievement of any Oxford man.

Scientific instruments of past centuries teach many lessons that cannot be learnt from books. Before the advent of the Lewis Evans Collection, no one in Oxford had seen, much less had any idea of, the perfection of the craft of the scientific instrument-maker at the time of William the Conqueror, or in the thirteenth century, or even in the seventeenth. All old instruments are hand-made, bearing in their exquisite design and finish the hall-mark of ages when beautiful work was done with home-made tools, when the artisan put his mind as well as his skill into his task, when no two articles were exactly alike. Every piece was made just a little better than the one before. These old instruments still serve as useful models for raising the standard of suitability and beauty even of modern tools.

To stay the corroding hand of time, some have been covered with gold. They may truly be affirmed to belong to the Golden Age of the Scientific Instrument-maker.

By long series it is possible to compare the various forms of instruments used for similar purposes in different countries and by different experimenters. It has repeatedly happened that the so-called obsolete instruments of one age have been revived in another and given a new lease of life. Let us preserve in this mechanized world as much as possible of the little differences of design and decoration, the sources of novelty.

The preservation of that historic locomotive, the 'Rocket' of George Stephenson, has given pleasure to tens of thousands of our people. Its sturdy frame is an example of how the strong can take care of themselves. It is for us to care for the weak and the feeble.

Is it not a special duty that we owe to our University to preserve the scattered evidences of the good work of our predecessors, and of the instruments used in their researches? Are not such evidences as worthy of preservation as are the flints and potsherds of prehistoric man? It is a duty we owe to posterity. For these original evidences are possessions not of a day, but for all time. Steps must be taken to save them from the destructive inactivity of ignorance and the activity of deliberate vandalism.

I have laboured to provide scientific memorials to our great alumni, of greater reliability and in greater profusion than those which we have inherited from the past.

In this task of conservation for the benefit of future historians I desire most gratefully to acknowledge the sympathy and assistance I have received from others. Colleges and Institutions alike have helped to make the collection a success. Especial thanks are due to the Friends of the Old Ashmolean and to the City Companies without whose financial help we might never have started at all.

With but a single and very justifiable exception, every College in Oxford possessing scientific objects of historical interest has contributed them.

The Colleges of Balliol, Oriel, Queen's, New College, All Souls, Magdalen, Christ Church, and St. John's have sent exhibits which mutually illustrate one another in a notable manner.

From University Institutions have come contributions from the Proctors, the University Museum and Observatory, the great Museum Departments of Chemistry, Experimental Philosophy, Electricity, Engineering Science, Human Anatomy, Zoology and Comparative Anatomy, Geology and Mineralogy. Also from the Hope Curators of Engraved Portraits and from the Radcliffe Library, before it became a branch of the Bodleian.

The external corporations of the Royal Society and the Royal Astronomical Society have materially helped, as have also the Radcliffe Trustees, who still have it in their power to place our young department on a really first-class footing.

As far as the work of the greater luminaries is concerned, I have, with the assistance of the Friends of the Old Ashmolean and others, been fortunate in having secured original and personal pieces of apparatus or specimens in the museum, connected with Henry VIII's first professor of astronomy, Nicholas Kratzer, John Blagrave of Reading, Archbishop Laud, Humphrey Cole, J. Tradescant, Edward Lhwyd, Lord Orrery, James Bradley, Hadley, Gowin Knight, Priestley, Sir William Herschel, George III, Earl of Lichfield, William Smith, father of British Geology; Daguerre, Fox Talbot, Sir John Herschel, pioneers of photography; James Sadler, father of British Aeronautics, Sir Humphry Davy, Faraday, Josiah Wedgwood, Brunel, J. Jackson Lister, James Ferguson, Baron Liebig, Dr. C. Daubeny, Darwin, Lord Lister, Sir Henry Acland, Sir Ray Lankester; and many others who are represented by pictures or models.

The greater number of these specimens are unique: if lost could not be obtained again. I know that given a little more space I could have obtained much more of value, and again I have the uneasy feeling that the space has not been forthcoming because it is being occupied by hundreds and thousands of printed books which are unwanted, or but seldom wanted, duplicates or editions of books already in the University Library.

Of many of these unwanted books it may be said that if they were lost, they would rarely be missed, and should they ever be required, replacement would not be difficult. Of unique, original pieces of scientific apparatus, this is unfortunately not the case. An opportunity of acquisition, seldom or never returns.

We have also exhibits of another kind: the rough-hewn, makeshift contraptions of the inventor in a hurry. Often the burning desire to see whether his idea will work has consumed all thought of art; concentration is given to providing the essential structures, and these have, as often as not, been thrown together from some other dismembered thing. There has been barely time to smooth off jagged corners, let alone for any final polish. If the model works, it is good enough, the maker must be away after something else. Life is short. But the greatest inventions have often sprung from junk such as this. The rough first models are then of the highest interest. Some of Faraday's crude early appliances are among the greatest treasures of the Royal Institution. But how rarely first essays are kept. Once they have served their turn their creator is prone to adapt them to other purposes.

While on this theme may I recall Mr. PENDRED's eloquent address concerning the inventions of Trevithick, father of the locomotive. All his steamboats, his boilers, his pumps, and other things, are, he said

'now of no account. The tide of invention has swept over them. Precious and dear to the memory, but all sunken; not reclaimable, not useful any more;

> "Wedges of gold, great anchors, heaps of pearls,
> Inestimable stones, unvalued jewels,
> All scattered in the bottom of the sea."

No inventor will turn to them for inspiration. Dead things. Drowned things. Swept over by the vast flood of invention which broke all barriers soon after Trevithick had gone to rest, and still sweeps onwards. You may see them in the Museum now. Toys; antiques; quaint relics. Valueless things. . . . And yet, not valueless if they bring back the gift of Wonder to an age that has ceased to be surprised at anything. And if we can only wonder, we shall pay the greatest tribute of our praise to Trevithick. We shall wonder how a man with so little knowledge, so few opportunities of learning, such poor means of achieving, yet wrought from his brain things that no one else could think of, could make. It is not enough to think, one must do too. . . . Thinking is not enough; it is the men who hammer their thoughts into realities that matter to the world. That was the way of Trevithick, the Cornishman.'

And that is why we know that the assemblage of objects to illustrate the work of Oxford Men of Science in a building of notable scientific achievements in Oxford has been worth while.

Science Museums

If it be agreed that the preservation of historic instruments and specimens that are associated with men of outstanding eminence be desirable, then there can be, I think, no doubt that the study or laboratory, in which the experimenter worked, with carefully chosen incidental surroundings and local colour, would form the most appropriate and popular setting for his work. But in the case of a University, except in very special cases, this is not possible, and a Repository for Storage with an Historical Museum for exhibition, affords the best solution to the problem.

The idea of what is now generally called a 'Science Museum' is not new. It is certain to have occurred to the scientifically-minded Alexandrine Greeks, whose instruments were kept in their famous Library. Cabinets of philosophical apparatus were among the valued treasures both of the Italian Academies and of Teutonic Princes.

When Sir Thomas Bodley refounded the Oxford library, as an 'ark to save learning from deluge', he made special provision for students of the history of science by endowing it with an armillary sphere, an ancient and magnificent quadrate, and other scientific apparatus, to which later benefactors added astrolabes. Bodley's thought for scientific studies is shown in 1605 by the lists of medical works added to the catalogue 'by his special desire'. As our plan for founding a Museum for the History of Science near the Bodleian has been strenuously opposed by the Bodley's late Librarian, it is reassuring to note that Bodley himself considered navigational instruments to be necessary in Oxford to save his ark of learning from deluge.

A repository for essential instruments was allotted to the SAVILIAN PROFESSORS of Astronomy and Geometry, who from 1619 to 1834 occupied the Savile Study next the Bodleian, and kept there a variety of instruments listed in the Bodleian Catalogue of 1697. WREN and WALLIS helped on the good work by contributing their libraries of mathematical and astronomical books, many even then only of historical value, for the use of Savilian Professors in the Savile Room.

London too felt the need for a scientific repository as an adjunct to a Scientific Institution at Vauxhall. In 1649 CHARLES I 'designed Fauxhall as a place of resort for artists, mechanicks etc. and a depôt for models and philosophicall apparatus'. There 'experiments and trials of profitable inventions should be carried on', which, wrote Hartlib in a letter to Boyle, 'will be of great use to the Commonwealth'. Ten years later the noble-minded JOHN EVELYN of Balliol planned a Philosophic-mathematic College on a still more lavish scale to which harassed men of learning could retire for quiet communion with their fellows as well as to continue their studies. In it he planned 'an elaboratory with a repository for rarities', and made a great attempt to persuade Robert Boyle to become the first Principal.

Yet another scheme was worked out in the fertile brain of the poet COWLEY. He contemplated 'a keeper of instruments, engines, etc.' to increase the utility of his Philosophical College for weighing, examining, and proving 'all things of nature, delivered to us by former ages', and thereby of recovering 'the lost inventions, and, as it were drown'd lands of the ancients'. For thus will all arts which we now have, be improved.

It was only natural that when in 1662 the Council of the Royal Society pondered schemes for the improvement of Natural Knowledge with the special design of separating superstition from truth, a Repository for Instruments and Specimens was found necessary.

Important series of instruments and engines of all kinds for the examination of the nature of bodies, optical, chemical, mechanical, &c., were got together by the indefatigable Robert Hooke of Christ Church; a handsome collection of rarities made by Mr. Hubbard was also purchased for £100—a considerable expenditure for the young society. Wren and other Oxford men realized that neither books alone, nor legal documents, were sufficient evidence on scientific matters. Elsewhere other societies imitated the Royal Society. The building of the Old Ashmolean was the outcome of a similar aspiration. The Philosophical Society of Edinburgh and doubtless the Dublin Society had similar repositories, and even little Spalding, the home of a provincial scientific society patronized by Newton, had its Air-pump, Microscopes, Thermometer, and Barometer, which have survived to this day.

The Royal Society Museum, catalogued by Grew in 1683, continued to be enriched by the addition of apparatus shown at the Meetings of the Society, and by natural history specimens such as those contributed by Sir Hans Sloane, the Hudson's Bay Company, and by other collectors. In 1781 other counsels prevailed, and the greater part of the contents of the Royal Society Museum was transferred to the new British Museum, though some of the specimens found their way to the College of Surgeons. For the instruments of science, however, the Principal Librarian could find no place in his National Museum—and to this day the British Museum has no department for Scientific instruments—so they remained in the custody of the Royal Society, suffering losses which in the course of years have been regrettable.

Recently, the last few surviving relics of past glories were handed over to the Science Museum, three or four minor but welcome pieces being offered to Oxford for our Historical Museum.

Educational Value of Science Museums

The educational value of the modern Science Museum has proved to be very great, and in London, and in the great towns of the north, Edinburgh and Glasgow, it is the general experience that properly equipped, properly arranged, and provided with competent guide lecturers, such Museums are enormously appreciated by the general public, as is shown by the visitors who pass the turnstiles, outnumbering by tens of thousands those visiting other Museums.

Carefully selected period or subject collections, chosen with regard to the *genius loci* have a special value, witness the local collections attached to the houses of eminent men, as for example to those of Shakespeare, or of Albert Durer, or of Darwin; or the larger collections formed by some great mercantile or industrial concern or government department, such as the Plantin press in Brussels, or the historic collection of Fire-making instruments of Messrs. Bryant and May, or the Artillery collections in Woolwich Rotunda, or the new Naval Museum at Greenwich; or again the Historical Medical Museum now in process of reconstruction on a comprehensive scale and with the widest compatible interests, by Sir Henry Solomon Wellcome.

The inspiring educational interest to which I have alluded is most keen when the local collections are concerned with the history of our own people, with the work of our own predecessors, with the circumstances under which they lived, with the homes in which they dwelt. The life of the people in general is appropriately shown in a Folk Museum, but the intellectual life of our great men, of our Doctors of Theology, Medicine, Law, and of Science is the especial duty of the University that has nurtured them. For the immortality of Theologians and Lawyers, ample provision is made where the shelves of their University Libraries groan under the accumulated weight of leather-bound volumes of controversial pamphlets and theses innumerable. But the work of the Man of Science or of Medicine is very imperfectly represented by his books. Even an intelligent academic public, and still more the man in the street, have been known to shrink from epoch-making memoirs hidden in scientific journals. For them the additional aid of the Science Museum is required.

If in all these cases, even of industrial concerns, exhibitions of historic specimens and apparatus has been acknowledged to be of great educational value, of how much greater value should a properly selected and arranged Science Museum have for a University? Surely a great University with a scientific history extending back for 600 years as Oxford has, is entitled to preserve and exhibit specimens of the only material evidence now existing of the work done by Oxford men in Oxford at periods when Oxford was the acknowledged leader in the world of science.

The last few years have been a favourable if a regrettable time for securing pieces of apparatus liberated through the break-up of the great country houses—houses where the Maecenas's of Science lived and worked, formed great libraries, encouraged chemical and astronomical research. Once distributed, their scientific treasures lose both history and value. And England is the poorer. When yet another First Folio Shakespeare goes west across the water, or is destroyed in a mansion fire, there is widespread grief, not always silent; but when a unique piece of scientific apparatus perishes, few know enough to care. It has happened only too frequently within the last decade that lack of space has led to Oxford's losing much of great and irreplaceable value.

It must not be supposed that every instrument acquired by a Science Museum will be of first-class educational importance: it might be were there no better to be had. Many will be passed over by the sightseer. It is the same with books, or with men. Not every holder of a College scholarship is more worthy of his prize than one who did not win the award, yet should a Faraday or a Stephenson be included in the list of winners, encouraged by some small offer from the state, a gift would have been presented to this country which would have been cheap had the nation contributed a million sterling to his production. So it is with scientific apparatus—some neglected specimen lying in a corner may one day suggest a design for the instrument for which the world has long been waiting.

At the present time there is an urgent need for wider diffusion of that accurate historical scientific background to illustrate the life that rich and poor alike have now to live.

Equipped with the means of displaying suitable exhibits the Science Museum becomes the most needed educational implement of the present day. It serves as an intermediary or interpreter between the research laboratories and observatories where original work of a delicate and advanced kind is being carried on, and with its historical background, can reveal to an inquisitive public the import of scientific work that is of necessity being carried on behind closed doors.

Within the ten years that the Lewis Evans Collection has been established in Oxford, exceptional changes in the national life and stress of the times under which we are all living have brought into being new departments charged with the preservation of objects of historic interest or aesthetic beauty. The rurality of England, the purity of her rivers, through the pauperization of their former protectors, are alike in jeopardy. Even powerful bodies like Societies for the Protection of Ancient Monuments or the Office of Works have found themselves powerless to prevent priceless panellings and carvings in wood and stone from being torn from their settings and sent to America. If such essential and well-known and appreciated objects be at the mercy of craze for improvement or desire for pecuniary gain, how much more vulnerable are the relics of ancient sciences that are dependent upon their historical associations.

The establishment of the Lewis Evans Collection amongst us has called a halt in the destruction of important apparatus, but much has been lost, and if the reasonable space for which the Committee is supplicating be not found, much more will be lost to us and to posterity.

It was Ruskin of Christ Church, our own Professor of Fine Art, who pointed out that the lost treasures of human intellect have been wholly destroyed by human industry of destruction. People talk of the scythe of Time, and the tooth of Time.

> 'But Time is scytheless and toothless; it is we who gnaw like the worm—we who smite like the scythe. It is ourselves who abolish—ourselves who consume: we are the mildew and the flame; and the soul of man is to its own work as the moth, that frets when it cannot fly, and as the hidden flame that blasts where it cannot illuminate.'

I repeat my plea, that destruction of valuable and irreplaceable historical material should cease; that the University in which they received their training, and the Colleges which they loved, shall unite in the common task of preserving the material and documentary evidences of the work of Oxford men of Science for the benefit of future generations; as an example to students and to the honour of our University.

To return to the point at which we started. Magdalen College and the Radcliffe Trustees have offered to provide the coping-stones ready hewn and shaped by Oxford's most loyal of sons, for the fine edifice of an Oxford Museum for the History of Science. The foundations were well and truly laid, not by Ashmole alone, so much as by his seniors, members of that historic group of Neosophers who brilliantly combined Experiment with Philosophy, who, requiring more ample space than Oxford provided, went to London and became the Royal Society.

The assemblage of the contents of the Museum has been, to use one of the catchy phrases of the day, a 'great co-operative enterprise', in which honourable parts have been taken by many.

We are proud to think that the work of the co-operators in Oxford has been attentively watched and appreciated not only in England, but abroad in America, and elsewhere.

Our good ship for the History of Science, almost complete with a library, is on the stocks. It is for the University to say how and when the launch shall take place.

OXFORD COLLEGES

AND THEIR MEN OF SCIENCE
THROUGH THE CENTURIES

1. MERTON COLLEGE, 1264 or 1274?

As the world should know, Merton has served as an admirable pattern for all other Colleges. The statutes given in 1264 by the Founder, Walter de Merton, have been copied by other Founders. They gave the right of self-government; the right to hold property; the right of choice of members; and the use of a common seal. Merton thereby became the nursing mother to secular clergy. She provided men for the professions, the civil service, medicine, and art. In a convent every one according to his rank helps to conduct the chapel services: in Merton special chaplains were charged with this religious duty, and thereby the other members of the College had the more leisure for their separate studies. Thus began a great reform in the position of the Oxford student. He became free from chapel service to work.

In those days the principal studies were the liberal arts, followed by Theology; but a story that is told of the Fellows and Henry III indicates that much time and thought was given to Logic and verbal quibbling. The Fellows, wishing to make a postern gate into Merton fields, sent three of their members to the King. The first of them asked for 'the making of a gate', but was at once interrupted by the second, that what they wanted was not 'the making of a gate', but 'the gate made'. 'No,' said the third, 'we do not wish the gate made, for if it were made, it already exists in the nature of things; and then we shall have a gate that is not our own; and so we shall wrong our neighbour.' Not unnaturally the King told them to withdraw until they should agree how to present their petition.

The success of Walter de Merton's plan was immediate. In a little more than a century Merton College sent out six Archbishops of Canterbury; the best training for physicians in England was to be had within its walls; the works of the Merton Astronomers acquired a world-wide reputation. The Oxford of the fourteenth century surpassed all other Universities in scientific attainment, and the credit for this was almost wholly due to Merton College.

The first mathematicians included THOMAS BRADWARDINE, 'Doctor Profundus', the Archbishop who advanced our knowledge of stellar polygons, ratio and proportion and loci in space; he died in 1349, and his *Geometria Speculativa* was printed in 1495; RICHARD SUICETH, 'calculator acutissimus'; and WALTER BURLEY. The preservation of the evidences of their work has been little short of a miracle. Not less than a cartload of valuable manuscripts are said to have been taken from the College library: they were ordered to be destroyed during the reign of Edward VI, as being profane if not diabolical, to be burnt or sold as waste paper. Fortunately, the famous mathematician, Allen of Gloucester Hall, was able to rescue a few of the more valuable scientific codices, which, passing into the possession of Sir Kenelm Digby, eventually came to the Bodleian Library.

Richard Suiceth, whose name was also spellt Swineshead, flourished at Glastonbury c. 1345 and wrote *De latitudinibus formarum*. Burley, a native of Oxford c. 1275, died 1357, having written on the Greek mathematical writers, Pythagoras, Plato, and Ptolemy.

Among the early men of science associated with Merton, who helped to guide following generations, was RICHARD OF

WALLINGFORD, Abbot of St. Albans, the inventor of the Rectangulus in 1326, also of a Planetary instrument, the Albion, and of the great astronomical clock with a revolving astrolabe-face at St. Albans. His persistent use of trigonometrical methods has led to his being called the Father of Trigonometry in England.

These were followed by JOHN MAUDITH, who determined the latitude of Oxford as 51 degrees 50 minutes, SIMON TUNSTED, SIMON BREDON, D.M. 1330, JOHN ASHENDEN or EASTWOOD, and REGINALD LAMBORN, whose surviving manuscripts have been noted elsewhere.[1]

The physician WILLIAM GRIZAUNTE or William English, Fellow of Merton 1292, was the father of Pope Urban V who promoted William Rede to the Bishopric of Chichester. And lastly SIMON ISLIP, Fellow of Merton 1307, Archbishop of Canterbury 1349–66, who died 1366, was so satisfied with the beneficial influence of 'secular' education that he founded a college of mixed monks and seculars on the site of Canterbury Quadrangle of Christ Church in 1361. It was, however, monasticised four years after his death. A clause in his will bears testimony to his efforts for Eugenics: he left 1000 of his best ewes to improve the breed of the sheep of the monks of Canterbury. His life (Cotton MS. Julius B. III) appears to have been written by Rede.

One work of the Merton School which was much read on the Continent was the *Theorica Planetarum* of WALTER BRITTE. In later years it was printed and falsely ascribed to Gerard of Cremona.

The chief and most lasting work of these early astronomers of Merton was the calculation and publication of astronomical tables. Up to the time of the death of Roger Bacon in 1292 astronomers were still using the Spanish tables of Alphonso, compiled at Toledo in 1272, although he had long declared new and better tables to be indispensable. The constructors of the Oxford tables improved the original Alphonsine Tables by adapting them for the latitude of Oxford, and by provid-

[1] *Early Science in Oxford*, vol. ii.

ing them with a new preface, which was the special work of WILLIAM REDE. The net result was that our Merton astronomers of the fourteenth and fifteenth centuries caused the name of Oxford to hold that place in the public estimation which Greenwich holds to-day. In 1430 Rede's Tables were adapted by John Holbrook for use in Cambridge.

Astronomical tables may be dull things, but like railway time-tables are indispensable. In particular, the Merton tables were of the greatest educational use in enforcing the superiority of Arabic numerals over Roman numerals. They are a monument to that great historic period when the methods and learning of the Moors were being transmuted into Western form.

The members of this early School of Astronomer-Physicians at Merton did more still. They mastered the use of the most advanced astronomical instruments of the time, and made observations with them. Certain of these have fortunately survived, and may be seen both in the College Library and in the Museum of the History of Science. The scientific tradition may doubtless have influenced the poet Chaucer when in 1391 he determined to send his son, little LEWIS, to study the use of the Astrolabe in Oxford. The character of the particular instrument that Chaucer used is clearly depicted in several manuscripts, and one most closely resembling it has just been acquired by the author.

A belief in astrology encouraged close study of the stars, and especially of the planets. That a certain amount of astronomical knowledge had become common knowledge among the people is indicated by the practice of Chaucer, who made a point of dating events, not only by their day in the calendar, but also by the position of the sun in the Zodiac. After the decline of the Merton School, we meet with no prominent name for two hundred and fifty years, until the time of Seth Ward and Wren and their contemporaries, who prepared the way for Halley and Bradley.

In other directions, too, Merton men showed their superiority. WILLIAM MERLE, a Fellow of the College who died in

1347, had the high distinction of being the first man in the world to keep a continuous journal of the weather. His *Considerationes Temperiei* were recorded for seven years, from 1337 to 1344, and he based on them useful rules for predicting the weather. In the matter of weather prognostication Merle was preceded by Aristotle, Aratus, and Virgil. It is as the first keeper of a day-by-day record that he is pre-eminent.

Medical studies were expressly forbidden by the early statutes, yet such was the spirit of contrariety among Merton men that they soon began to seek medical knowledge and degrees. In 1284, only ten years after the foundation of the College, a visitation was held by Archbishop Peckham at which it was proposed to correct abuses, including that of the admission of medical students who came in on the plea that medicine is a branch of physics. This innovation the Visitor absolutely prohibited. Happily, remarked a recent Warden, his injunction was neglected, medical science continued at Merton as a branch of 'Philosophy', and it is remarkable how many of its Fellows devoted their lives to 'Physics' as they were then understood.

First and foremost came JOHN OF GADDESDEN, who graduated D.M. about 1309, and wrote a treatise, the *Rosa medicinae* in the seventh year of his 'lecture'. The *Rosa Anglica*, as it is more usually called, though largely a compilation from the works of the classical physicians, includes so many personal observations that it is evident that John must have had a large practice. Some of his clinical pictures, e.g. ascites with obstructive jaundice, are wonderfully vivid, and several of his remedies anticipate modern practice. Incision for dropsy, urea as a diuretic for the cure of a hydropic child, treatment for phthisis are all noted. His list of signs of leprosy is most detailed, and he mentions a rapid clotting of the blood, recently confirmed by the observation of Boeck and Danielssen, that fibrin ferments largely increase in the blood of lepers. His surgery was limited to tapping for dropsy, an operation for hernia, and the reduction of dislocations, that of the jaw being well described. In cases of colic he prescribed the wearing of a girdle of sealskin with a whalebone buckle, the precursor of the modern cholera belt of flannel.

An important and unexpected anticipation of the use of coloured light in the treatment of small-pox was due to him. While attending the son of Edward I for small-pox, he wrapped the boy in a scarlet cloth in a bedroom with scarlet hangings, and found the result to be 'bona cura, et curavi eum in sequenti sine vestigio variolarum'.

The *Rosa* gave directions on diet, cookery, and beauty culture. It received its name because its author compared the five chapters of his book to the five petals of a rose and as the rose excels all other flowers, 'so does my book'. It was an answer to Bernard's *Lilium medicinae*, 1303.

With Bernard of Gordon and Gilbert the Englishman Gaddesden is mentioned by Chaucer in the *Canterbury Tales*.

In the fifteenth century Merton became the leading medical college of the time. There were JOHN KYLLINGWORTH, fl. *c.* 1360, JOHN CHYLMARK, *c.* 1386, NICHOLAS COLNET, physician to Henry V at Agincourt, JOHN SOMERSET, physician to Humphrey Duke of Gloucester, JOHN KYLLINGWORTH, proctor 1441, WALTER HART, one of the first Fellows of All Souls, JOHN CURTEIS, 1442, THOMAS BLOXHAM, 1455, HENRY SUTTON, 1458, JOHN STAG, 1412. And more eminent than all, JOHN CHAMBRE, elected to a fellowship in 1492.

When Henry VIII recognized the importance of the good work of the scholar physicians as opposed to the harm which was being done by irresponsible quacks, he, in 1509, promulgated the first English Act regulating Medicine, requiring examination and forbidding unlicensed folk to practise. Nine years later Thomas Linacre persuaded his enlightened Majesty to found the College of Physicians. In the letters patent the second name was that of JOHN CHAMBRE of Merton College. Chambre like Linacre had graduated at Padua. He was an accomplished apothecary and on occasion helped the King to compound ointments and plasters (M.S. Sloane 1067):

'A black plastre devised by the Kinges hieghnes'
'Take

gummi armoniaci oz iiij
dei omphacini [oliue oil] oz. ii
tyne thebinthine oz. vj
gummi Elemi [a cedar resin] j
Resun pini oz x

Boyle them together strongly on a soft fyre of coolys in a faire basyn allwayes styrring it untill it be plaster-wyse; and so make it uppe in rolles, and kepe it to your vse.'

In 1536 when Warden he subscribed to the Articles of Faith as Dean of the Collegiate Church of St. Stephen, Westminster.

Some of the more distinguished members of Linacre's College included:

John Blysse, B.M. 1525, 'medicus et astronomus quam doctus'; Robert Huicke, D.M. 1566, of Berkshire parentage, held the Principalship of St. Alban's Hall for two years until 1536, when he began a successful medical career in London. As physician to Henry VIII and Queen Katharine Parr and physician extraordinary to Edward VI, he enjoyed a stipend of £50 a year. Thomas Huys, D.M. 1548, died 1558 'regius medicus'; Roger Giffard, Fellow of Merton and All Souls c. 1563, President of the College of Physicians 1581: he died of haematemesis 1597. Thomas Jeesop, D.M. 1569; Richard Hawley, D.M. at Leyden in 1627; Daniel Whistler, Fellow 1639, D.M. Leyden 1645, wrote as his inaugural dissertation the earliest account of 'the Rickets', five years before Dr. Glisson's work appeared. He was chosen Gresham Professor of Geometry in 1648. But although Pepys found him 'good company and a very ingenious man', his financial methods were too ingenious to please the College of Physicians.

Sir Henry Savile, 1549–1622, born in Yorkshire, had the good fortune to enjoy the favour of Queen Elizabeth, which he owed partly to his reading of Greek and politics but quite as much to his extraordinary manly beauty. As Provost of Eton he is said to have been very strict, and correspondingly hated by the boys. When a certain youth was recommended to him for his cleverness, he said 'Out upon him. I'll have nothing to doe with him, give me the plodding student. If I would look for wits, I would go to Newgate: there be the wits.' When he became Warden of Merton he seems to have felt that there was a reproach in the abandonment of scientific studies to Cambridge, where Recorde, Digges, Wright, Caius had all made their reputations and that of the University. Accordingly, about 1570 Savile began to give lectures on geometry, which he opened free to all members of the University, but he never succeeded in leading his class beyond Euclid, Book I, Proposition 8. In 1578 he went for a tour on the Continent, and got to know many people who helped him to collect rare Greek manuscripts, and he in his turn helped Bodley.

Meanwhile there occurred a great outburst of scientific inquiry—the result of the invention of new methods and instruments by which natural knowledge was advanced. Thus, in 1614 Napier of Merchiston made known his discovery of logarithms, already privately communicated by him to Tycho Brahe. Tables were calculated by Henry Briggs, and published in 1617. Slide-rules were being devised, decimals were coming into use; algebra was being written in modern notation by Francis Vieta of Paris in the *Canon Mathematicus*.

That Oxford might keep abreast of the new learning Sir Henry Savile, who had made money, founded the Chairs of Geometry and Astronomy in 1619. He considered Gunter of Christ Church for the former Chair, but when at an interview Gunter showed his sector and quadrant, and 'fell to the resolving of triangles and doing a great many fine things', Savile pulled him up 'Doe you call this reading of geometry? This is showing of tricks, man!' He dismissed him with scorn, and sent for Briggs from St. John's College, Cambridge. The Fellows' Quadrangle at Merton was built by him in 1608.

Henry Briggs, 1561–1630, had been first Gresham Professor of Geometry (1596–1620) before his Oxford appointment brought him a Fellow-commonership at Merton. Logarithmic tables to a base of 10 are due to him. He lies buried in the

SIR HENRY SAVILE

By the courtesy of Dr. John Johnson

College chapel, where a Greek epitaph assures us that his soul is still astronomising, while his body is geometrising. He had visited Napier in 1616, and Lilly records that when they met 'almost one quarter of an hour was spent each beholding the other, almost with admiration, before one word was spoke'. At last Briggs began 'My Lord, I have undertaken this journey purposely to see your person, and to know by what engine of wit or ingenuity you came first to think of this most excellent help unto astronomy, viz. the logarithms; but my lord, being by you found out, I wonder nobody else found it out before, when now known it is so easy.' Amongst the Ashmolean manuscripts were six letters addressed by Sir Christopher Heydon to Briggs about comets, dated 1603–1619.

Savile's first Professor of Astronomy was Dr. John Bainbridge, who in 1631–5 became Junior and Senior Reader of Linacre's Lecture. He was a Cambridge man practising medicine in London who had apparently attracted the notice of Savile through a pamphlet that he wrote on the Comet of 1618. As a young man he seems to have been superstitious *re* comets, but as he grew older he lived that phase down and pointed out the vanity of astrological predictions grounded upon the grand conjunction of Saturn and Jupiter, which, he declared, 'will recur every twenty years agreeably to the stated laws of nature'. He died in a house opposite the College, in 1642, and was buried in the chapel, on a buttress of which an east-facing Dial was constructed by him. His manuscripts are in the library of Trinity College, Dublin.

In 1620 Briggs was succeeded in the Geometry chair by Peter Turner, 1586–1652, of St. Mary Hall, who had become a Fellow of Merton in 1607. Being a skilful writer he was appointed by Laud when drafting his celebrated Statutes 'to polish the style, methodise the book and prepare it for the Press'. In 1629 he drew up the Caroline Cycle to regulate the election of Proctors in the various Colleges. Like some other good men he was ejected from his fellowship and the Savilian chair in 1648.

Bainbridge was succeeded in the Savilian Chair in 1617 by John Greaves, 1602–52, of Balliol, who moved on to Merton in 1624. Becoming professor of Geometry in Gresham College in 1630, he travelled on the Continent and in the nearer East,

EFFIGIES IOHANNIS GRAVII.
A.D. 1650.
E M. fec:

and collected the notes from which he compiled his *Pyramidologia* in 1646, and *A Discourse of the Roman Foot and Denarius* in 1647. In 1642 he held office as Subwarden of Merton, but was ejected from the College in 1648. In 1659 some valuable instruments were presented to the Savilian Observatory by his brother Nicholas in his memory. It is difficult to believe that Greaves could have made much use of them during his troubled career. It is more likely that they were a part of the equipment of Bainbridge's observatory which he had inherited, and this view is supported by the early date '1637' that is inscribed on one of them, a fine Mural Quadrant made by Elias Allen. The following works by Greaves were printed posthumously. *Lemmata Archimedis e vetusto codice Arabico*, 1659; *Of the manner of Hatching of Eggs at Cairo*, 1677; *Account of some Experiments for trying the Force of Guns*, 1685; *An Account of the Longitude and Latitude of Constantinople and Rhodes*, 1705; *The Origin of English Weights and Measures*; *Dissertation on the sacred Cubit*. Thomas Birch wrote his biography in 1737.

Meanwhile, on the medical side, TOBIAS VENNER, 1577–1660, had qualified in 1613 as a Doctor of Medicine at St. Albans Hall, which adjoined Merton. His portrait is extant.

On four occasions the Censorship of the College of Physicians was filled by WILLIAM GULSTON, 1572–1632, Fellow 1596, D.M. 1610. His scholarly attainments are shown by his *Critical Notes on Galen*, 1640, and a Latin translation of Aristotle's Rhetoric and Poetics, but he is best remembered by the £200 that he left for lectures to be delivered before the College of Physicians, now a long series since 1639. Merton possesses several of his books presented by his widow Helena. Also JOHN WILBY proceeded D.M. in 1646.

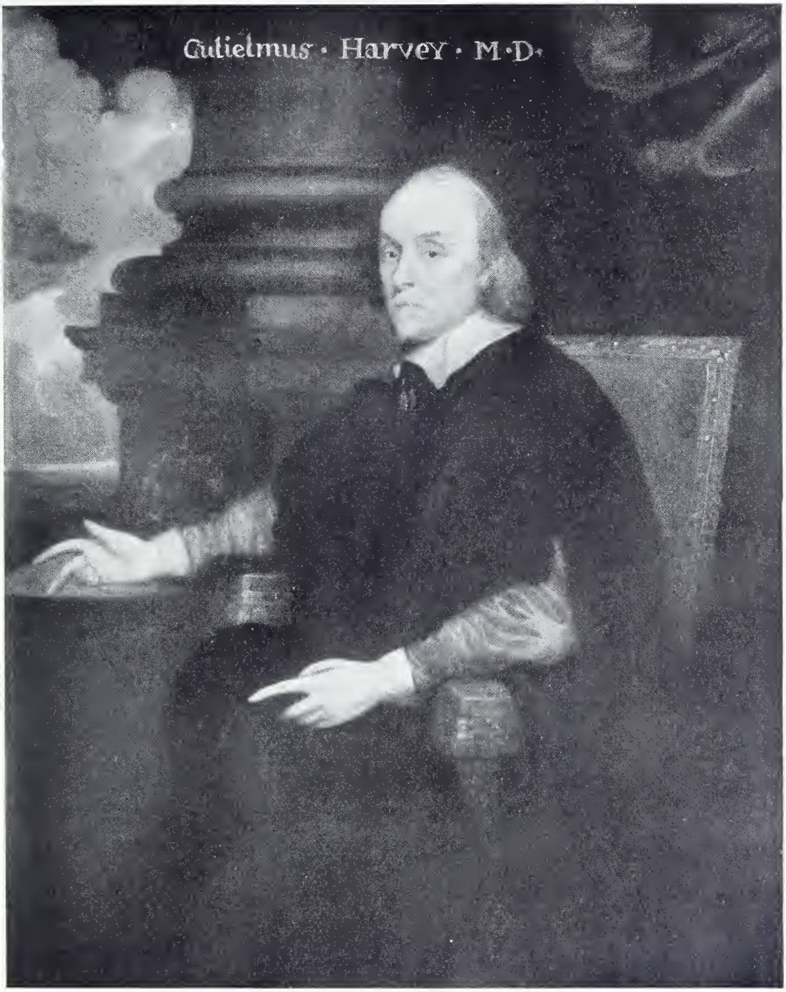
WILLIAM HARVEY came to Oxford with the King after the battle of Edgehill, where the care of the young princes was his special duty. He was incorporated M.D. in 1642 and was appointed Warden of Merton three years later. When Oxford surrendered to Fairfax in June 1646, Harvey ceased to be Warden, leaving his autograph in two places in the College register. In an inaugural address to the Fellows assembled in the Hall he alluded to the fact that some of his predecessors 'had sought the office of Warden in order to enrich themselves from it; but that he himself had sought it in a far different spirit, to wit with the intention that he might bring profit and emolument to the College'. His official rooms in the College seem to have been used by the Court, while he found more congenial employment at Trinity, studying the incubation of chickens in the rooms of George Bathurst. The results of those investigations are published in his *De generatione*, 1651. In new-laid eggs he discovered that the cicatricula was the starting-point of development, and pointed out the similarity between developing stages of the chick and of those of mammalian foetuses. He greatly improved on Aristotle's view that the male parent furnished the body of embryo, while the female only nourished it, by proving that both parents contribute to the ovum.

'By the same stages in the development of every animal, passing through the constitution of all, I may say—ovum—worm—embryo, it acquires additional perfection in each.' Can we not take this as a first brief intimation of the great Theory of Evolution?

This valuable work might never have been published had it not been that Dr. George Ent, when visiting Harvey, found the unpublished manuscript which, after some modest alterations, he obtained permission either to publish immediately, or to suppress till some future time. 'I went from him', says Dr. Ent, 'like another Jason in possession of the golden fleece, and when I came home and perused the pieces singly, I was amazed that so vast a treasure should have been so long hidden.' Thus came about the publication of the work of *Generation* which was so closely connected with Harvey's Oxford period.

Harvey was Physician to Francis Bacon; he lived during the lifetime of Gilbert, one of the most notable of a cluster of geniuses who appeared in the Elizabethan era. Fortunately for them, it was the period when genius was appreciated; had they lived elsewhere they, like Galileo, Bruno, or Servetus, might have been persecuted for the novelty of their discoveries. In a machine-cut age, originality is what the world chiefly needs—Harvey gave it.

It is often forgotten that another eminent member of the College, Anthony Wood, 1632–95, had had that training in science which comes from close association with the leading scientists of his time. From 1649 to 1659 he was constantly meeting and chronicling the doings of the early founders of the Royal Society, and with John Locke he attended the chemical lectures of Peter Sthael. His father let lodgings and



WILLIAM HARVEY

From the portrait in the Royal College of Physicians

kept a tennis-court in the vicinity of the college. He took his exercise by walking to taverns a mile or two out of Oxford, where he drank ale at Cumnor, Botley, or Headington as the case might be, and devoted his evenings to music or cards and the gossip of coffee-houses, which he carefully recorded

Anthony Wood.

in his famous Diary. He investigated the great Oxford collections of Bryan Twyne in the University archives, incorporating the result in a *History of Oxford* that is at once the wonder and the envy of other Universities.

The herbalist William Coles, born at Adderbury in 1626, took the degree of B.A. in 1650. His first work, the *Art of Simpling*, 1656, was dedicated to Elias Ashmole. His larger book, *Adam in Eden, or Nature's Paradise*, appeared in the following year and was highly praised in the prefatory testimonials. Coles found Sundew in Bagley Wood, Adder's

Tongue near Botley, as well as numerous additions to the Oxford flora. A fellowship at New College doubtless introduced him to Dr. Duppa, Bishop of Winchester, whose secretary he became. He died at the early age of thirty-six (p. 138).

Jonathan Goddard, c. 1617–1675, left Magdalen Hall without taking a degree, after residing for 3 or 4 years, to study medicine on the Continent. He proceeded D.M. at Cambridge in 1643 and practised in London. As first physician to the army he accompanied Cromwell on his campaigns from 1649 to 1651 in Ireland, Scotland, and at Worcester. As a reward he was appointed Warden of Merton in December 1651. In the Little Parliament of 1653 Goddard sat as sole representative of the University.

Very naturally so conspicuous a Cromwellian was removed by Charles II from the wardenship. Goddard removed to Gresham College, where he had been chosen Professor of Physick in 1655, and was nominated one of the first council of the Royal Society in 1663. Dr. Goddard is said to have made with his own hands the first telescope ever constructed in England. He was a good practical chemist and the inventor of the volatile Guttae Goddardianae long in repute, and recommended by Sydenham. Goddard's secret remedies under the name of the Arcana Goddardiana, were held in such high repute by Charles II that he paid £1,500 for the secret of distilling Goddard's Drops, a crude spirit of hartshorn prepared from raw silk. When the 'volatile salt' was mixed with a well-scented essential oil, the mixture was known as the King's Salt. To him was due a proposal of great economic value, namely, to make wine from the sugar-cane, and so to give a fillip to the languishing prosperity of the British Plantations in Barbados.

He exposed the abuses of apothecaries, and published *Observations concerning the nature and similar parts of a Tree*, 1669; *The Fruit Tree's Secrets*, 1664; *A Discourse concerning Physick and the many Abuses thereof by Apothecaries*, 1668; *Discourse setting forth the unhappy conditions of the Practice of Physic in London*, 1669.

The chemical researches on the hardness of water of Dr. Edmund Dickinson were esteemed worthy of mention by Borrichius in 1668. By 1692 Dickinson had moved to Westminster, where he continued alchemical studies until 1705. Charles II, to whom such chemical researches were matters of great interest, appointed him his physician-in-ordinary. He died of stone in the bladder in 1707, aged 85. Contemporaries were Richard Trevor, D.M. of Padua 1658; Thomas Alvey, D.M. 1671, Harveian Orator 1681, author of *Dissertatiuncula Epistolaris, unde pateat Urinae Materiam potius e sero Sanguinis quam e sero ad Renes transmitti* 1680; and Richard Smith, D.M. Utrecht 1675, who practised at Aylesbury.

Thomas West came from Exeter College to Merton to take his D.M. degree, while Humphrey Ridley, who matriculated at Merton in 1671, went to Leyden to graduate D.M. on a thesis *de Lue Venereâ*. Gulstonian lecturer in 1694, he 'performed the duties of his office to the honour of the College of Physicians, to the establishment of his own reputation, and the general satisfaction of the learned auditory'. His published works dealt with *The Anatomy of the Brain, containing its Mechanism and Physiology; together with some new Discoveries and Corrections of Ancient and Modern Authors upon that subject*, 1695, and *Observationes Medico-Practicae et Physiologicae de Asthmate et Hydrophobiâ*, 1703.

In the last quarter of the seventeenth century Merton received botanical collections from Charles Willoughby, D.M., a Fellow in 1673, and from Robert Huntingdon, Fellow 1680, who had travelled in the countries bordering upon the eastern Mediterranean; and but for a quarrel it would have received the Museum collected about 1720 by John Pointer, who bequeathed it to St. John's College instead.

The catalogue of Materia Medica drawn up by Pointer while at Merton is an example of the great interest that was being taken in medical matters by many laymen at this time, when the practice of compiling volumes of medical recipes was very prevalent. His collections are now in the Old Ashmolean Museum, while his manuscript notes on *Waters*, on *Hot and*

Cold Baths, and on *Cautions before Bathing* are in the Library of St. John's College.

Amongst other savants were John Bateman, who became the President of the College of Physicians in 1716, and is supposed to have been the Celsus of Garth's Dispensary; George Aldrich, who endowed the Chair of Chemistry in 1803; John Matthew, D.M. 1782, afterwards Colonel of the Hereford militia; and Dr. William Rowley and John Bulkeley, both of St. Albans Hall.

The need of better instruction in Chemistry was becoming generally felt, and Oxford supplied St. Bartholomew's Hospital with a young and energetic lecturer in Richard Powell, 1767–1834, born at Thame, who matriculated at Pembroke but migrated to Merton. A summary of his *Lectures on Chemistry* appeared in 1796. Becoming physician at the hospital 1801 to 1824, he published *Observations on the Bile and on the Economy of the Liver*, 1800; *A Case of Hydrophobia*, 1808; and a most helpful English translation of the *Pharmacopoeia Londinensis* of 1809. His portrait has been engraved.

The subject of *Mineral Poisons* in 1795, with *An Account of the Discovery of the Power of Mineral Acid Vapours to destroy Contagion*, 1803 and 1805, were the work of John Johnstone, a most successful physician practising in Birmingham. He will always be remembered as the author of the monumental *Life and Works of Samuel Parr, LL.D.*, 1828, which was described in 1837 as 'a fearless, manly, and noble specimen of biography, putting to shame the meagre attempts of those puny scribblers who have sought to write themselves into ephemeral notice by the celebrity of the great name with which their own may be thus temporarily associated' (*Gent. Mag.*, May 1837).

The Founder of Merton desired that his Fellows should not spend all their lives in the College, but should go out into the world; he also charged those who may rise to 'more abundant fortunes' to remember the institution to which they owed their first advancement. The observance of his injunction receives abundant witness in the scientific gifts that have been received by the College Library. Among the donors are James Leeche,

H. B. Gray *C. F. Ryder* *William Hine*

E. Schuster *Minchin* *Frank Sherlock* *Weldon* *Jenkinson* *E. Gurney Darbishire*

GROUP OF ZOOLOGISTS

Roger Gyfford, Higgs, Helena Gulston. Numerous special volumes were received between 1670 and 1690.

The attractive but illusive topic of *Psychic Force and Psychic Media*, which formed the basis of experiments by Messrs. Home and Crookes,[1] was critically examined by J. P. EARWAKER of Merton in the *Popular Science Review* in a manner that did much good at the time.

GRANT ALLEN, 1848–99, was a Canadian who became one of the most successful scientific journalists of his time. With a profound admiration for Darwin and a very happy knack of lucid interpretation and exposition he produced a charming succession of popular articles on botanical, geological, and other topics of natural history, especially such as could be interestingly dealt with from the standpoint of evolution.

To the work of EDWARD CHAPMAN, RAY LANKESTER, and JOHN WATTS reference will be made elsewhere.

The elucidation of the minute structure of the lowest forms of animal life, by mastery of a skilful microscopic technique and more particularly by the application of improved methods of staining and section-cutting, was the principal life-work of EDWARD ALFRED MINCHIN, 1866–1915. He came up to Keble about 1887, becoming a pupil both of E. B. Poulton and of W. Hatchett Jackson. A Radcliffe Travelling Fellowship, 1893–5, and a Fellowship at Merton made possible prolonged visits to the principal Marine Biological Stations of Europe. His chief educational appointments were demonstrator of Comparative Anatomy, Oxford 1890–9, lecturer on Biology, Guy's Hospital 1898–9, Jodrell Professor of Zoology and Comparative Anatomy, 1899–1906, first Professor of Protozoology, London University, in which capacity he moved to the Lister Institute of Preventive Medicine, Chelsea, to direct the new department. Having spent some of his earlier years in India he came up to the University somewhat more matured than most of his contemporaries. A keen observer and an enthusiastic naturalist, he published his first scientific papers before he took his degree.

[1] *Quarterly Journal of Science*, July 1871.

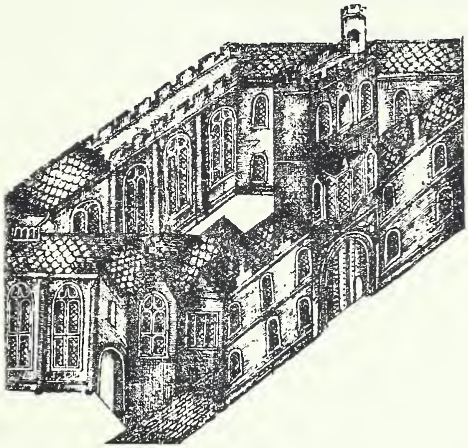
His principal publications included *An Introduction to the Study of the Protozoa,* many articles on Sponges, and a translation of Bütschli's *Protoplasm* 1894. After serving on the Royal Society's Commission to investigate Sleeping Sickness in Uganda, his untiring industry and patience were devoted almost entirely to the study of parasitic Protozoa, the germs of so many diseases fatal to mankind. It is said that he dissected 1,700 fleas of the rat to pursue the life cycle of *Trypanosoma lewisi.*

In the borderlands of modern physics and chemistry one of the most important discoveries of our time is that certain chemical elements are undergoing spontaneous disintegration. The change is a breaking-up of heavier and complex atoms into lighter and less complex parts, and in a state of nature the rate of this disintegration is regular and can be measured, as for instance in the case of the change of uranium into lead. In this work a most important part has been taken by a Member of Merton College, who has received the recognition of a Nobel Prize.

The following passage may be quoted from his book:

'To-day we know that the radio-active minerals are in reality geological clocks, and they record more accurately than in any other way the age of the stratum in which they occur. In a uranium mineral, for example, each 1 per cent. of lead in terms of the quantity of uranium signifies the lapse of 80,000,000 years. Errors of course are possible, if lead should have been an original constituent of the mineral, but these are minimized by taking a large number of different minerals. On the other hand, every cubic centimetre by volume of helium per gram of uranium in a uranium mineral signifies 9,000,000 years, and—as here helium, being a gas that forms no compounds, cannot have been originally present, and as, moreover, some will have escaped—the age of the mineral by this method is a minimum, whereas the age by the lead content may be too high. The carboniferous rocks tested by this new method appear to have an age of some 350,000,000, and the oldest Archean rocks of over 1,500,000,000 years.' (Soddy, *Science and Life*, pp. 100–1.)

COLLEGIVM BALLIOLENSE.



2. BALLIOL COLLEGE, 1260

It is fitting that the story of Merton should be followed by that of Balliol, because the work of her early astronomers has been continued with conspicuous success by one of the most distinguished of Balliol men. In another respect, too, Balliol is the more fortunate in that she can still show a few of the books that belonged to her early scientific members, including two that were presented by William Rede, who has already been mentioned as the constructor of astronomical tables and founder of the Merton Library.

The prestige of this College, as a centre where certain forms of scholarship have thriven gloriously, and the number of its members who have made great names for themselves by rising to high office in Church and State, make it difficult to believe that Balliol has not always been a great and a flourishing College. It is in accordance with nature that she should have been born small, even as what has been described as 'a simple almshouse' for a few students. The great Baron, whose name she bears, is believed to have made provision for four students only; from this minute beginning she might have been expected to have grown steadily to her present dimensions and reputation. This, however, was not so.

The College history covers nearly seven hundred years; by the end of the first century she had received her most famous member, John Wycliffe, as Master. By the end of the second century she had attracted an eminent band of scholars, distinguished among the early English Humanists, of whom more presently. They bring us to 1450–60, but then Balliol sank into comparative obscurity for three hundred and fifty years. At the close of the seventeenth century Balliol was described as being in a deserted state, and a pleasant tale is told about a neighbouring President, who being out taking exercise in his garden was seen to throw stones at the windows of Balliol 'to complete the appearance of its ruin'.

The earliest lecturer on medicine in Oxford was a Balliol man. NICHOLAS TINGEWICK read lectures in the Physic School adjoining his Inn on the east side of Cat Street on the site of All Souls Cloisters. His advice was most highly esteemed by his patients, and it was of him that King Edward I, when convalescent, wrote 'To him, after God, we owe thanks for our recovery from the illness which lately oppressed us', this in October 1306. The King was taken ill at Carlisle, and the cost of conveying Tingewick's remedies from London to that city amounted to £159 11*s.* 10*d.*, the apothecary's bill being £134 16*s.* 4*d.* Another physician of the College, SIMON BREDON, D.M. 1330, migrated to Merton. He was an astronomer, as all good doctors had to be while the stars still exercised influences for ill or good on their patients.

Students came up to Oxford so young that we should regard them as schoolboys rather than as undergraduates. Their first four years were spent in studying the Trivium—Latin Grammar, Logic, Rhetoric—at the end of which they became Bachelors of Arts. At Cambridge even now an undergraduate is correctly spoken of as *juvenis*, while a Bachelor is *vir*. Perhaps this explains their reluctance to admit women to degrees. These *viri* then proceeded to study the Quadrivium for three years, including as much science as can be learnt from the pages of

Boethius and Isidorus. The principal subjects were Logic, Philosophy, and Theology. At the end of that they were dubbed Masters of Arts, which gave licence to teach, for no Bachelor might teach. For the medical profession it was necessary to study one book of Galen and the Aphorisms of Hippocrates. For a licence a student had to put in six years of book-learning, but no clinical experience or anatomical knowledge was required.

If we do not hear much of the later Balliol physicians, it may be that there is little to know—so small a College could not have produced many. The Black Death may have decimated the book-learners. Medicine was at a very low ebb. The one specific was Bleeding: Uroscopy the chief diagnosis. Medicines were elaborate to futility. The most famous drug was Theriac; people travelled as far as Montpellier to learn how to concoct it: its seventy-five ingredients included flesh of vipers. The majority of children died in infancy; a man of fifty was rare. It was 1388 before the first Sanitary Act was passed. Hospitals for sick and aged were in charge of the religious, even if on occasion they were debarred from doctoring. Peasants lived in mud-daubed huts, and it has been truly said that any one of us would feel more at home in ancient Babylon than in the Oxford of Tingewick.

Four students, Grey, d. 1478, Free, d. 1465, Gunthorpe, d. 1498, and Tiptoft, d. 1470, made up a party to visit Italy and work under Guarino Veronese at Ferrara, where they studied Greek and Medicine. They were joined by a Lincoln man of the name of Fleming. John Phreas or Free of Bristol is said to have paid his expenses by teaching medicine at Padua, Ferrara, and Florence. His excerpts from Pliny are in MS. Balliol 124, and ten of his letters are in Bodley MS. 2359. He translated *φαλάκρας ἐγκώμιον* of Synesius, *De Laude Calvitiae*, proving that baldness is more desirable than a thick head of hair. Three of the travellers were rewarded by ecclesiastical preferment, becoming Bishops of Ely and of Bath and Wells, and Dean of Wells, respectively, while Tiptoft became Earl of Worcester.

In the chapter on Merton College it was shown how the old learning of the Moors in Spain had been cherished, transmuted, and increased by the Astronomer Mathematicians of the Merton School in Oxford in the 14th century. If we turn to the history of our sister University we find that the author of a History of Mathematics at Cambridge states that there were only two English mathematicians of any note in the first half of the 16th century. These were the first mathematicians at Cambridge of whose lives and works any details are known, and they may therefore be considered as the pioneers who blazed a trail for the most brilliantly successful mathematical school in the world. The names of them are CUTHBERT TONSTALL and ROBERT RECORDE. TONSTALL was a Yorkshireman born in 1474, who entered Balliol in 1491. 'But finding the philosophers dominant in the University, he migrated to King's Hall, Cambridge'—and our Cambridge authority, to spare our feelings, explains that his 'action only meant that he could continue his studies better at Cambridge than at Oxford'.

He subsequently went to Padua, where he read the works of Regiomontanus. His Arithmetic *De arte supputandi* was the best of its time, and is particularly valuable for the illustrations of medieval processes of computation. It was printed in the year in which the author became Bishop of London, 1522, special type for cancelled digits being cut for the book. A presentation copy printed on vellum is one of the treasures of Corpus Library.

The Magnetic Compass was described in 1616 as 'the most admirable and useful instrument in the whole world' by WILLIAM BARLOW, 1544–1625. All very early history of this instrument and of its practical application to Navigation is lost beyond recovery. We have no very ancient examples of the Mariner's Compass. We must therefore remain content with such literary references as we can find. Roger Bacon's compass was a lode-stone swimming on water. An *Epistola de Magnete* was written in 1269 by Peter Peregrinus, who describes an improved floating compass with a needle thrust through a pivoted axis, placed in a box with transparent lid, a divided circle, and an external rule provided with sights. Without the guidance of this useful instrument and the confidence inspired by its sure guidance, Columbus, Magellan, and Vasco da Gama would scarcely have ventured out into the vast unknown of the open ocean. Columbus even discovered the magnetic declination.

In his *Navigator's Supply* 1597, Barlow refers to Magnetic needles as used in the 16th century, '*of 6 inches long and longer, upon a pinne in a dish of white China earth filled with water*'. He suggested an improvement. 'The needle should be a true circle, having his axis going out beyond the circle, at each end narrow and narrower unto a reasonable sharpe point, and being pure steele as the circle itself is, having in the middest a convenient receptacle to place the capitell in.' Barlow is believed to have been the first to print the word *Magnetisme* in the English language.

And now the curtain falls. When it rises again it reveals a star of the first magnitude.

John Evelyn's connexion with the College began on May 10, 1637, when he noted his admission as a Fellow-commoner: his subscription to the Articles followed ten days later. He confessed to having been somewhat idle, but for that he made ample amends during the four years when he was abroad doing the Grand Tour. After a preliminary trip to the Low Countries in the autumn of 1641, he set out from Boulogne on his great journey on 12 July 1643. After staying several months in France he reached Leghorn in October 1644, wintered in Rome and Naples, and reached Venice in the following summer. On the return journey he visited Sir Kenelm Digby in Paris, and discoursed on chemical matters. Whenever there was anything worth seeing, Evelyn would go to inspect it. On August 6, 1656, 'I went to see Col. Th. Blount, who showed me the application of the "Waywiser" to a coach, exactly measuring the miles and showing them by an index as we went along—very pretty and useful.' Wilkins had one that read up to hundreds of miles in 1670. In May 1662 Evelyn was chosen Commissioner to reform the streets of London, and went to view St. Martin's Lane how it might be made more passable into the Strand—'there were divers gentlemen of quality in this Commission'.

He was an indefatigable sightseer, this he called being very *pragmatical*, and kept a Diary that has served many of his successors with an excellent guide-book—full of interesting things not in the ordinary guides. In particular he describes the arts and architecture, the natural curiosities, the menageries and gardens, manners and customs of all the countries that he visited.

He collected too. At The Hague he furnished himself with shells and Indian curiosities, but he avoided the woman who had had twenty-five husbands. In Leyden the skeletons, from the whale to the spider, impressed him greatly. At Padua he collected a *hortus hyemalis* by permission of J. Vesling, the Professor of Anatomy, and the celebrated rare Table of Veins and Arteries which he presented to the Royal Society. It was greatly admired by Moulins, the surgeon.[1]

In 1660 Evelyn became an early member of that 'Invisible' assembly of men of learning which was destined two years later to receive a charter as the Royal Society. In these days of the election of Fellows for research within narrow limits, the range of Evelyn's interest and work for the Society is sufficiently remarkable to merit setting out at length.

Jan. 9. Ordered to show his catalogue of Trades, And was desired to bring in an History of engraving and Etching.

Jan. 23. To communicate his observations on the Anatomy of Trees. Dr. Goddard presented a paper on the same subject, which Evelyn published in *Sylva*. He introduced the Danish Ambassador on this occasion.

Feb. 2. He was desired to prepare Oyl of Sulphur.

Mar. 15. Relation concerning Teneriffe.

May. Boyle and Evelyn were appointed Curators for the observing of Insects, and to meet at Boyle's lodgings.

June 5. A Rain of Corn having been reported at Norwich, Evelyn was intreated to sow some of those rained seeds to try their product.

[1] *Early Science in Oxford*, iii, p. 95.

July 19. 'We tried our Diving Bell in ye Water-Dock at Deptford in which our Curator continued for half an hour: it was made of Cast Lead.'

Later, the 'Powder of Sympathy' interested him and the Society.

Sept. 18. The Society had prepared a petition to the King, praying for incorporation, but 'it cannot now be found'.

Dec. 11. Evelyn was thanked for having presented a Panegyric (a poem upon the King's Coronation) to the King on April 24th, 1662.

Jan. 18. He read an account of making Marbled Paper.

June 11. He presented his *History of Chalcography*, 1662.

July 15. 'Our Charter' passed the great seal. And thus were the *Invisible College* of Boyle and the ideal *Philosophical College* of Evelyn incorporated by Royal Charter.

Oct. *Sylva* was ordered to be printed. His designs for Armorial Bearings for the Society were considered, and his motto *Nullius in Verba* was adopted.

One of his most charming essays was entitled *Fumifugium: or, the Inconvenience of the Aer, and Smoake of London dissipated, together with some remedies humbly proposed to His Sacred Majestie and to the Parliament now assembled*, 1661.[1] He had had, as he said, his indignation kindled against a 'presumptuous Smoake' that, issuing from one or two tunnels not far from Scotland-yard, did so invade the Court, that all the rooms, galleries, and places about it were filled and infested with it. A complaint by the Duchess of Orleans caused him to descant upon the nature of smoakes in general, pointing out with many examples that smoake is one of the foulest inconveniences that can possibly befall so noble, and otherwise incomparable a City as London. Finally he suggested that an Act of Parliament for the removal of such Trades as are manifest nuisances to the City, modelled on the Act against the burning of Ling and Heath and other Moor-burning in certain northern counties, would supply a remedy.

It will not be forgotten that Evelyn had also been requested to consider planting of trees by the Commissioners of the

[1] Evelyn's *Fumifugium* has been reprinted in 1930 as an *Old Ashmolean Reprint*, No. viii.

Navy, who became concerned by the waste and destruction of our English woods during the Civil Wars, and apprehensive of the growing dependence of English marine power on seaborne supplies. Evelyn in *Sylva* was able to report that 'many million timber trees were planted by the direction of their work'. Disraeli said that the ships of Nelson were made possible by the science and forethought of John Evelyn.

He was in the best sense a lover, promoter, and patron of all the arts and sciences of his day. He helped every good cause: his success as a courtier was of the greatest service to learning, for it facilitated the promotion of the Royal Society: besides making the discoveries noted in his diary, he obtained the Arundelian Marbles for the University of Oxford and the Arundelian Library for the Royal Society.

A contemporary of Evelyn, NICHOLAS CROUCH, 1634–72, deserves mention for his work in cataloguing a very important set of medical pamphlets in the library.

And about the same period the following members of the college qualified as physicians:

JOHN ATFIELD, D.M. 1657; ROBERT FIELDING, D.M. 1653, practised in Gloucester, and elected mayor in 1664; Sir JOHN FINCH, *c.* 1626–82, took his B.A. here, but then went to Christ's College, Cambridge, and Padua where he proceeded D.M. He was knighted by Charles II in 1661, and declared F.R.S. in 1663; TIMOTHY CLARKE, an original F.R.S., succeeded Dr. Quartermaine as physician-in-ordinary to King Charles II; an office in which THOMAS WALDRON, 1619–77, followed him.

A new era in the teaching of science was inaugurated early in the eighteenth century by JOHN KEILL of Balliol, 1694–1731. When the Royal Society was founded, one of the guiding principles was that discoveries communicated to the Society should be proved by experiments made before a Committee. As Dr. Spratt put it, 'The work is not to be so fine and easie as that of teaching is, but rather a painful digging and toiling in nature.' It was this digging and toiling in the presence of an audience that distinguished the best lectures on Natural Philosophy in Oxford of the eighteenth century, or as we now call it Physics, from the dogmatism of previous systems of teaching. On coming to Oxford Keill lectured as deputy for the Sedleian Professor, Sir Thomas Millington, and illustrated Newtonian Neosophy with apparatus of his own invention.

'Dr. John Keill was the first who publickly taught Natural Philosophy by experiments in a mathematical manner; for he laid down very simple Propositions, which he proved by Experiments, and from those he deduc'd others more compound, which he still confirmed by Experiments; till he had instructed his auditors in the *Laws of Motion*, the *Principles of Hydrostaticks* and *Opticks*, and some of the chief Propositions of Sir Isaac Newton concerning *Light* and *Colours*. He began these Courses in Oxford about the year 1704 or 1705 and that way introduced the Love of the Newtonian Philosophy.'

From the year 1691 to 1708 the Savilian Chair of Astronomy was held by a Master-commoner of Balliol. He was the son of an Aberdeenshire physician of the same name, DAVID GREGORY, 1661–1710, who had been professing mathematics at Edinburgh for eight years before his preferment to Oxford in 1691. He qualified as D.M. in 1692, and published *Astronomiae Physicae et Geometricae Elementa* in 1702, one of the first text-books based on gravitational principles, and an edition of *Euclid* in 1703. He observed a partial eclipse of the sun in September 1699. His uncle James Gregory at the age of 24 had published the *Optica Pronota* 1663, in which he described his famous reflecting telescope. His son, also a David, became Dean of Christ Church 1756–67.

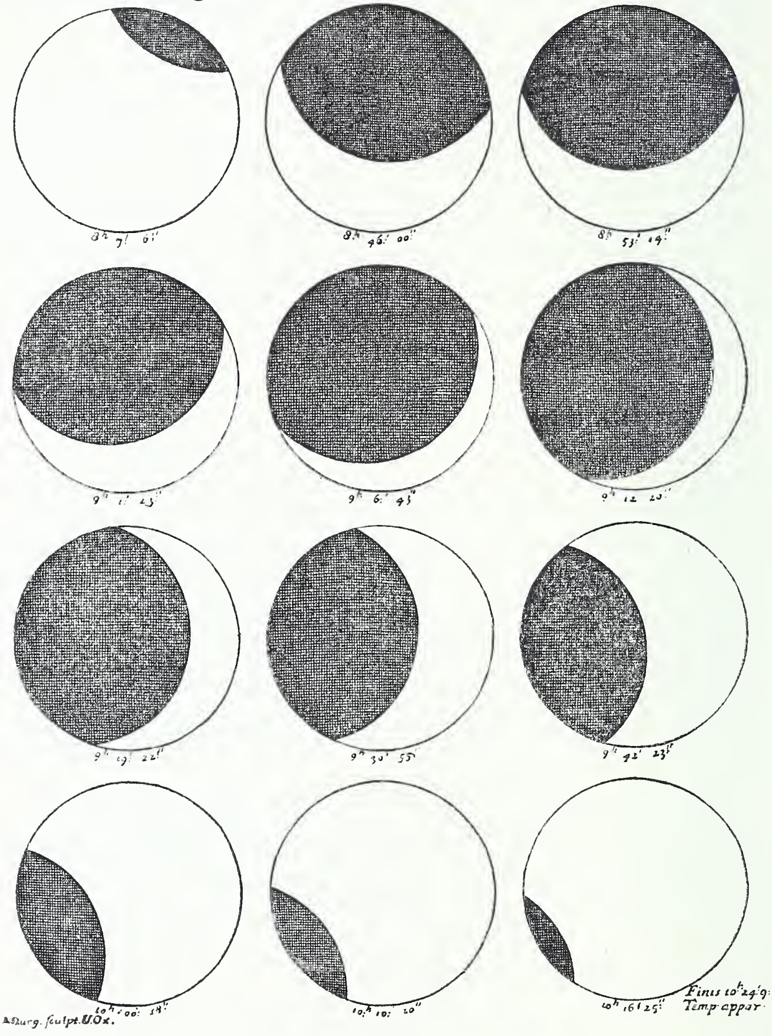
The publication of Newton's mathematical works had a small repercussion in Oxford in 1717 when JAMES STIRLING of Balliol printed at the Sheldonian Theatre Press *Lineae Tertii ordinis Neutonianae—Solutio Trium Problematum*. It bore the imprimatur of Jo. Baron, Vice-Chancellor, and an interesting list of names of subscribers.

On Keill's death in 1721 JAMES BRADLEY followed him as Savilian Professor of Astronomy, and a new spirit was breathed into astronomical studies.

SCHEMA

Phil. Trans. N.°

Phasium SOLIS Deficientis
An. 1699. Septembris 13. Stilo Iuliano *A.M. OXONIÆ, Observatarum*
a Davide Gregorio *M.D. Astronomiæ Professore Saviliano & S.R.S.*



Bradley was born at Sherbourne in Gloucestershire in 1693 and came up as a commoner to Balliol in 1711. He became one of the very greatest men of science of this University. Trained by his uncle, James Pound of St. Mary Hall, Rector of Wanstead in Essex, he acquired consummate skill in the use of astronomical instruments. Halley soon perceived his extraordinary merit, and introduced his paper on an appulse of Palilicium to the moon in December 1617, describing him as 'eruditus juvenis, qui simul industria et ingenio pollens his studiis promovendis aptissimus natus est'.[1] His election as F.R.S. was secured next November when Newton was still President. In 1719 he was ordained and presented to the vicarage of Bridstow by the Bishop of Hereford, whose chaplain he became, with the living of Llanddew Felfrey in Pembrokeshire.

As Savilian Professor Bradley found himself in the position of being able to pursue his favourite work on an income of £138 5*s.* 9*d.* a year. He gave his inaugural lecture on April 26, 1722. For ten years he came up only for the delivery of lectures. He continued, however, to visit his uncle, James Pound at Wanstead and to help him to test Hadley's new Reflector (1723). He also attempted to grind specula himself (Smith, *Optics*, ii. 302) but with no conspicuous success. He had not the technical skill or experience of a William Herschel, and his specula were not very good, but he could repair and adjust his instruments. In October 1723 Halley discovered a comet, and Bradley computed the orbit—a most laborious task, which no one but Halley was attempting at that time.

On Pound's death in November 1724 Bradley continued for a time to reside in a small house at Wanstead with his aunt, and with his uncle's instruments made several of his chief discoveries. The first of these was of Aberration. In November 1725 Sam. Molyneux had fixed a 24-foot Graham telescope pointing to the zenith to investigate Hooke's observation. A fortnight later Bradley repeated Molyneux's observation on December 17, and found the star to pass a little more to the

[1] *Phil. Trans.* xxx. 853.

South. At the end of the year the star had oscillated 39 seconds of arc.

As he could not understand the cause, he got Graham to fit a $12\frac{1}{2}$-foot zenith-sector in the upper part of his aunt's house and by assiduously observing the overhead stars for a year he tried to prepare a set of rules for the annual apparent motions of stars in various parts of the sky. But he could find no rule that satisfactorily explained all their motions.

However, one day on a river-excursion in a sailing-boat he noticed that the wind as indicated by the vane at the top of the mast seemed to shift each time that the boat put about. The boatman pointed out that the wind was really quite steady, but that the apparent changes were due to changes in the boat's course. He immediately applied this idea to the stars. The Earth was the boat: the progressive transmission of light was the wind. Evidently as the Earth tacked to and fro on its orbit round the sun, it must cause an annual shifting of the apparent position of the fixed stars.

And this he found to be the case, and he called it the 'Aberration of Light', which he announced in a letter to Halley in 1729. It was a most perfect discovery. In value it is 20.25 seconds. From this he deduced the time that light takes to come from the Sun—viz. 8 minutes 13 seconds—a good modern value being 8 minutes 21 seconds.

From 1729 onwards he gave regular courses of *Lectures on Experimental Philosophy*, until 1760 after the close of his 79th course. There was at first no endowment, for Lord Crewe's benefaction of £30 only became payable in 1749, but fees of £3 3*s*. a course, with an average attendance of 57, produced an income. He lectured in the Old Ashmolean, under the Museum, of which he tried to become Keeper in 1731. His own register of persons attending is now printed as an appendix to this book. It shows what a large number of Oxford men were willing to pay fees for instruction in Science in those early days.

In May 1732 he moved to Oxford and occupied the house in New College Lane attached to his Professorship.

With him came aunt Pound and two of her nephews, who

JAMES BRADLEY

lived with him for five years. To this house he moved most of his instruments, except the Graham Zenith Sector, which he continued to use at Wanstead during the next fifteen years. In 1742 he succeeded Halley as Astronomer Royal at Greenwich. There he equipped the Observatory with new instruments, and strove to obtain a higher degree of accuracy than had previously been achieved, yet he never had an achromatic telescope!

By a micrometer screw he measured intervals of $\frac{1}{2}$ second with Graham's 8-ft. quadrant, but later found it to be defective through being out of centre.

The next achievement was the discovery of a nutation or nodding of the Earth's axis, due to an unequal gravitational pull by the Moon on the equatorial parts of the Earth. For many years he did not consider the evidence sufficient, so he carried on with observations and measures of star positions for twenty years, until he had tracked each star position through an entire revolution of the moon's nodes ($18\frac{1}{2}$ years). His announcement was made to the Royal Society in 1748.

This work set an exceedingly high standard on the accuracy of astronomical observation in all other observatories. It also drew attention to the dearth of instruments at Greenwich, and secured a grant of £1,000 for new ones. John Bird was commissioned for an 8-ft. quadrant, a 40-inch quadrant, and an 8-ft. transit. A 6-ft. reflector was ordered from Short and £20 spent on magnetic apparatus. Bradley determined the distances of Sun and Moon by concordant observations made at the Cape and at Greenwich.

As in Flamsteed's time, the salary was £100 per annum. For three months in every year he resided in Oxford, until poor health caused him to resign his Readership in 1760. For years he had been suffering from an obscure internal malady, doubtless accentuated by his overtaxing his strength when correcting the Lunar Tables. He became depressed, and feared for his mental faculties.

The last phase was pathetic. He had made all arrangements to observe a Transit of Venus on June 6, 1761, but when the moment arrived was unable to use the telescope. He died a year and a month later. His case was described by Daniel Lysons, D.M., in the *Phil. Trans.* iii. 635. His biographer, Stephen Rigaud, states that he had 'a most extraordinary clearness of perception, both mental and organic; great accuracy in the combination of his ideas; and an inexhaustible fund of that industry and patient thought to which Newton ascribed his own discoveries. In his astronomy work no discrepancy was too minute for his consideration. He is the *founder of modern observational astronomy*.

His first great discovery was the outcome of a reinvestigation of Hooke's observation of the parallax of the over-head star γ Draconis. By his discoveries of aberration and nutation it first became possible to fix the places of the Fixed Stars, and thereby the movements of all other heavenly bodies, an advance comparable with the discovery of the use of standard weights and measures in ordinary life.

Bradley thereby gave Astronomy a new birth, the importance of which was so great that Radcliffe Trustees, to further it, built the Radcliffe Observatory, and equipped it with just the kind of instruments that Bradley would have liked to have had at Greenwich. Some of these Radcliffe instruments are now safely housed in the Old Ashmolean with one of Bradley's own telescopes, but others are still being kept out in stores undergoing deterioration.

Prominent among the physicians of the eighteenth century were John Diodati, D.M. 1722, F.R.S. 1724; William Fullerton 1692–1737, D.M. 1728, F.R.S. 1731; James Monro, 1680–1752, D.M. 1722; John Thomas Batt, M.D. 1746, Harveian Orator 1754, at St. George's Hospital; James Robertson-Barclay, 1753–1827, appointed to a Radcliffe Travelling Fellowship in 1780, physician to St. George's Hospital 1785, and physician extraordinary to the Princess of Wales 1799, when he assumed the additional name of Barclay.

The study of Pathology was greatly advanced by the work of Matthew Baillie, 1761–1823. His was undoubtedly a case of inherited genius nurtured in the most favourable environment. Through his mother, the sister of Drs. John and William Hunter, he inherited the family genius and the interest of the two foremost anatomists of the age. While residing at Balliol during term time, he passed his vacations in London under the roof of his uncle William, who spared no pains to cultivate in his young pupil that habit of ready and exact explanation of every subject he treated for which Baillie

was in after-life so remarkable. The manner he adopted, it is related, was as follows:

'Matthew, do you know anything of to-day's lecture?' demanded Dr. Hunter of his nephew. 'Yes, sir, I hope I do.' 'Well, then, demonstrate to me.' 'I will go and fetch the preparation, sir.' 'Oh, no, Matthew, if you know the subject really, you will know it whether the preparation be absent or present.' After this short dialogue, Dr. Hunter would stand with his back to the fire, while the young Baillie demonstrated the subject of the lecture which had just been delivered; and then the student was encouraged by approbation and assistance, or immediately upon the spot convicted of having carried away with him nothing but loose and inaccurate information.

It was science tuition at its most effective and best! His uncle William bequeathed to him the use of the museum (the contents of which are now piously preserved in Glasgow) and of his theatre and house in Windmill Street. To this Baillie added a well-selected collection of specimens of diseased organs, now in the College of Physicians, of which be became a Fellow in 1789. In 1810 he was commanded by the king to attend, in conjunction with Sir H. Halford, on the Princess Amelia, and shortly afterwards was appointed physician extraordinary to the king.

Baillie's best-known work is *The Morbid Anatomy of some of the most important parts of the Human Body*, 1795. Styled 'superior to any eulogium in his power to bestow' by Professor Soemmering, and perpetually cited by Meckel, the most distinguished anatomist in Europe, it passed through many editions and was translated and retranslated into French, German, and Italian.

It was characteristic of his singular honesty of mind, that he remained to the end modest as to his powers: he used to say to his own family, 'I know better, perhaps, than another man, from my knowledge of anatomy, how to discover a disease, but when I have done so, *I do not know better how to cure it*'.

A celebrity in quite another field was Thomas Andrew Knight, who is remembered by horticulturists for his success in raising many new varieties of fruit and vegetables that bear his name. He matriculated at Balliol in 1778. He began experiments in raising new varieties of fruits and vegetables near Downton Castle, Herefordshire, where his brother, Richard Payne Knight, the antiquary, lived. In 1795 he read a paper to the Royal Society on *Grafting and the inheritance of disease in Fruit Trees*. This was followed by *Culture of Apple and Pear and Manufacture of Cider and Perry* in 1797, and *The Pomona Herefordiensis* with 30 coloured plates appeared in 1811, the first year of his presidency over the Horticultural Society. In Physiology he experimented on the influence of Gravity on Growth. Two years before his death in 1838 he received the Society's Knightian Medal with a portrait. A *Selection* of his

L. FLETCHER

Papers was published in 1841. Another member of the College with cognate interests, WILLIAM PHELPS, 1776–1856, published *A Botanical Calendar*, 1810.

By the middle of the nineteenth century Balliol had become the leading College in the University. Among other circumstances that had contributed to build up its pre-eminence was the far-sighted integrity of the Master, Dr. Jenkyns, in regarding it as the first duty of a College to promote intellectual distinction. He waged an incessant war with privilege, abolishing gentlemen-commoners and throwing open close endowments as far as he legally could. One of the brightest lights under the new régime was HENRY SMITH, 1826–83, who had been winning both classical and mathematical prizes, when Balliol found itself in need of a mathematical lecturer. It was commonly reported that he had tossed a halfpenny to solve the doubt as to whether he should devote himself to classics or mathematics. He chose the latter as being likely to strain his weak eyes least. The finest expositor of abstruse mathematics in his day was the result. In 1860 he succeeded Professor Baden Powell in the Savilian Chair of Geometry, holding it with his College lectureship until 1873, when he was elected a Fellow of Corpus, and later to the Keepership of the University Museum, vacant on the death of Professor Phillips.

A few of his sharp and witty sayings have been collected. When the lectures of a certain tutor were reported to be 'cut and dried'. 'Yes,' said Smith, '*dried* by the tutor and *cut* by the men.'—On the occasion of an after-dinner dispute as to the comparative prestige of bishops and judges, the argument seemed all in favour of the latter. 'No,' said Smith, 'for a judge can only say "Hang you", but a bishop can say "Damn you".' 'Yes,' said Jowett, 'but when a judge says "Hang you", you are hanged!' It was Henry Smith who suggested that the late Sir Norman Lockyer was apt to forget that he was only the editor and not the author of *Nature*.

In recent times Chemistry has been the science in which Balliol men have chiefly excelled. The beginning of their success may perhaps be traced to the teaching and researches of Sir Benjamin Collins Brodie, 1817–1880, the eldest son of the eminent surgeon, who came up to Oxford from Harrow, and proceeded M.A. in 1842. He was appointed to the Professorship of Chemistry in 1855, and finding the Old Ashmolean unsuited for his purpose was a strong advocate for the Glastonbury Kitchen and other conveniences at the New Museum in the Parks. The apparatus used for some of his more important research relating to the production and properties of Ozone, was still in existence there when I was an undergraduate, but it has now disappeared. One of his earliest pupils, A. G. Vernon Harcourt, having obtained First Class Honours in Science in 1858, was appointed Lee's Reader at Christ Church, where, among others, Sir John Conroy was his pupil, and he, going back to Balliol, became the colleague and tutor of those who organized the Chemical Laboratories in the Balliol cellars, where much good work was subsequently done. For the running of its laboratory the College has been greatly indebted to the practical mind of D. H. Nagel of Trinity. Conroy was a grandson of the second Earl of Rosse.

John Watts, 1844–1933, the chemist, and Lazarus Fletcher, 1860–1910, who obtained Firsts in 1876, were followed by J. E. Marsh in 1882.

An epoch-making investigation was undertaken in the spring of 1880 by A. P. Thomas. During the winter of 1879–80 some three million sheep were destroyed by a parasitic disease known as the Liver-rot or 'Staggers', known to be produced by a Trematode worm, the liver-fluke *Distomum hepaticum*. It was suspected that this fluke lived in an asexual form in another host, but what it was, or how and when the sheep became affected, was quite unknown. In consequence of the seriousness of the epidemic, the Royal Agricultural Society offered Dr. Rolleston a grant for an investigation of the life-history of the parasite. On December 22, 1880, Thomas found, in the snail, *Limnaea truncatula*, captured on an infected field at Wytham near Oxford, a cercaria which has since been proved to be the larva of the liver-fluke. The very complete information thus gained, and Thomas's clear drawings of the successive stages, sporocyst, redia, and cercaria, of the life-history of this ento-parasite from Wytham meadow, studied in the Sanitary Laboratory of the Oxford Museum, and incorporated in zoological text-books for medical students all over the world, has proved a most stimulating introduction to the far-flung study of Ento-parasitology. Thomas became Professor of Biology at Auckland, New Zealand.

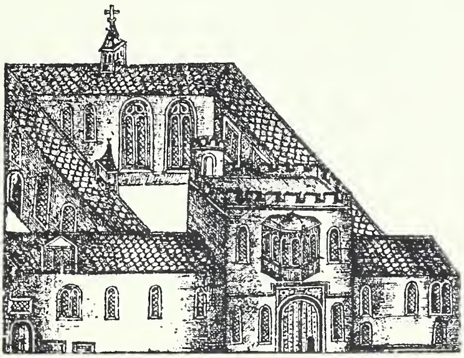
In 1883 Professor Edward Burnett Tylor, 1832–1917, the father of Anthropology, became attached to the College as Keeper of the University Museum.

As a boy he was prevented by incipient consumption from entering his father's business as a brass founder, and so he toured in America in 1855. In 1856 a chance meeting with the ethnologist Henry Christy in a Havana omnibus led to their travelling to Mexico, where he was able to indulge his taste for anthropological study to the full. *Anahuac: or Mexico and the Mexicans, Ancient and Modern*, 1861, was the result, and in 1865 he established his reputation by the publication of *Researches into the Early History of Mankind*. Six years later his *Primitive Culture* followed. It was distinguished for the fullness of the treatment given to *animism*, defined by him as the 'general doctrine of souls and other spiritual beings'. His excellent handbook *Anthropology: an introduction to the Study of Man and Civilization* appeared in 1881. In 1871 he was elected F.R.S. In 1883 he was appointed Keeper of the University Museum and Reader in Anthropology.

Among biologists J. T. Cunningham became a Fellow of University.

Before concluding this chapter on Balliol mention must be made of the name of Oxford's benefactor and my friend the late Sir John Findlay, proprietor of *The Scotsman*. To his generosity Oxford owes the superb silver microscope made by George Adams for George III, a masterpiece of the 18th century. The argument for keeping open the highway from Scotland to Balliol is therefore not quite so one-sided as Dr. Johnson pronounced it to be.

COLLEGIVM·VNIVERSITATIS.



3. UNIVERSITY COLLEGE, 1249

THE date of the foundation and even the identity of the Founder of University College have been obscured by the mists of antiquity. Yet I cannot forbear from quoting a passage from the scientific writings of the reputed founder, who, if he did not found University College, was a noble example to British men of science. The story of a memorable work of Alfred the Great, stimulated by high ideal, has been retold in forcible words of one syllable by Bishop G. F. Browne on the occasion of the thousandth anniversary of that great king:

'He could not bear to waste time. The day was too short for all that he felt bound to do for man and for God, for his land and for his soul. He must mark the flight of time, so that none might be lost. He had not a clock or a watch which he could take with him in his tent, or keep in the rude huts they made for him in the woods as he went from place to place. Men had to trust to the sun to tell them the time of day; and when the sun was hid, they had to guess. So he weighed out wax, and put a wick in it, and marked by the sun how long that weight of wax would burn. Then he cut white ox horn quite thin, so that you could see through it, and he put this round the flame that the draughts might not make the wax burn too fast. Thus he knew how the time went, by day and by night, and he spent it all well.'

What a shining example to all men of science!

A list of the men of Science who belonged to University College shows a preponderance of those who have turned their training to advance the Art of Healing. The genius loci was favourable. Adjoining the site of the College were apothecaries' shops which appear to have shepherded members of the College in the direction of medicine.

One of these shops, kept by an apothecary of the name of Crosse, which, serving as a depot of scientific material and providing the means for its manipulation, ought to be the most celebrated in Europe. For there worked Boyle, the Father of Chemistry, and Hooke, maker of the pneumatic engine, the most historic of all air-pumps.

At an earlier day, in the thirteenth century, Oxford Chemists had no surnames. They were merely Richards, and Alfreds and Thomases, but to distinguish them from other Richards, Alfreds, and Thomases, they received the surname of le Spicer. And the addresses of the houses of Richard, Alfred, and Thomas le Spicer were Karefouk, in Quarefac, in quadrivio. One Thomas Apothecarius in 1280 lived in Kybald Street, Roger Spicer lived in Grove Street, and the *Spicery* proper was in Cat Street, all so close that the site of University College may be described as right in the midst of the apothecaries' quarter. It is not remarkable, therefore, that in the seventeenth century Crosse should have set up his mortar and coloured bottles in a house near No. 90 High Street.

The first considerable contribution by a member of the College to medical practice had relation to the prevailing custom of frequent blood-letting at the Barbers. Bleeding was regulated by special calendars prepared for the use of the public and multiplied by the printing-press. A Purgation Calendar of 1457 is believed to be the first printed medical publication. It was followed by a Blood-letting Calendar in 1462. Leonard Digges compiled an account of the traditional and approved procedure in '*A Prognostication*; imprynted at London, within the Blacke Fryars', by Thomas Gemini, 1555, containing 'many pleasant chosen rules for ever'.

Let bludde at no tyme, without great cause: for it bryngeth wekeness and many infirmities. If ye do, see it be after good digestion, and fastinge, in a fayre temperate daye. Beware before all maner *exercise, bathinges, watchings,* and *c.c.* &c. After, vse fine meates, of light digestion: abstaininge from all the aforesayd, vntil the fourth daye. These signes are mooste daungerous for bludde letting, the *Moone* beyinge in them, *Taurus, gemini, Leo, Virgo,* and *Capricorne,* with the laste half of *Libra* and *Scorpius.* The rest are all good, so the *Moone* beare no dominion in that member whiche ye cut as followeth.

The aspects of the planets and especially the Moon were believed to influence all vital phenomena. Even the growth of hair, or the good or ill effect of a bath. 'Cuttinge, shaving, clipping in the wane causeth baldness: what is then cut, groweth litel.' But Digges knew a remedy: 'Calvitium prohibet oleum Tartari.'

Digges has, however, a far higher claim to our respect. His name is associated with two most notable advances in the construction and use of surveying instruments. After outlining the purpose of the Geometrical Square, he described an 'Instrument Topographical', whence has sprung the paramount surveying instrument of our own day, the Theodolite—a name apparently invented by Digges himself before 1570. Moreover, in its modern form this instrument owes its power to the Telescope, the other, and more famous invention by which Digges was able by 'Perspective Glasses duely scituate upon convenient Angles in such sorte to discover every particularities in the country rounde about wheresoever the Sunne beames might pearse'.

Again in 1570 his son wrote:

'My father by his continual paynfull practises, assisted with demonstrations *Mathematicall*, was able, and sundrie times hath by proportionall Glasses duely situate in convenient angles, not onely discovered things farre off, read letters, numbred peeces of money with the very coyne and superscription thereof, cast by some of his friends of purpose uppon Downes in open fieldes, but also seven myles of declared what hath been doon at that instante in private places.'

There is no good reason to deny Leonard Digges the honour of having used a telescope thirty-five years before Galileo.

In 1595 Lord HERBERT OF CHERBURY came up to University at the early age of 12. Earnestly pursuing his studies, realizing that Arithmetic and Geometry are fit to learn, 'for their helpfulness in keeping accounts and for enabling a gentleman to understand fortifications', this precocious child also advocated the study of plants as a 'Fine study and worthy a gentleman to be a good botanic, that so he may know the nature of all herbs and plants'. Certainly his contemporaries made full use of their knowledge of medicinal herbs.

Lord Herbert's *Autobiography* has been described by Horace Walpole as the 'most extraordinary account that was ever given by a wise man of himself. Few have figured so conspicuously, in lights so various, as the famous Lord Herbert of Cherbury. As a soldier his valour . . . won for him the esteem of the great captains of the age; . . . as a public minister, he supported the dignity of his country, even when its Prince disgraced it. . . . These busy scenes were mingled with, and terminated by, meditation and philosophic enquiries.'

The books that he bequeathed to Jesus College bear witness to the justness of Walpole's estimate.

In the seventeenth century many followed in his footsteps. WILSON, TWYSDEN, HENSHAW, STRODE all advanced scientific interests. They seem to have mastered the *Rules for a Healthy Life* by Cogan of Oriel, and knew how to live and what to do when ill. SAMUEL WILSON, when a freshman about 1619, was warned by the Fellows that he should not enter any house in the town 'ad potandum vel ad fumigandum cerebrum' (= take tobacco). A century later the régime was relaxed, and an eminent member of the College, Charlett, had to go to Bath when he got crippled with gout.

An unpleasant case of the absence of medical treatment is reported in December 1633 when the son of a Hampshire gentleman of University College 'fell doone deat at ye Cookes house being diseased with an Apoplexie which deprives a man of all sense and motion for 48 houres, in which space he is not to be buried: & tho he revive yet never is he perfectly sound' (Crosfield).

A good instance of inability to keep off Medical Studies is supplied by J. Twysden, 1607–88, M.D., who matriculated in 1623. His main bent was mathematical, for in 1654 he edited S. Foster's *Four Treatises of Dialling* and in 1659 published *Miscellanies or Mathematical Lucubrations.* In 1685 he described the *Use of the Great Planisphere called the Analemma.* Feeling it to be his duty in 1666 to support the orthodox medical doctrines against Marchmount Needham he did so with a great parade of mathematics, but little or no clinical or pathological observation. He probably also talked to his brother, a judge in the King's Bench, because therein Needham was defeated in an action by the College of Physicians.

Amongst the original members of the Royal Society was Th. Henshaw, 1618–1700, who had served with the French Army abroad, and acted as French under-secretary to Charles II, James II, and William III. He had translated Samedo's *History of China* in 1658. His brother Nathaniel Henshaw, F.R.S., was M.D. of Leyden. He died in 1673.

Thomas Strode, 1642–88, son of Th. Strode of Shepton-Mallet, was a mathematician and an authority on Dialling. He published a *Short Treatise of Combinations, and Permutations of Quantities* 1678, and a very useful *New and Easy Method to the Art of Dyalling containing All Horizontal Dyals and all Upright Dyals,* 1688.

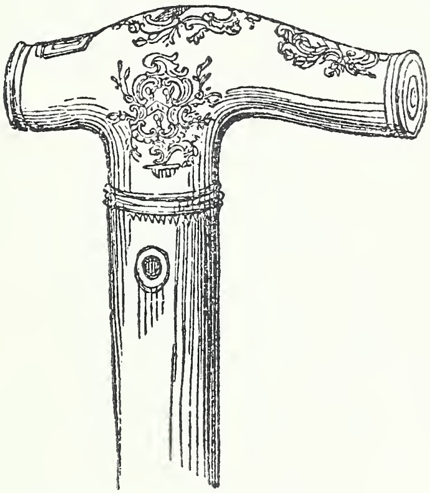
Before the time of Robert Morison, 1620–83, the science of botanical classification had not made much progress since the days of the Greeks. The old classification of plants adopted by Theophrastus into (1) Trees and shrubs, and (2) Herbs and undershrubs, held good until the time of Linnaeus. Cesalpinus, 1519–1603, of Pisa added the idea of *Fructification*, and classified by '*seeds*', including one-seeded fruits. But, excepting for Ray, botanists did not adopt the better system. And when Botany had fallen to its lowest level, Morison appeared on the scene. A native of Aberdeen in 1620, he fought (he was a Royalist) at Bridge of Dee 1644. Going abroad he became a D.M. at Angers, and after some instruction from Robin in Paris he took charge of the garden of the Duke of Orleans at Blois.

In 1660 Charles II, happening to visit Blois, saw Morison's work with such approval that when he returned to London he appointed him King's Physician and Professor of Botany. In 1669 Morison became our first Professor of Botany. His history of Umbellifers appeared in 1672, to be followed by the great *Historia Plantarum*, pars secunda on Herbs, in 1680. He was killed three years later when crossing the Strand, and his great work was not completed before 1699 (Pars Tertia) by Bobart. In his autobiography he tells of a wonderful new and original classification 'known to myself only' although 'written on plants from the creation'. 'I have made order from chaos', he said, but has left no clue to the method.

A man of the very widest scientific interests was Dr. ROBERT PLOT, who having been an undergraduate at Magdalen Hall, (p. 257), elected to enter University College as a Commoner about 1676 when he was 36. He paid for placing a statue of King Alfred over the portal in the High Street.

Plot's junior by ten years was Dr. JOHN RADCLIFFE, an ideal son of Oxford. He came up at the early age of 15 to prepare for a professional career, by the exercise of which he made a fortune in London, and then left it to the lasting benefit of the University. While still a student it was his boast that he was preparing himself for the practice of the art of healing on the recent work of Sydenham and other modern writers to the exclusion of the 'rubbish of antiquity contained in musty volumes'. In particular he adopted Sydenham's method of treating small-pox by cooling rather than by the heating and stimulating treatment which was then in vogue.

It is impossible at the present day to pass by this ante-history attitude of Radcliffe's in the silence that gives approving consent. Many of his successors, including some of the greatest modern exponents of the Art of Medicine, e.g. Sir William Osler, have taught us the very great utility of the historical approach. A comparison of the course of a disease in the past, with the course of the same disease at the present, will often show differences of a most instructive nature. In no case is history of greater service than in the study of the rise and decline of the greater epidemics—the plagues that threaten man's power in the present even as they have shattered



Radcliffe's Gold-headed Cane.

it in the past are always a standing menace to civilization. A knowledge of how ancient diseases, for example leprosy in the medieval Occident, have been practically annihilated by the common endeavour of physicians and governmental authority is of the greatest value when any new type of disease arises. Epidemiology and history have been shown to have the closest relations: they are indispensable to each other, and this interdependence will continue whenever we succeed in eradicating new diseases, as is well-nigh the case with bubonic plague, cholera, and yellow fever, while others such as typhoid, typhus, and dysentery must still be fiercely combated. It has been rightly advised that the armouries of history should ever be held in readiness as important sources of orientation with reference to later invasions, and as a supply depot of experience to wipe out any that may recur in future.

Radcliffe meant well, and with the problems that presented themselves to him he certainly succeeded well. But his success was no less due to his independence of mind and character. The phenomenal increase of his practice after he became Physician-in-ordinary to King William III is a matter of history. It is said that even his near neighbour, a Dr. Gibbons,

Kneller's Portrait of Radcliffe.

received more than £1,000 a year from patients whom Radcliffe had no time to see. His house was in Bow Street, Covent Garden, next to Sir Godfrey Kneller. Their gardens adjoined and their intimacy was great. Radcliffe suggested to Kneller that it would be convenient if a door were made in the wall, so that he could enter and rejoice in the flowers, &c., in Kneller's garden. Unfortunately the servants also entered and trampled down the flowers. Kneller, naturally annoyed, threatened to have the door bricked up. Whereupon Radcliffe: 'He may do what he likes with the door, so long as he doesn't paint it.' This was reported.—'Did he really say that? Well, go back, and after presenting my service to him, tell him that I can take anything from him but physic.' In 1714 Radcliffe left his Yorkshire estate to the College for two Travelling

JOHN RADCLIFFE

From the statue by John Michael Rysbrack

Fellowships; £5,000 to enlarge College Buildings; £40,000 for a Library, finished 1749; £500 a year to mend the diet at St. Bartholomew's Hospital; estates to executors in trust to be applied to such charitable purposes as they should think best; but no part thereof to their own use or benefit. JOHN GARDINER proceeded D.M. in 1706. The Radcliffe endowment brought a long succession of Travelling Fellows from other colleges to University College, and the more distinguished of them will be mentioned under the colleges at which they matriculated. The roll has been ably edited by one of their own body, Dr. Nias. They were intended to improve the raw material for appointments to University Professorships.

Another naturalist of distinction was RICHARD RICHARDSON, 1663–1721, who began preparation for a medical career in Oxford and completed it at Leyden, where he dwelt for three years in the house of the eminent botanist Paul Hermann and made the acquaintance of Boerhaave. Although one of the most skilled botanists of his day he did not publish anything on that subject, but communicated his discoveries by letters to his friends. Four papers in the *Philosophical Transactions* were by him. *On Subterraneous Trees, or Fossil Wood, at Youle near York*; *Several Observations in Natural History made at North Bierley in Yorkshire, on the Trouts of the Welch Lakes, the Ermine, etc.*; *An Account of a wonderful fall of Water from a Spout on the Moors in Lancashire*; *Concerning the voraciousness of the* Squilla Aquae dulcis, *in destroying the young Fry of Carp and Tench in ponds.*

WILLIAM SCOTT, Lord Stowell, 1745–1836, was the son of a 'coal-fitter' who obtained a scholarship at Corpus Christi College restricted to persons born in Durham. He was then elected to a Durham Fellowship at University in 1765. He lectured well but never published his lectures, and forbade his executors to do so. Gibbon singled him out as a shining example amid the general incapacity of university teachers of the time. A story is told of him that shows that he was a lawyer as well. Instead of saying that the Greeks 'had no chimneys', he preferred the circumlocution: 'They had no convenience by which the volatile parts of the fire could be conveyed into the open air'. He was a close friend of Samuel Johnson. He lived to be a senior member of The Club and was one of three executors to Johnson's will. A 'two-bottle' man! He became one of our greatest lawyers: his services to Maritime Law have never been surpassed. Without a doubt he owed his success to his scientific education, to which his note-books still bear witness.

As Stowell loved the law, so his contemporary, Sir WILLIAM JONES (1741–94), disliked it for the 'bad Latin' in which it was written. He became, perhaps, the most profound Oriental scholar of the day, knowing thirteen languages thoroughly and twenty-eight fairly well. The botany and zoology of India were also subjects of special interest to him. An F.R.S. in 1772, he presided over the Asiatic Society of Bengal.

Remembering the great foundation of John Radcliffe, it is interesting to note that Sir William Jones in his instructions to travellers recommended that notice should be taken of the learned men of the country, of such as have abilities in any kind, are worthy to be known and the best books are to be inquired after. Men that travel, he said, must be very cautious both of their speech and demeanour; the Italian proverb saith, For a man to travel safely through the world, 'It behoveth him to have a falcon's eye, an ass's ears, a monkey's face, merchant's words, a camel's back, a hog's mouth and deer's feet.'

Among the physicians who spent their undergraduate years in the College were ARTHUR DANIEL STONE (1764–1824), D.M. 1794, who received his professional training at St. Bartholomew's Hospital and at Edinburgh, and wrote *A practical Treatise on Diseases of the Stomach and of Digestion*, 1806; and ROBERT BREE, 1759–1839, to whom we owe a more full and complete view of asthma than had hitherto appeared. After serving as physician at the Leicester Infirmary, he was appointed physician to the General Hospital at Birmingham in 1810. Having suffered from asthma himself, he published *A practical Inquiry into Disordered Respiration, distinguishing* *the Species of Convulsive Asthma*, 1797—a work in which he embodied numerous experiments that he made in his own case, and laid down some important therapeutic rules the practical value of which has been universally acknowledged.

The Duke of Sussex consulted him, moving to the salubrious quarter of Hanover Square by his advice. By such treatises as his *Use of Digitalis in Consumption*, 1799, people came to appreciate the value of preliminary scientific education for doctors: it became increasingly realized that Chemistry was one of the key-sciences a knowledge of which was necessary for all physicians.

A new Professorship of Chemistry was endowed by George Aldrich in 1803. Kidd, the first Aldrichian Professor, 1803–22, had as two of his pupils Daubeny of Magdalen and Shelley of University College. The latter's college rooms were 'littered' with books, boots, papers, philosophical instruments, clothes, pistols, linen, crockery, bags, and boxes . . . and a small glass retort above an Argand lamp, which soon boiled over, adding fresh stains to the table, and rose in disagreeable fumes.

In more recent times, Donkin, Savilian Professor of Astronomy in 1842, being gifted with a singular knowledge of mathematics and Greek music, wrote a valuable contribution on the Secular Acceleration of the Moon's Motion (*R.A.S.* 61), and a part of a work on Acoustics published in 1870.

A member of the College who formed a close friendship with John Ruskin and accompanied him to Italy was William Gershom Collingwood, 1854–1932, the son of W. Collingwood, the landscape painter.

Joseph Thomas Cunningham, 1859–1935, came up in 1878 as a Brackenbury Scholar of Balliol. In 1882 he was made a Fellow of University College, which helped him to develop his main interest, the study of marine zoology. In intervals of teaching he conducted important researches at the Marine Biological Stations of Naples, Granton, Plymouth, and at St. Helena and on the Amazon. He described at length the Renal Organs of Patella (*Q.J.M.S.*, 1883), and made many contributions to fishery problems. His *History of the Common Sole* is his best-known work, and his observation on the vertical movements of marine plankton have had a wide influence. A confirmed Lamarckian, his leanings to speculative biology found expression in *Sexual Dimorphism* 1900, *Hormones and Heredity* 1922, and *Modern Biology* 1928.

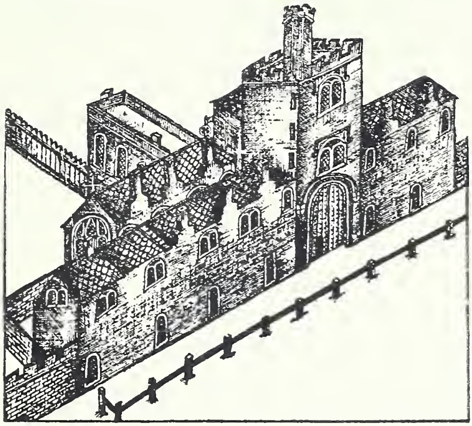
The chemist Victor H. Veley, F.R.S., made a great reputa-

V. H. Veley.

tion by discovering that pure copper would not dissolve in pure nitric acid (1890).

We now come back to the place from which we started, the apothecaries' shops, the valuable businesses conducted by single tradesmen who lived in and on their premises, and who prepared their own drugs. That is what commended the shop of Crosse the apothecary to Robert Boyle. See p. 304.

CCLLEGIVM EXONIENSE.



4. EXETER COLLEGE, 1314

EXETER COLLEGE grew out of Stapeldon Hall, established in 1314 by Walter de Stapeldon, Bishop of Exeter, for West Country students. The earliest information with regard to the beginnings of science here comes from the wills of two members of the Merton School of astronomer-physicians, Simon Bredon and William Rede, who died in 1368 and 1385 respectively. Bredon bequeathed a score of books to Merton and two to Exeter; Rede bequeathed a hundred to Merton and twenty to Exeter, but he is also reputed to have given twenty-five more during his lifetime in 1375. Some of these works were scientific, and PALMER, physician to the Queen of Henry VI, may have been educated on them. We may therefore fairly attribute antiquity, if not continuity, to science teaching at this College. From these early beginnings it was a far cry to the appearance of the first names on our list, but it was here that the first Greek lectures by an Englishman were delivered. Grocyn of New College, returning from Italy *c.* 1491–3, hired a room in Exeter and taught the new learning, and it is still remembered that Sir Ray Lankester of this college valued Greek roots and prefixes highly for the construction of scientific names, taking advantage of his colleague Professor Bywater's advice as to their correct composition. Lyell's names for the subdivision of Tertiary rocks—Eocene, Miocene, Pliocene—illustrate the same thing.

Passing over Dr. Vilvain, the Devonian Fellow from Cambridge who atoned for his legacy of 'scraps, whimsies, and dotages' by his valuable benefactions both to Exeter City and to the College, we come to those scientific thinkers of the seventeenth century who took all knowledge for their province. The leaders among them were at the same time physicists, chemists, botanists, and geologists, perhaps, too, astronomers and architects; in addition they often showed deep interest in theological matters which might be manifested in widely different ways. And so in every generation within the limits of a single Oxford College, men skilled in at least one half of these matters were not infrequently to be found.

At Exeter Branker, the mathematician; Glanvill, theologian and critic; Marsh, physicist and mathematician; Moyle, zoologist; Borlase, mineralogist and antiquary; Nicholls, anatomist. All were up within a few decades, and although their names are not all remembered now, each was the best of his kind in his day.

A prevision of the *Electric Telegraph* in this century is a good example of how far the more active minds of the period were in advance of their time. George Hakewill, having described the use of the Mariners' Compass in his *Apologie*, 1627, and then going on to mention 'another excellent invention said to be lately found out upon the loadstone', suggested the use of magnetic needles for telegraphy. Hakewill eventually became Rector and built the College Chapel—so it is not unlikely that his book may have suggested the subject to Joseph Glanvill some years later.

In 1649 Cambridge amply repaid Oxford for her gifts of the early mathematicians, Tonstal, Digges, and Recorde, by sending her John Wallis, 1616–1703, 'the modern Archimedes', prince of mathematicians, who in that year came to fill the Savilian Chair of Geometry. His famous *Arithmetica infinitorum*, 1655, contained the germs of the differential calculus.

He invented the symbol for infinity ∞. He interested people with his ingeniously constructed Flat Floor. With Wren he produced a correct statement of the theory of impact. Wallis's higher education began at Emmanuel College, Cambridge, where he acquired some notoriety for having been one of the first of the younger generation to announce the circulation of the blood. His next achievement was an exhibition of skill in deciphering cryptograms,—a most valued accomplishment during the Civil War. In 1649 Cromwell appointed him to the Savilian Chair of Geometry, a trust that was amply justified by his epoch-making professorial lectures, and by a succession of most learned mathematical works which in their turn proved an incentive to Newton. By the publication and illustration of his famous books, printed in the Sheldonian Theatre, Oxford printing acquired a reputation which age has not tarnished. Truly he was one of the intellectual giants of those days. Another mathematician of eminence, THOMAS BRANKER, 1633–76, held a Fellowship from 1656 to 1663, when he was deprived for Nonconformity. His early knowledge of mathematics and chemistry seems to have been derived from Peter Sthael from Strasburg, who in 1660 at Boyle's suggestion held classes attended by Ralph Bathurst, Wren, Wood, Branker, and others. His works included *Doctrinae Sphaericae Adumbratio una cum usu Globorum Artificialium*, Oxford 1662.

In 1668 he produced a table of *Odd Numbers up to* 100,000, showing those that are incomposite and resolving the rest into their factors or coefficients. John Collins, Maseres and Wallis all thought well of it. A curious cipher, published in *Archaeologia* for 1877, is supposed to have been invented by him. In 1669 he became headmaster of Macclesfield Grammar School, and translated the introduction to the *Algebra* of Rhonius from the high Dutch.

Space will not permit to do justice to JOSEPH GLANVILL, who came up to Oxford from Plymouth in 1652. He was one of the first Fellows of the Royal Society, but since he migrated from Exeter to Lincoln College his work may be appropriately alluded to under that head, p. 148. Another early

Fellow of the Society, NARCISSUS MARSH, born near Cricklade in 1638, was of Magdalen Hall, 1655, where, as an undergraduate, 'he kept an entire fast every week from Thursday 6 p.m. to Saturday 11 a.m., for which God's name be praised'. As a young Wiltshire Fellow of Exeter in 1658 he studied Mathematics and held weekly music parties in his rooms. In 1678 he was appointed Provost of Trinity College, Dublin, where the students in his charge were, according to him, 'both rude and ignorant, and I was quickly weary of 340 young men in this lewd debauched town'. With William Petty and W. Molyneux he founded the Royal Dublin Society, the meetings being held at his own house. His mathematical and musical interests combined led him to investigate the physical laws of the vibration of strings which were set forth at length by Plot in his discussion of *The Doctrine of Sounds*.[1] Marsh ended his days as Archbishop of Cashel, Dublin and Armagh, 1702–13.

It was largely due to the researches of these early Fellows of the 'Royal Society in Oxford' that the Oxford Philosophical Society was founded in 1683 under the Presidency of John Wallis. Exeter College showed her sympathy with the new learning by opening her 'back-gate which joyns on to the west side of the Museum' to the Duke and Duchess of York, the Lady Anne and retinue after their banquet in the Hall of the Old Ashmolean on the great occasion of the opening of the new institution on May 21, 1683.

The lists of her early medical men include the names of WILLIAM DUNNE, D.M. 1582, who held the Lumley lectureship from 1602 till his death in 1607; and RICHARD INGLET, M.A., admitted Extra-Licentiate by the College of Physicians 1660–1.

JOHN BIDGOOD, 1623–91, B.M. 1647, was noted for his accuracy in diagnosis at Exeter.

Sir SIMON BASKERVILLE, 1574–1641, the son of an apothecary of Exeter, proceeded D.M. in 1611 and practised at Oxford for two or three years before moving to London, where he became Anatomy Reader at the College of Physicians and

[1] *Natural History of Oxfordshire*, pp. 289–99.

physician to James I and Charles I. 'He would never take a fee of an orthodox minister under a dean, or of any suffering cavalier in the cause of Charles I under a gentleman of an hundred a year, but would also with physic to their bodies generally give relief to their necessities.' RICHARD SPICER, also a native of Exeter, proceeded D.M. 1622 and died in 1640; GEORGE BEARE, D.M. Padua 1652, incorporated at Oxford and practised at Exeter; SIMON WELLMAN, matric. 1653, a demy of Magdalen 1658, but migrated to Cambridge, where he proceeded D.M. in 1686; HENRY NORTHCOTE, D.M. July 1701; HUMPHREY COLMER, D.M. 1705; ABRAHAM CARSLAKE, B.M. and certificated to serve as a physician in H.M. fleet 1708.

It is perhaps in the field of Natural History that Exeter men have reaped their richest harvest. The series began appropriately enough with two west countrymen. WALTER MOYLE, 1672–1721, long remembered for his fine literary taste, has been lately discovered to have been the first man to study carefully the birds of Cornwall. Unfortunately his collection, which included a Great Auk, was destroyed by fire. He left Exeter without a degree to continue the study of the Law at the Middle Temple, where he became acquainted with Congreve, Wycherley, and other literary people at Will's Coffee House. In 1695 M.P. of Saltash. He was a keen student of botany and ornithology. See Appendix D, p. 341.

The works of Walter Moyle, Esq.; none of which were before publish'd, 1726. With portrait as frontispiece. A collection of discourses and letters, dedicated to his brother Joseph Moyle by Thomas Sergeant, whose introduction ran as follows:

I fear certain gentlemen 'will be disappointed when they find here so few productions of that beautiful Imagination which made Mr. Moyle the Delight and Joy of the most pleasant and entertaining conversations; so few of the fruits of that bright faculty, which in conjunction with a judgement, even in the bloom of life, consummate, gave him so sure and so fine a taste of the *Belles Lettres*, and enabled him to decide like an absolute Master, what was the real merit of all the great authors who have signalized themselves in human Literature, Orators, Historians, Poets both antient and modern'.

His writings included an *Essay upon the Roman Government; Charge to the Grand Jury of 1706;* and *Letters to Dr. William Musgrave of Exeter on Classical Inscriptions.*

Next, WILLIAM BORLASE, 1695–1772, the author of the *Natural History of Cornwall* printed in Oxford in 1757, came up in 1712, and taking Priest's Orders in 1720 was presented to the living of Ludgvan near Penzance, 1722. In 1748, after a meeting with Dean Lyttleton at Exeter, his paper on 'Spar and Sparry productions, called Cornish Diamonds', appeared in the *Philosophical Transactions,* and he was made an F.R.S. Of his *Cornish Antiquities,* 1753, published in Oxford, Dr. Johnson wrote: 'This is one of the most pleasing elegant pieces of Local enquiry that our Country has produced.' And in 1758 he gave his whole collection in a cabinet inscribed by his name to the Old Ashmolean. Keepers of the Ashmolean have lost his collection, but have used the cabinet in 1924 for housing old wine-bottles. The University recognized Borlase's merit by giving him the degree of LL.D. He held the view that rot among sheep was caused by an insect which laid its eggs, and fed, on sun-dew (*Drosera*), and from his account it has been considered to be the Dropsy worm of Dr. Tyson. His last work, dealing with the Creation and Deluge, was not published.

The year 1757 was also marked by the reception of a large and handsome Orrery by the Exeter library, as a donation from Thomas Blackall of Great Haseley.[1]

Meanwhile medical studies were beginning to be taken more seriously. Anatomy lectures that were being given at several of the colleges were reinforced by private lectures advertised in the *Daily Courant* to be delivered by CHRISTOPHER FURNEAUX, Fellow of Exeter, assisted by Thomas Blathwait, Surgeon.

> Subscriptions are to be taken in at Mr. Powell's, an apothecary, over against the Public Schools in Oxford where the Course is to be performed. N.B. Forty-two subscribers are already entered.

The students regarded bodies for dissection as one of their rights, so much so that on one occasion in 1721 when the body

[1] W. M. Wade, *Walks in Oxford,* 1817.

of a criminal was not forthcoming, they seized upon the child of some unfortunate parents who were conveying it in a coffin to be buried, and carried it into Exeter College where it was dissected. Not unnaturally the Oxford mob became 'mutinous'.

In Dr. Francis Nicholls Exeter could boast of having the most distinguished teacher of anatomy in his day, but he left Oxford for London before 1738, where he married a daughter of the famous Dr. Richard Mead, and, like his father-in-law, became Physician to the King. He was celebrated for the fine corroded anatomical preparations that were first made by him in Oxford with such success that he has been widely credited with their invention. The idea was, however, probably borrowed from Govard Bidloo, who filled lungs with a fusible bismuth-mercury alloy, and then removed the soft parts by corrosion, a method that was worthy of wider application. His art in the making of injections was known to, and commended by, Cuvier, and in 1741 was transmitted to his pupil William Hunter, who may therefore be regarded as a scion of the Oxford School. In a manuscript copy of Hunter's lectures it is stated that nothing has contributed more to the promotion of anatomical discovery than this method of injection. Hunter's watery injections were made from glue, isinglass, and gum arabic, while for the finest work turpentine thickened with a little resin was used. He also made lead casts of the vascular and other body cavities.

After Dr. Nicholls's departure from the Anatomy School about 1738 Nathan Alcock, D.M. of Leyden, lectured in his place.

Apparently Nicholls's notes continued in use at the Anatomy School for many years. A printed copy, dated 1746, was interleaved by or for Francis Henry Egerton in 1777, and was presented to the Magdalen Library by Richard Walker in 1839. It is entitled *Compendium Anatomico-Oeconomicum ea omnia complectum, quae ad Cognitam Humani corporis Oeconomiam spectant*. The 39 lectures are illustrated with 7 plates, clearly engraved by G. King.

John Andrew, D.M. 1742, was in practice in Oxford in

1768. In 1754 EDWARD SPRY of Plymouth was concerned with the *cause célèbre* of the old lighthouse keeper at the Eddystone who died from internal burns. A lump of lead weighing over 7 ounces was taken from his stomach (*Philosophical Transactions*, 1756).

Sir FRANCIS MILMAN, Fellow of Exeter, 1765, President of the College of Physicians, 1811–12, was one of the first to profit by the great Radcliffe endowment for travelling. When abroad in Rome he made the acquaintance of the Duke of Gloucester, through whose influence he obtained a practice in London. He became Gulstonian Lecturer on Scurvy 1780, Croonian Lecturer 1781, Harveian Orator 1782, President 1811–12, and Physician-in-ordinary to the King 1806. He was the author of *Animadversiones de Natura Hydropis ejusque curatione* dedicated to the Radcliffe Trustees, and based on observations made during his travels abroad. He did not distinguish between dropsies due to cirrhosis of the liver, to malignant growth of the peritoneum, and to renal disease. He recommended purgatives and tonics, and that the patients' liquid food need not be restricted. His *An Enquiry into the Source from whence the Symptoms of the Scurvy and of Putrid Fevers arise* was dedicated to Lord Southampton. From all accounts his brilliancy as a physician was less than that as a courtier. Henry Hart Milman of B.N.C., 1791–1868, Dean of St. Paul's, was his son.

Hybridization among the Amaryllidae was studied by WILLIAM HERBERT, 1778–1847, who was also of Christ Church, and became Dean of Manchester. JOHN EDMONDS STOCK, M.D., in practice at Bristol, compiled a volume of *Memoirs of the Life of Thomas Beddoes*, M.D. 1811. Sir GEORGE SMITH GIBBES, F.R.S., made a great reputation at Bath and in 1819 was appointed physician extraordinary to Queen Charlotte and received the honour of knighthood. He died at Sidmouth in 1851. His three published works will be mentioned under Magdalen College, of which college he was a Fellow when he took his D.M. degree in 1799. WILLIAM DANSEY, B.M., B.A. 1814, took orders.

The greatest of the Exeter naturalists was undoubtedly Sir CHARLES LYELL. But the 'life of a man of science can rarely or never present the same stirring interest or variety as that of a man engaged in an active profession, or who has taken a prominent part in public life'. Of such, historians will never cease to weave fairy tales for others to unpick, and reknit all over again.

Born in 1797 at Kinnordy in Forfarshire, he was the son of a Scotch laird of moderate fortune with interests in botany, entomology, and Dante. He went to school at Ringwood and Salisbury, and came up to Exeter, aged 17. Here for the good of science he attended BUCKLAND'S lectures. While still an undergraduate he studied the estuary of the Yare, the rocks of Staffa and Iona which make every one a geologist, and in 1818 travelled through France, Switzerland, and Italy. People *really* travelled then and were not rushed along at railway speed. On his return he entered at Lincoln's Inn, but weakness of eyesight compelled him to desist from preparation for the Bar.

In the year when he took his degree he became a Fellow of the Geological Society, and Secretary in 1823. His early papers relate to deposits of shell marl in Scottish Lakes, and to Tertiary deposits on the Hampshire Coast and the Isle of Wight. In 1826 he was made a Fellow of the Royal Society. In Paris he met Cuvier, Humboldt, and Brogniart. In 1828 he went to Rome, Naples, and Sicily, and it was this tour more than any other that contributed to lay the foundation of his geological fame. He began to collect notes for his great work, the *Principles of Geology*.

'For upwards of half a century Lyell exercised a most important influence on the progress of geological science, and for the last 25 years of his life he was the most prominent geologist in the world, equally eminent for the extent of his labours, and the breadth of his philosophical views.' His life centred round his unswerving endeavours to explain 'the former changes of the Earth's Surface by reference to Causes now in operation'. He laid down lines from which the science is never likely to deviate. He may be considered as holding much the same place in the history of Geology that Charles Darwin assumed a few years later in that of Biology.

In neither case were their views strictly original. The doctrine of transmutation of species had been put forward by Lamarck, many years before it was taken up by Darwin. The theory that the operation of such causes as we now witness around us in action would suffice, if only time enough were allowed, to account for all geological changes, had been first advanced by Hutton in his *Theory of the Earth*, 1705, and supported by Playfair, 1802. But a contrary opinion was generally held, both in Britain and on the Continent.

It was only natural that in the early history of civilization geological phenomena, if considered worthy of notice, should have been explained in accordance with the theological belief of the time. Creation began from Chaos. Gods arose before Heaven and Earth, and being all-powerful did not take long to shape the sea and the dry land. *Marduk* of Nineveh was the champion of the gods who vanquished the god of Chaos, divided his body into two, and made heaven out of one part, and earth and sea out of the other. Starting with such a view of the Creation, and being able to call upon a quick rise and fall of waters, or outbursts from the central molten mass in the earth, it was not difficult to explain all ordinary phenomena in accordance with the few sentences bearing on terrestrial changes in Genesis or in other parts of the Bible.

Every one agreed that the sea had at some time covered the mountain tops—witness the marine fossils in the rocks. It followed that all pre-existing terrestrial organisms must have been drowned by the Flood.

Granting all this, and the tremendous force of the Bible, Lyell's achievement in obtaining credence for his view was little short of miraculous. It was but too easy to accept and exaggerate the effect of the poetical words of the Psalmist when he wrote of the works of the Lord and his wonders of the deep: 'For he raiseth the stormy wind which lifteth up the waves thereof. They mount up to the heaven, they go down again to the depths: he turneth the wilderness into a standing water and dry ground into watersprings.' Elsewhere: 'The waters stood above the mountains, they go down by the valleys into the place which thou hast founded for them.' Lyell believed in all these things so far as dynamical geology is concerned, but disagreed with those who postulated too miraculously brief a time for the never-ceasing changes that are going on all round us. Persons who believe that all geological history must be compressed into 6000 years must hold catastrophical theories to explain even so simple a phenomenon as a valley.

The last great geological work which had caused a sensation was Dean Buckland's *Relicks of the Flood*—written expressly to reconcile existing appearances with the Mosaic account of the Deluge—in confirmation of the Bible story.

'An inquiry how far the former changes of the Earth's surface are referrable to causes *now* in operation.' In the words of the Psalmist's happy man 'His delight is in the law of the Lord: and in his Law does he meditate day and night'.

Between 1830 and 1875 twelve editions of the *magnum opus* were called for. The *Principles* begin with an excellent introduction where he discussed the causes of the slow development of his science and the many false directions into which it had so often been misled.

The Mosaic time-scale presented the chief difficulty. And next to that, the invocation of some huge unknown power that operated in the past, that was quite different to anything we know of nowadays. Further, that sedimentary deposits once extended uniformly over the whole earth, but owing to a catastrophic sudden change had got distributed as we now find them.

The subdivision of Tertiary rocks into three groups, which he named Eocene, Miocene, and Pliocene, found universal acceptance.

By the appointment of Stephen Peter Rigaud, 1774–1839, to the Savilian Chair of Geometry in 1810 and of Astronomy in 1827, the University obtained the inestimable advantage of acquiring the accumulated inherited learning and traditions of three generations of astronomer-physicists, for Rigaud's father Stephen had been astronomer royal at Kew, while his mother, Mary Demainbray, b. Richmond, 12 Aug. 1777, was the daughter of Stephen Charles Triboudet Demainbray, 1710–82, the discoverer of the influence of electricity in stimulating the growth of plants, tutor to George III, and his astronomer at the Royal Observatory, Kew, 1768–82, in which post he was succeeded by his son STEPHEN GEORGE FRANCIS TRIBOUDET DEMAINBRAY, 1770–1854, Fellow of Exeter 1778–99.

In the first half of the nineteenth century WM. GOULD wrote on *English Ants*; a second JOHN WALLIS of Exeter produced maps of the *Bodmin* District in 1816–48; W. E. HONY wrote about the Geology of Maestricht, 1817; and the most famous of all, RICHARD DODDRIDGE BLACKMORE, 1825–1900, of Blundell's School and Exeter, 1843, wrote on the west country. He spent the latter part of his life at Gomer House, Teddington, where he wrote *Lorna Doone* and devoted his spare time to the cultivation of fruit, which he reckoned cost him £250 a year.

That zoological studies were likely to thrive in the College was suggested by a story of CHARLES PEARSON, 1830–94, who afterwards read science with Acland and Maskelyne, that even the Sub-Rector, William Sewell, was so greatly impressed by the resemblance of a typical vertebra, as described by Oken or Owen, to the Cross in that both have a central column with lateral processes, that he proceeded to argue that the visible proof of the Crucifixion was scattered up and down throughout creation.

GILBERT WILLIAM CHILD took his B.A. in 1854 and proceeded D.M. in 1859. He became lecturer on botany at St. George's Hospital and hon. physician of the Radcliffe Infirmary and medical officer of health for Oxfordshire.

HENRY NOTTIDGE MOSELEY, 1844–91, was a Harrovian who came up to Exeter in 1864. Finding mathematics and classics distasteful, he was allowed to attend Professor Rolleston's

H. N. MOSELEY

laboratory, and gained a first class in the natural science schools. A Radcliffe Travelling Fellowship in 1869 enabled him to continue his medical studies in Rokitanski's laboratory in Vienna. After entering as a medical student at University College, he seems to have been persuaded by E. Ray Lankester to turn his attention to biological problems. Together they studied at Leipzig under Professor Ludwig. A short but productive visit to Ceylon, where he formed a collection of land planarians, led to his appointment as naturalist on the staff of the great Challenger Expedition round the World, 1872–6. His work helped to make this scientific expedition a general model for all subsequent explorations of the ocean. On his return he ensured that valuable portions of the material collected upon his great voyage should be available to students for minute study at home. Thus Poulton of Jesus and Keble was able to study in Oxford the histology of the tongues of Perameles and Ornithorhynchus. A fellowship at Exeter followed, and for several years his time was fully occupied in preparing reports upon the significance of the immense mass of new material collected during the expedition.

In 1879 he was elected a Fellow of the Royal Society, and two years later succeeded Rolleston as Linacre Professor of Human and Comparative Anatomy, becoming thereby *ex officio* a Fellow of Merton College. He married Miss Gwyn Jeffries (p. 235) in the same year.

In his Oxford Laboratory he organized the most elaborate system of class-work for the honour schools that had as yet been attempted. The manuscript descriptions of dissections of types, which he laboriously compiled to assist his pupils included much original observation. They were in fact elaborate monographs which he would have published had he lived. The labour of their preparation, accentuated by lecturing all over the country, undoubtedly contributed to a nervous breakdown in 1887, the result of overwork. Doctors Sydney Hickson and Hatchett Jackson were appointed as his deputies. Among his pupils O. H. Latter, Chalmers Mitchell, Henry

Balfour, and Sir Halford Mackinder have all achieved fame. By his devotion and example the Honour School of Zoology reached a standard unsurpassed by that of any of the other Science schools in the University.

Edwin Ray Lankester, 1847–1929, was one of those who could claim membership of several colleges and universities, but from personal knowledge I know that his preference was for Exeter, where he found congenial society in the senior common room. Beginning as a scholar of Downing College, Cambridge, he migrated to Christ Church and won the Burdett-Coutts Scholarship in Geology and the Radcliffe Travelling Fellowship in 1870. Aided by these endowments he worked for several happy and stimulating months with A. G. Bourne at the Stazione Zoologica at Naples, which had been founded but two years previously by Anton Dohrn. Elections to a Fellowship at Exeter in 1872, to the Professorship of Zoology at University College, London in 1874, and to the Fellowship of the Royal Society in 1875 followed in rapid succession.

In 1891 he returned to Oxford as Linacre Professor of Comparative Anatomy, but resigned in 1898 on his appointment to the premier zoological post in the world, the Directorship of the Natural History Museum and Keepership of the Zoological Department of the British Museum. In spite of much unnecessary friction it may truly be said that he left each of his posts better organized for the advancement of natural knowledge. No zoologist has had a wider interest in the general problems of his subject, nor, since Huxley, a greater talent for expounding the elements of zoological science to his pupils. He began his practical teaching in a laboratory fitted up for his class in Exeter College.

Always intolerant of humbug, he procured the conviction of the spirit-medium Slade as 'a common rogue and vagabond'. Himself a close follower of the work of Klein and Metschnikoff, the application of bacteriology and protozoology to preventive medicine was ever in his thoughts. He had himself studied the life-history of Trypanosomes, and had been a most active

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member of the Royal Society Committee for investigating sleeping-sickness and other tropical diseases. Metschnikoff and Pasteur were among his intimate friends. His chief publications include *A Monograph of the Fossil Fishes of the Old Red Sandstone*, 1870; *Degeneration*, 1880; *Limulus an Arachnid*, 1881; *Rhabdopleura and Amphioxus*, 1899; authoritative articles, which some consider his best work, on *Protozoa*, *Hydrozoa*, *Polyzoa*, *Mollusca*, and *Vertebrata* in the *Encyclopaedia Britannica*. His articles on *Science from an Easy Chair* attained to a wide popularity.

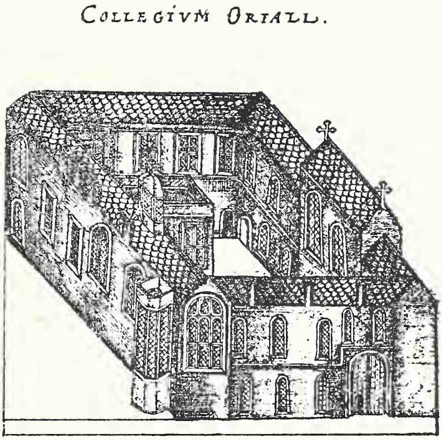
In 1869 he succeeded his father as editor in chief of the *Quarterly Journal of Microscopical Science*. In 1884 he secured the foundation of the Marine Biological Association at Plymouth, of which he became President.

In recent years the teaching of Zoology was furthered by the work of G. H. Morrell, of Headington, an early recipient of honours after examination in 1867. For some years he acted as demonstrator in Zoology and published a *Student's Manual of Comparative Anatomy and Guide to Dissection*, 1870, with a supplement in 1872.

W. A. B. Coolidge, 1850–1926, matric. 1869, obtained a first class in modern history in 1873, and a Fellowship at Magdalen in 1875. He remained an American citizen and was the greatest authority on the topography and physical geography of the Alps. A climber of the very front rank, especially at the time of his association with that wonderful guide Christian Almer, he became also the most erudite of his generation. His editions of Ball's *Alpine Guide* and Murray's *Handbook of Switzerland*, and his charming *The Alps in Nature and History* will make his name live for ever in the annals of Alpine Clubs.

Sir D'Arcy Power, b. 1855, F.S.A., F.R.C.S. 1883, Lt.-Col. R.A.M.C., was awarded a first in the Natural Science School in 1878. He had filled the posts of Consulting Surgeon and Archivist to St. Bartholomew's Hospital, Honorary Librarian to the Royal College of Surgeons, Hunterian Orator 1924, President of the London Medical Society and of the Historical Section at the Royal Society of Medicine.

John Wilfred Jenkinson, 1871–1915, presented a rare case of the manner in which an exceptional mind trained in the school of Literae Humaniores can readapt itself to the exacting requirements of an original investigator in Biology, and, more particularly, in Embryology, in which he excelled. Benefiting by preliminary study in the laboratory of Professor Hubrecht at Utrecht, he published some score of papers on the early development of vertebrates, which show that had his life not been cut short by the War, he would have gone far in his science. An *Experimental Embryology* is his best-known work.



5. ORIEL COLLEGE, 1326

In the year 1326 King Edward II took over Adam de Brome's two-year-old institution and refounded it with a Royal Charter as the King's Hall. To this, which soon received the name of Oriel, Adam de Brome gave St. Mary's Church and its revenues, and Edward III gave the Hospital of St. Bartholomew and, what was then of quite as much importance, the skin of St. Bartholomew. There were five twelfth-century hospitals for lepers in Oxfordshire, the oldest of these was this hospital of St. Bartholomew, founded in 1126 by Henry I. Its ancient walls are still standing about a quarter of a mile beyond St. Clements, though they had already been allowed to fall into decay, owing to a rumour that leprous folk from overseas had, at the instance of the Saracens, 'poisoned the fountain of sweet gliding streams'.

In 1329 Edward III, 'to gratifie his scollers of Oriel Hall, conferred on them the hospital, which was then much decayed, so that they might have the use of wholesome air in times of pestilential sickness' in the town.

The therapeutic agents used here are well worthy of remembrance. There were St. Edmund the Confessor's comb, one of the ribs of St. Andrew the Apostle, the bones of St. Stephen, and the aforementioned skin of the patron saint of the hospital. 'Those who were troubled with continual headakes, frenzies or light-headed, were, by kembing their heads with St. Edmund's combe, restored to their former healthe; or those troubled with a weakness of joints or halting were by the handling and applying those bones to the places affected, restored to their pristine state.' This equipment may have been worth as much as is an ounce of radium to a modern hospital.

Notwithstanding such endowments, Oriel was a poor college, and this is indicated by its bad luck with its early library. Soon after the foundation it so happened that some books bequeathed to the University were in pawn. Adam de Brome, having the good of Oriel very much at heart, redeemed these books with the building in Cat Street in which they were then stored, and transferred them to Oriel. But the college was apparently not strong enough to keep them, and ten years later, in 1337, a body of students broke into the building and carried them off.

Later the college received Peter Lombard's *Liber Sententiarum*, 1365, from Simon Bredon, and ten more books under the will of William Rede of Merton, who died in 1385, but these are not now to be found.

The first physician of eminence known to have been connected with Oriel was Roger Marbeck, an erstwhile student (1536–1605) of Christ Church. In the second year of his appointment as Senior Proctor he was created our first Public Orator, and unanimously elected Provost of Oriel in 1564. It was he who made such a prettily turned speech in Latin before Queen Elizabeth that she paid him the compliment 'We have heard you before, but now we know you'. Admitted D.M. in 1573, he became the first Registrar of the College of Physicians, for which he received 40*s.* a year and a fee of 3*s.* 4*d.* on each admission, and on each person fined. He was physician to Queen Elizabeth, and accompanied the Lord High Admiral Howard in the expedition against Cadiz in 1596. He wrote a *Defence of Tobacco*, 1602, and died in 1605.

He was also the author of *A briefe and true Discourse of the late honorable Voyage into Spaine; and of the wynning, sacking and burning of the famous Towne of Cadiz there; and of the Miraculous Overthrowe of the Spanish Navie at that time.* The MS. is in the British Museum.

But the most eminent of a number of physicians of considerable learning was THOMAS COGAN, 1545?–1607, who made gifts of books that are still in the library. He held a Fellowship from 1563 until 1574, when he became Master of Manchester Grammar School. His most popular work, *The Haven of Health*, 'made for the comfort of Students' in 1584, contains much shrewd advice as to diet and exercise suitable for Oxford undergraduates. The concluding pages are on *A Preservation from the Pestilence with a short censure of the late sickness at Oxford.*

The book contains many local allusions as the following quotations show:

'Husbandmen and Craftsmen for the more part doe live longer and in better health than Gentlemen and learned men, and such as live in bodily rest. Wherefore Galen himselfe sometimes used rusticall labors, especially in winter: as to cleave wood, to punne Barley, and such like.

'In Oxford in my time *c.* 1580, they used commonly at dinner, boyld beefe with pottage, bread and beere and no more. The quantity of beefe was in value an ½*d.* for one man, and sometimes, if hunger constrained, they would double their commons.

'Cyder, best after Xmas and about Lent. I remember when I was a student at Oxford one mistris G sold Pery insteed of Rhenish Wine, and so beguiled many a poore Scholler.'

'Mutton', he says, 'is commended of the most part of Physicians, save Galen who saith that it maketh il juice, for so he writeth of lambe and mutton jointly. . . . But how much Galen is deceived . . . experience proveth here in this realm, for if it be young and of a wether, it is right temperature meat, and maketh good juice. . . . Rammes mutton I leave to those that would be rammish, and old mutton to butchers that want teeth'.

Continuing on the topic of mutton: 'The Kidneys make grosse and ill blood. . . . Yet at Oxford the scullion is glad of the Kidneies of loynes of Mutton, and many a poore scholler is glad to receive them well roasted at the scullion's hands.'

Doubtless Cogan would have had many discussions with the kitchen and buttery staffs. 'At Oxford upon festivall days, they are wont to eat Crevises, last after flesh.' 'They that go from Oxford to Botley to eate Creame make but a sleeveless errand, yet raw Cream well-boyled with a little Sugar is a good nourishing meate and good for a weak student.'

Students are to be careful not to overtax the brain. 'Weariness of the mind is worse than weariness of the body. . . . Diligent students must apply themselves earnestly to reading and meditation for the space of an houre: then to remit a little their cogitation, and in the meantime with an ivory combe to kembe their head from the forehead backward about 40 times, and to rub their teeth with a coarse linen cloth.'

On the subject of exercise he quoted Galen with approval. 'Above all other kindes of exercise Galen most commendeth the play with the little ball, which we call Tenise, . . . wherefore those Founders of Colleges are highly to be praised, that they have erected Tenis-courts for the exercise of their schollers: and I counsell all Students as much as they may to use that pastime.' Cogan was the first to write the Rules of Health for University men, and when we remember that they produced a Walter Raleigh at his college, they could not have needed much amendment.

He tells us that there was a visitation of the Plague in Oxford in his time. It spared no one, not even old folks, men and women above 70 years old. He recommended going away to the country. 'But if it be necessary to stay in the city then do not go out without eating and drinking first, put a clove in your mouth and take an orange in your hand, etc. Half a glass of white wine and water every morning.'

The last six pages on the *Sicknesse at Oxford* refer to the *Sudor anglicus* that swept Germany in 1529. It began in England in 1485, first year of the reign of Henry VII. It reappeared in

SIR MATHEW LISTER

GILBERT WHITE

1528 and for the third time in 1551. At Antwerp 500 persons died in 3 days. If people got chilled, it drove the sweat in and killed them. If they were kept close, they got stifled. If they were allowed to sleep, they died in their sleep or on waking. The remedy suggested was to lie quiet with cloths on for 24 hours. To fast, no meat, to continue in moderate sweat without sleeping for 24 hours, then sleep and moderate food was permitted. There might be relapses and three relapses killed.

Cogan presented the college library with a copy of Galen 1561–2 in five folio volumes each carefully inscribed outside the binding under a window of horn, and also with the *De humani corporis fabrica* of Vesalius.[1]

Worthy successors were John Jackman, B.M., 1584, who practised in Oxford; Sir Matthew Lister, 1564–1656, D.M. of Basel, who incorporated at Oxford in 1605. He led an active life as agent to Mary, Countess of Pembroke, Physician to Queen Anne of Denmark, Consort of James I, and to Charles I, who knighted him; Sir Maurice Williams, D.M. Padua 1628, Anatomy Reader at the College of Physicians; John Saunders, D.M. 1628, Principal of St. Mary Hall, 1632–44.

Sir Walter Raleigh, 1552–1618, the hero of a heroic age, was up at Oriel from 1566 to 1569. He will never lack biographers, so we may confine ourselves here to recalling his horticultural efforts, the introduction of tobacco and potatoes into Ireland, and his exploration for gold-mines in the New World. His most important contribution to the literature of science was his *Discovery of the large, rich and beautiful Empire of Guiana*, 1596. The enforced leisure which he philosophically suffered in the Tower was in part alleviated by his chemical experiments, converting a little henhouse in the garden into a still, he spent his days in distillation. On occasion, too, he compounded medicaments, e.g. the balsam that saved the life of Anne, James I's Queen. No man died a braver death.

[1] *The Oriel Record*, June 1935.

Contemporary with Raleigh was THOMAS HARIOT, 1560–1621, a native of Oxford, of St. Mary Hall now incorporated with Oriel, who has not had the recognition his merit deserved, chiefly because he would not profit by the warning of his pupil, Sir W. Lower, that unless he published, he would lose the priority of his rarest inventions. He, too, made the Virginia voyage in 1585, making observations with an astrolabe and a perspective glass. His discoveries in mathematics and particularly his treatment of equations are in part recognized by his name applied to Hariot's Law of Signs. He invented the signs of inequality $>$ and $<$, $\sqrt{3}$ for cube root, and continuing the work of Recorde practically gave to algebra its modern form. His work on Specific Gravity and on the Laws of Falling Bodies is worthy of all praise.

HARIOT's work on Algebra was published ten years after his death, though probably written about 1610. *Artis Analyticae Praxis, ad Aequationes Algebraicas nova Methodo resolvendas,* London, 1631. The work includes the formation of equations with given roots, the law as to the number of roots, the relation of roots to coefficients, the transforming of equations into equations having roots differing from the original roots according to certain laws (Hariot's law of Signs), and the solution of numerical equations. He used small consonants for known quantities, and small vowels for unknown quantities. He also began a system of analytical geometry with rectangular coordinates, and a recognition of equivalence of equations and curves, 20 years before Descartes.

$$aaa - 3bba = +2.ccc$$
$$x^3 - 3b^2a = 2c^3$$

Hariot's career, or at least his navigational methods, may have been followed with interest by a west-country man, ROBERT COCKRAM of Cullompton, Fellow from 1578 to 1626, and a kinsman of Martin Cockram who sailed with Drake, for he included the following rather unusual clause in his will dated March 3, 1631.

Item. In regard of the regall and bountiful benevolence and exhibition I have longe tyme recyvd in Oriell Colledge and in regard to the knowledge of learninge by studdie and practice pruved I doe geeve an bequeathe unto the Provoste and Fellows of the said Colledge one astrolab of brasse with the p(ar)ts belonginge thereunto in a case of leather w(i)th one other broade and rounde instrument of brasse and also I gave unto them one booke of parchment in writinge bounde in a cover of parchement.

In the *Oriel Record* reasons have been regretfully stated for believing that Cockram's astrolabe is no longer in existence.

Humphrey Whitmore of St. Mary Hall proceeded D.M. in 1648.

Daubigny Turberville (1612–96), at Oriel 1634, was a Royalist who went off to fight for his King, until Exeter surrendered to Fairfax in April 1646, when he took to practising medicine at Wayford. He took his D.M. in 1660 and soon acquired a great reputation in cases of diseases of the eye, for which he was consulted by Pepys, to whom 'he did discourse learnedly about them'.

For instance, Pepys has it on record that on July 3, 1668, he went 'To an Alehouse: met Mr. Pierce the surgeon, Dr. Clerke, Waldron, Turberville my physician for the eyes, and Lower, to dissect several eyes of sheep and oxen, with great pleasure and to my great information. But strange that this Turberville should be so great a man, and yet to this day, had seen no eyes dissected, or but once, but desired this Dr. Lower to give him the opportunity to see him dissect some.'

According to Pope he cured Queen Anne, when she was a child, of a dangerous inflammation of the eyes, which had baffled the Court physicians.

An interesting group of Physicians and Botanical students were up at the same time. Christopher Merrett, D.M. 1643, was one of a flourishing botanical circle, to which belonged Hooper, Browne, Stonehouse, and Drope, all of Magdalen, 1644–5; Dr. Stephen of Magdalen Hall; William How, of St. John's, 1645; William Cole of New College; and Jacob Bobart, who had then in preparation the first Catalogue of the

Physick Garden. It is likely that in their botanical studies these students were seeking a refuge from the political troubles of the time.

All may have known, or were known to, John Goodyer, many of whose plant-records were printed by Merrett in his *Pinax*, 1666. Having been appointed Harveian Librarian by Harvey himself, he had in his charge the books that were burnt in the fire of 1666. When the College of Physicians gave up their ancient site to St. Paul's they considered their librarian to be no longer necessary. But Merrett held the contrary opinion and brought an action in the King's Bench against the College, which may partly explain why in 1681 he was expelled from his Fellowship. Perhaps he was naturally quarrelsome, for in 1670 he had had an historical scrap with the Apothecaries. One of his botanical discoveries was that a change of colour of Wild Succory from blue to white was to be attributed to a transplanting to a poor soil.

Another botanist of distinction was Edward Dyer, 1651–1730, who was too modest to publish anything under his own name but contributed anonymously a preface to the third volume of the Oxford *Historia Plantarum*. In 1685, doubtless inspired by the good advice of John Evelyn, he planted eight Virginian Cedars in the Oriel Grove. His collections of botanical and mineralogical specimens are now on view in the Museum of the History of Science in the Old Ashmolean.

There is a note about him in Archbishop Laud's own handwriting. Mr. Dyer 'is a Man of great Modesty and of exquisite skill in these Studies. It has most if not all the Plants in the Catalogue of the Garden at Leyden. The Collector has taken a prodigious deal of pains, & fixt each plant upon the Leaf with great exactness. These Specimens are all taken from the Trees or Roots themselves, and fasten'd with Past.'[1] His contemporary Ralph Stubbs practised physic at Reading, *c.* 1700.

Botanical studies were again taken up many years later

[1] On a loose paper in a thick folio, *Hortus Hyemalis, Arch. Seld.* B.

by A. BOURKE LAMBERT of St. Mary's Hall, who wrote a great monograph of the Genus *Pinus* and a description of *Cinchona*.[1]

JAMES POUND, F.R.S., the astronomer, matriculated from St. Mary Hall but became associated with Hart and Gloucester Halls, under which head his further career is indicated (p. 290).

The greatest naturalist of all was GILBERT WHITE, born at Selborne Parsonage in 1720, who, having received his schooling at Farnham and Basingstoke, was admitted in December 1739 commoner of Oriel. As a B.A. in 1743 he attended Bradley's Scientific lectures in the Old Ashmolean and became a Fellow of the College. Following the usual practice he took Holy Orders, and after holding many curacies eventually obtained his heart's desire by succeeding to that of Selborne. He also took office as Dean at Oriel in 1752, but curiously enough was unpopular among his colleagues. When in 1757 Dr. Hodges, Provost of Oriel, died, White was an unsuccessful candidate for the headship. His triumphs were in other fields: his *Natural History of Selborne* has become one of the classics of the world.

Soon after, he was given the College living of Morton Pinkney in Northamptonshire, which gave him a small income, while he held curacies of Faringdon and of West Deane in Wiltshire. If we review the somewhat unsettled years of his early life, three facts emerge:

1. Neither his father nor he were at all well off financially, even the historic house, the Wakes at Selborne, where his father lived, did not belong to them, but was rented from an uncle at £5 per annum.

2. White had an insatiable desire to see the country, which he did, taking long journeys on horseback. His great friend, John Mulso, called him the 'hussar parson', for he was always on the move across country visiting friends in Sussex, in

[1] Lambert (A.B.). *A Description of the Genus Pinus illustrated with Figures, Directions relative to the Cultivation, and Remarks on the Uses of the Several Species.* Second Edition (by Don), 1837. *An Illustration of the Genus Cinchona,* 1821.

London, in Rutland, in Cambridge; on occasions going to Bristol, Essex, Norfolk, and as far north as the Peak.

3. However great his pleasure may have been when he started out on his various travels, he was always uncommonly glad to get back to Selborne. He loved that village and its country-side with a life-long affection. Even at his West Dean curacy he felt lonely and unhappy: it was so far away from Selborne. And the reason is not hard to define. He was a born naturalist with the keenest possible sense of the beauty of nature.

He did not set out to write a popular natural history in the literal sense of the word. He wrote a few scientific papers, one of which was the admirable account of the British Hirundinidae contributed to the Royal Society (*Phil. Trans.*, vols. 64 and 65) and afterwards reprinted in the *Natural History of Selborne* 1789. It is remarkable that Bowdler Sharpe and many of the writers of scientific treatises on the Swallows should omit to mention it.

Gilbert White was an ardent letter-writer. In 1751–67 he began to keep a 'Garden Kalendar' on small letter paper, but after 1767 his observations were entered on elaborate forms supplied by Daines Barrington. It has been suggested that 'the taste for observing and recording periodic natural phenomena' had been acquired by him from Stephen Hales, rector of Faringdon.

Among the books that he read in his early period were Benj. Stillingfleet's *Miscellaneous Tracts* 1759; Scopoli, 5 vols. 1769–72, which he often quoted; and Ray's *Synopsis Methodica Avium et Piscium* (purchased 1753), his zoology, supplemented later by Linnaeus.

He did not begin the study of Botany until he was 46. A high standard of scientific work was doubtless maintained by an annual visit to London, where his brothers Thomas and Benjamin were domiciled. There he attended many meetings of the Royal Society and Society of Antiquaries. He became acquainted with Sir Joseph Banks, Daniel G. Solander, Forster the naturalist of Cook's 2nd voyage, Wm. Curtis, Sir Ashton

Lever, John Lightfoot, Pennant's fellow traveller, and there also as a man of 47 he made the acquaintance of Pennant, who was then engaged on a new edition of *British Zoology*. Their correspondence lasted until the completion of the fourth edition in 1776, the proofs of which were revised by White himself. White's Letters to Pennant were subsequently returned to him, and formed the basis of the *Natural History of Selborne*.

The correspondence which forms the second part of the *Natural History of Selborne* was begun in 1769 through an acquaintanceship with Barrington, who had then newly invented the *Naturalist's Journal*. In 1770 Barrington appears to have suggested the publication of the *Natural History*, to which White timorously replied that 'It is no small undertaking for a man unsupported and alone, to begin a Natural History from his own autopsia'. He doubted whether he had 'resolution and spirits to set about it'. By overmuch reading his eyes began to fail in 1775; yet two years later we find him working up the antiquities of Selborne, with the help of musty archives in Magdalen College, a research in which he was helped by R. Chandler. By 1788 he had completed the book less the index, the making of which he found to be 'an occupation full as entertaining as that of darning of stockings'.

The book was published by his brother Benjamin. Success was slow, but great amongst Naturalists. It brought correspondence. 'Oh, that I had known you twenty years ago. It has been my misfortune never to have had any neighbours whose studies have led them towards the pursuit of natural knowledge.'

We can at any rate repeat two statements about White's great book. He designedly describes Nature as *he* saw it, and is not continually introducing the opinions of others. He wrote to Barrington—'Faunists, as you observe, are too apt to acquiesce in bare descriptions and a few synonyms: the reason is plain; because all that may be done at home in a man's study, but the investigation of the life and conversation of animals, is a concern of much more trouble and difficulty, and is not to be attained but by the active and inquisitive, and by those that reside much in the country'. Next he entirely ignores extraneous events. The loss of the American Colonies, the conquest of India and the horrors of the French Revolution have nothing to do with Selborne. The politics of Pitt and Fox, the genius of John Hunter, the brilliance of Edmund Burke, the oratory of Sheridan, and the deeds of Warren Hastings are all passed by as being less worthy of notice than the nesting habits of martins, or a shower of aphides.

Will not some one some day write a History of Natural Histories? They have too often been passed over in general Histories of Science, but their influence for good has been enormous. And who will gainsay it if, for instance, we trace some of the exquisite descriptions of our local scenery, its sylvan and rural beauty contained in the poems of one of Oriel's great poets, Matthew Arnold, back to his predecessor in the Fellowship of Oriel? When quoting or re-reading the *Scholar-Gipsy* let us remember Gilbert White.

The chief Oriel physicians in the eighteenth century included James Hawley, D.M. 1737, who delivered the Gulston lectures; and William Cadogan, 1711–97, D.M. of Leyden 1737, M.D. Oxon. 1755, F.R.S.; an *Essay on the Nursing and Management of Children*, 1750, led to his being appointed physician to the Foundling Hospital. His *Dissertation on the Gout and all Chronic Diseases jointly considered as proceeding from the same Causes* passed through eleven editions.

Sir Richard Jebb matriculated at St. Mary's Hall in 1747, but did not take a degree. He served at St. George's Hospital in 1760, was elected F.R.S. and F.S.A., became physician to George III, and laid out a park, called Trent-place, on 200 acres of Enfield chase.

Among the members of an interesting group of learned physicians who were at the college during the second half of the eighteenth century, mention must be made of Richard Tyson, 1730–84, D.M. 1760, who served St. Bartholomew's Hospital for twenty-two years until his death; Stephen Pemberton of Lincoln, Fellow of Oriel 1767, who graduated M.B. in 1770;

JOHN MAYO of B.N.C., D.M. 1788, who became physician at the Middlesex Hospital and physician in ordinary to the Princess of Wales. Almost contemporary was Dr. THOMAS MONRO, 1759–1833, who proceeded M.D. in 1787 and took up an appointment at the Bethlem Hospital, in which he was succeeded by his son EDWARD THOMAS MONRO, also of Oriel. It seems as though there were something in the atmosphere of this college that inspired Thomas Monro to recognize the merit of the paintings of the celebrated artist, J. M. W. Turner, and to collect his early works, just as one century later his successor, Lancelot Phelps, provost of Oriel, collected the beautiful works of William, the 'Oxford' Turner. However that may be, heredity has counted for much in the Monro family, and also among the Mayos, for John Mayo's son THOMAS MAYO, 1790–1871, took his education into his own hands with the view of becoming like his father, a Fellow of Oriel. For this we have his own statement:

'I had pledged myself to my father, provided he would permit me to escape the "foundation" of Westminster school and its peculiar training, which combined with a very fair proportion of Latin and Greek occasional aerostation in a blanket.'[1] So he went to coach with the Rev. George Richards of Oriel and eventually obtained his heart's desire with honours. He became President of the College of Physicians in succession to Dr. Paris, and was re-elected every year until 1862. And, yet another link with Oriel, when he retired in that year, it was Dr. Francis Hawkins, brother of the Provost of Oriel, who moved a vote of thanks to Mayo.

Before Mayo resigned his physicianship at the Middlesex, CHARLES GOWER, M.D. 1799, entered it, but he eventually paid the penalty for not taking medical duties very seriously, treating medicine as 'a plaything, never being steady in professional pursuits' (Munk). A more sedate Fellow of the College of Physicians was PETER RAINIER, D.M. 1805.

A special feature of the period was the interest that many amateurs took in experimental physics. Thus we find GEORGE

[1] Note of Dr. Mayo to W. Munk in 1861.

Children, who was up at Oriel in 1758 and later became a partner in Tunbridge Bank, devoting himself to experimenting in electricity. He died in 1818.

Henry Beeke, 1751–1837, who came up as a scholar of Corpus, was elected to a fellowship at Oriel in 1775 and Vicar of St. Mary's in 1782. When he was preferred to the living of Ufton Norcot, he took an interest in the local flora and wrote an excellent report on the Hop Trefoils growing about Ufton. He died Dean of Bristol.

A remarkable collection of Physical Apparatus, mostly made by Edward Nairne and dating from near the close of the eighteenth century, came to the College with the library of Lord Edward Leigh in 1786. It is now an important exhibit in the Museum for the History of Science as an illustration of the new method of teaching natural science that had been advocated by the Royal Society from its foundation, but which had then only been recently introduced into Oxford. As Dr. Sprat put it, 'the work which the Society proposes to itself is not so fine and easie as that of teaching is, but rather a painful digging and toiling in nature by experiment and in front of an audience'. Perhaps the old style of teaching that they condemned as fine and easy was of the kind that wearied Bishop Butler when he was up at Oriel, which he described as 'frivolous lectures and unintelligible disputations'. The possession of this physical apparatus certainly distinguished the Oriel lectures on natural philosophy in the eighteenth century from the dogmatism of previous systems. It was of a kind that so deeply interested kings and nobles in practical scientific studies, that many a well-furnished library in large country houses came to be provided with a cabinet of philosophical instruments in addition to the usual pair of globes. Lord Leigh also left £1,000 in trust for models and apparatus to illustrate the mathematical lectures and experiments explained by Dr. Bradley and Mr. Bliss in the Old Ashmolean Museum.

Sir Christopher Pegge, 1765–1822, of Christ Church, became a Fellow of Oriel in 1788, F.R.S. in 1795, and Regius Professor of Medicine in 1801–22. As Lee's Lecturer in

Anatomy he held courses of instruction in the Anatomy School at the House which were at first well attended, but during the first decade of the nineteenth century his lectures were described as being so 'desultory' that 'the protection of the Dean and Tutors of Christ Church could never make his anatomical school famous beyond the walls of the University, or popular with the young men within them'.

One of his students was WILLIAM JOHN BRODERIP, 1780–1859, who attended the chemical and mineralogical lectures of Dr. John Kidd and the anatomy lectures of Sir Christopher Pegge. Later he read for the Bar at Lincoln's Inn, and filled the posts of Police Magistrate at Thames Court, 1822–46, and then at Westminster, 1846–56. But his early love of natural history was always springing up again.

His unrivalled collection of shells, many of which were published in the *Proceedings* and *Transactions* of the Zoological Society, was ultimately purchased by the British Museum. He became F.L.S. in 1824, an original F.Z.S. in 1826, F.R.S. in 1828, and co-secretary with Sir Robert Murchison of the Geological Society until 1830. The habits of animals had rarely been more graphically described than in a series of magazine articles collected in his *Zoological Recreations*, 1847 and *Leaves from the Notebook of a Naturalist*, 1852. He also wrote an historical introduction to Owen's *Memoir of the Dodo*, 1861, effectively demolishing the view previously expressed by John Edward Gray that the pictures of the Dodo were made up artificially by joining the head of a large vulture to the legs of some great gallinaceous fowl.

The story of the Dodo was continued by HUGH E. STRICKLAND, 1811–53, a grandson of Edmund Cartwright of Magdalen. These singular birds furnish the first clearly attested instance of the extinction of an organic species through human agency. It is sad to think that many other species of animals and of plants are now undergoing this process of destruction before the ever-advancing tide of human population.

Strickland was a competent geologist, having been trained by Buckland, whom he would probably have succeeded, had not an accident, when he was examining the rocks in a railway-cutting, ended his promising life in 1853. But the work that he was not fated to do was continued by his contemporary ROBERT GOODWIN-AUSTEN, 1808–84, who became a Fellow of Oriel and of the Geological Society in the same year 1830, and F.R.S. in 1849. He had accompanied Sedgwick through parts of Devonshire 1837. His paper on Pope's Nose, Torquay, was criticized by Greenough, who believed that the sea sank. 'This young man thinks he has seen a raised beach; I don't believe a word of it.' When he was given the Wollaston medal in 1862, he was referred to as '*pre-eminently the physical geographer of byegone periods*'. He realized the extension of the coal-measures beneath the south-eastern counties of England.

The rise of modern Oriel began under Provost Eveleigh. During the first decades of the nineteenth century the Oriel Common Room became the most intellectual in Oxford, and in various ways its Fellows began a movement which by renewing the life of the Church of England has become a part of the national history. But it is not so widely recognized that this movement has had a considerable repercussion upon Scientific Studies, as will be more fittingly noted when alluding to the work of the Duncans of New College. A prominent member of the room, the Rev. BADEN POWELL, who matriculated in 1814, was one of the most able natural philosophers of his age. It is said that when he was being examined in mathematics he forgot the proposition, and had to work them out anew out of his head in the Schools. Far from strong physically, his exceptional mental powers enabled him to outstrip his contemporaries. He was elected F.R.S. in 1829 and to the Savilian professorship of geometry three years later. His power of drawing caricatures was remarkable. Baden Powell, with Professors Rigaud, Daubeny, and Walker, was one of the founders of the Ashmolean Society in 1828, and for many years continued to make valuable contributions to the society's meetings. His published papers were: *On the Achromatism of the Eye*, 1834; *On the Theory of Ratio and Proportion*, 1836; *Observations for determining the Refractive Indices for the Standard*

BADEN POWELL

By the courtesy of Oriel College

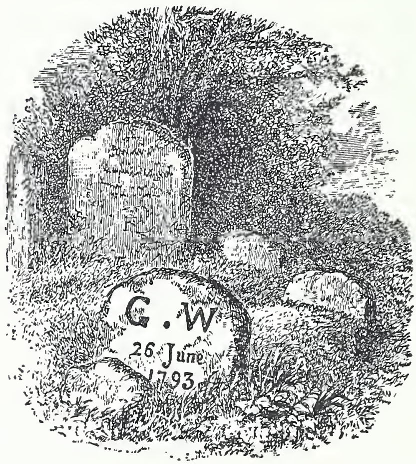
Rays of the Solar Spectrum in various Media, 1836–8; *On the Primary Laws of Motion*, 1837; *On the Theory of Parallel Lines*, 1842; *On Necessary and Contingent Truth*, 1849. Several of his discourses were on celestial phenomena: *On Periodical Meteors*, 1845; *On the Comet of 1843*, 1846; *On the Perturbation of the Motion of Uranus*, 1846; *On Luminous Meteors*, 1848; and *On the Solar Eclipse of July 28, 1851*. He was most active in University reform.

An Examination of the Electrical Nomenclature of Du Fay and Franklin was the title of an essay by the Rev. J. P. POTTER, whose experiments showed that the designations 'vitreous' and 'resinous' electricity were not satisfactory, because it was possible for the same body on excitation to exhibit either vitreous or resinous electricity, according to the electric state of the body with which it is compared.

The Hon. C. HARRIS was another member of the college who was interested in physics. Considering ordinary methods for measuring the force of the wind to be insufficient, he proposed in 1833 an anemometer in which a sphere is suspended by a fine but stiff wire to a horizontal axis, the rotation of which, as the sphere is raised by the wind, is marked by an index on a graduated quadrant.

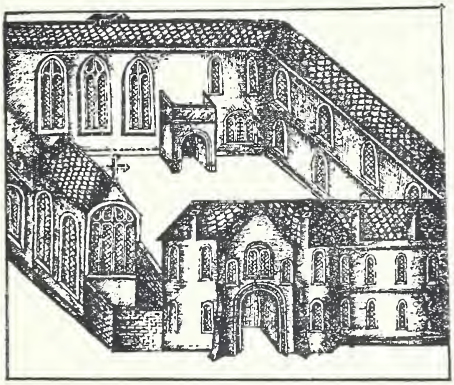
Several of the Oriel Divines came to attend the Old Ashmolean Lectures: PUSEY, WHATELY, HURRELL FROUDE, CHARLES MARRIOTT, MARK PATTISON, all came to hear Daubeny on Chemistry, while NEWMAN attended Rigaud's lectures on Physics.

The acquaintance that the leading Tractarians thus came to have with the rudiments of science proved of value when plans for the Science Museum were being discussed. One member of Oriel, Dr. Pusey, opposed the movement. He admitted to Acland that he discouraged the study of Natural Science because it led to 'temper of irreverence, and often of arrogance inconsistent with a truly Christian character'. Pusey, it may be remarked, was a chemist. 'Then', said Acland, 'am I to understand that in proportion as I devote my life with earnestness to discharge the duties to which you, under Providence, have appointed me, I am to be held up as a dangerous and mischievous member of Society?' Pusey laughed heartily; and from that day ceased his opposition to the plan for the Science Museum. The Tractarians followed in his wake and a vote for the new Museum was carried by a small majority, 70 to 64 votes on 11 December 1854 (p. 225).



Tombstone of Gilbert White

COLLEGIVM REGINALE



6. THE QUEEN'S COLLEGE

In Wells's popular history of Oxford it is recorded that the Queen's College was stamped with a marked character by its founder: it was more distinctly religious than the older Colleges, and that 'medieval Queen's has completely disappeared, nor has even the original arrangement of the parts been preserved; only the entrance in Queen's Lane remains where it has always been'. But of traditions of the greater men of science there is no mention, except of one who has had more honour in England than he had in his own country, viz. Aristotle. Of him it is recorded that an early student of Queen's was walking on Shotover, doing nothing else but thinking, when a wild boar charged him, so, presumably being a theologian and having no better use for his Aristotle, he stuffed it into its mouth, while he shouted 'Graecum est'.

An early member of the College who was most keenly interested in Natural Science was Sir Henry Wotton, 1568–1639, who came up to New College at the age of 16, but after two years migrated to Queen's. In 1620 he communicated to Francis Bacon an account of experiments which he had seen made with a Camera Obscura in Kepler's house at Linz, and in 1622 wrote to Charles Prince of Wales about philosophical experiments performed in Venice. Izaak Walton consulted him on strong scented oils for alluring fish. With Sir Edmund Bacon he discussed distillates from herbs. He experimented with a Water Clock leaking drop by drop.

The able lawyer EDMOND WINGATE, B.A. 1614, who started in life in Paris as teacher of English to Princess Henrietta Maria, but afterwards sided with the Parliament, was also a skilled mathematician and author of *L'Usage de la règle de proportion en arithmétique*, 1624, translated into English in 1626.

News about everyday life is often transmitted in the notes of the lesser lights of learning, and the Diary of THOMAS CROSFIELD, Fellow of Queen's from 1618 to 1640, is unusually informative.

1626. March 13. Anatomy lecture.

March 20–1. Childblaine because of cold & intemperate diet.

Oct. 21. Advised to drinke white wine for healthe.

Nov. 17. Disputationes in Medicina: Squirelling day.

1627. April 13. One fellowe of 41 yeares standing eating one meale a day.

Tussis nunquam est negligenda.

Tobacco alwayes hurtfull & nocuous to ye Liver & if it helpe digestion.

Oct. 9. Mr. Ayrey come to take physike: Mr. Provost admonished ye schollars to beware of Candles in their study: on coming in at gates not to revile ye fellowes.

Oct. 18. Chilblains.

1628. July 1, 2, 3. Mr. Praepositus aegrotavit prae nimiâ purgatione sibi a seipso applicatâ.

Mrs. Wilcoxe can direct a soveraigne potion for ye voidance of th' stone, borrowed a booke there of diverse kindes of Chirurgery.

1631. Dec. 25. On Christmas Day Mr. Coperthwait soe exceedingly distempered with sicknes that he could scarce be kept in bed. . . . Vpon Innocents day, being ye 14th from ye beginning of his sicknes, he dyed. Some suspected that ye infirmity was in his head, but being opened by ye Chirurgeon, his lungs were found to have bene perished.

1633. Dec. 16. 'Unexpected accidents.' A Smith and his wife kiled their prentice running an hot iron into his belly.

One Breane of our Colledge that by an accident not reveelled almost bitt off his tongue, which Price & Kennew cured for 3*li* or thereabout, tho they asked 20*li*.

1634. Jan. 15. 4 onely allowed to sell Tobacco in Oxford: 2 barbers & 2 mercers.

Jan. 23. A great Rott of Sheepe this yeare in most parts about Oxford.

1636. Jan. A patent granted for Tobacco pipes that all the Clay shalbe bought of one man.

Jan. 14. 'Because mirth is ye best sauce to meate, & yt princes by too long feeding and sittinge at ye table are subject to surfeite whether as well for preservation of their highness health . . . it was not convenient yt some selected witts at such times be appointed to discover of some philosophicall questions or otherwise to retaine some fool or jester as in like case is usual.'

Feb. 1. There happened to be a great Tempest of Thundr & Raine, whereby some steeples were thrown doone, as Witney by name. A Boat was sunk at Eynsham ferry.

Between 1677 and 1695 Oxford provided the Royal Society with three Presidents, and two were members of Queen's.

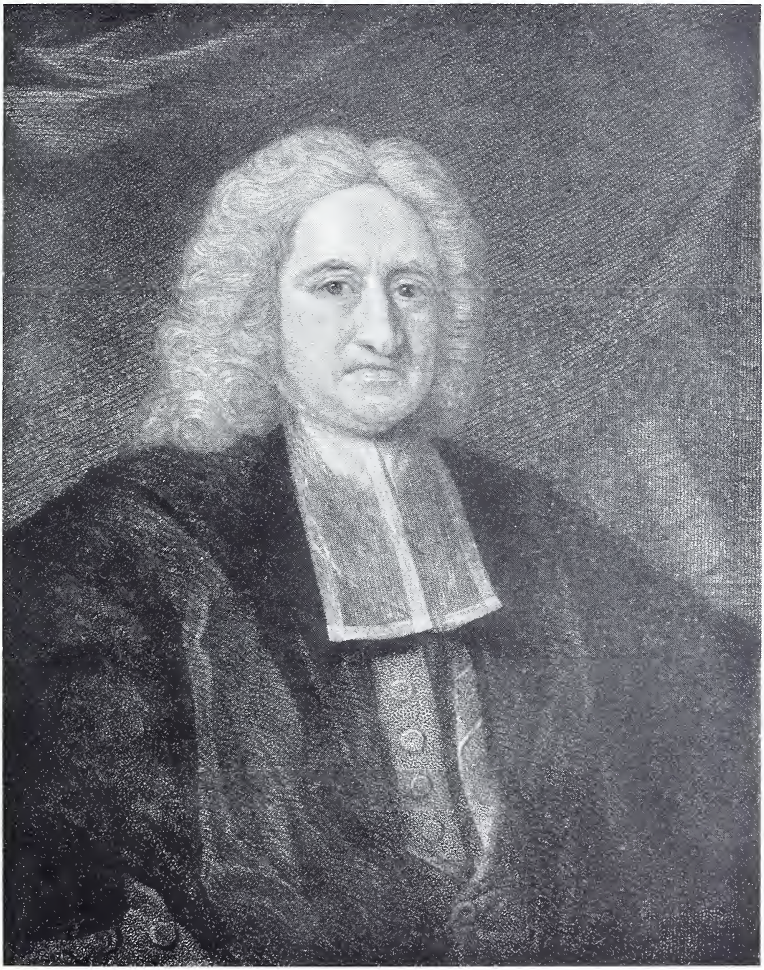
JOSEPH WILLIAMSON, 1633–1701, a poor Scholar from Cumberland, like his schoolfellow Robert Hooke, had been educated at Westminster School under Dr. Busby. He was the first of Sthael's pupils in Chemistry, and became a Fellow of Queen's in 1657. In 1660–1 he was appointed Secretary in the office of Sir EDWARD NICHOLAS, also of Queen's, Secretary of State, and promotions followed rapidly. In 1661 he became Keeper of Charles II's Library at Whitehall; in 1663 F.R.S.; in 1665 Editor of the *Oxford Gazetteer* which became the *Oxford Gazette*, and M.P. In 1674 Secretary of State in succession to Lord Arlington, to whom he paid £6,000 for the office. P.C. and LL.D. Oxford, and in 1676 Master of the Clothworkers Company. When he was elected to the Presidency of the Royal Society, 1677–80, he provided a magnificent supper at which Evelyn was a guest. Hooke and Grew were his secretaries. In his second year as President HALLEY was elected a Fellow. It was hoped that Boyle might have succeeded him in the office, but he refused, and Wren was elected. Williamson went back to politics and power. He treated William III 'like a child who was to be fed on whipt cream'. To the end he always showed himself a great friend to Queen's College men and to the College, to which he bequeathed valuable manuscripts.

The other occupant of the Presidency, Sir Robert Southwell, 1635–1702, was the son of an Irishman who was Vice-Admiral of Munster and Sovereign of Kinsale. He took his B.A. from Queen's in 1655, was knighted in 1665, and sent to Portugal for diplomatic work. Oxford honoured him with a D.C.L. degree in 1677. He became Principal Secretary of State for Ireland, 1690, and President of the Royal Society, 1690–5. At this time he became interested in Docks, Locks, Sluices, &c., for all of which he tapped the brains of Robert Hooke in 1693. His son Edward was also interested in such waterworks, and came up to Merton College.

An eminent member of King's College, Cambridge, Thomas Hyde, D.D., 1636–1703, migrated to Queen's in 1658 to take up a Readership in Hebrew and in 1665 the Librarianship of the Bodleian. His tastes lay in the direction of the history of Oriental Science. He published *Ulugh Beig's Work on the Latitude and Longitude of the Fixed Stars*, 1665; and on the *Weights and Measures of the Chinese*, 1688.

Edmond Halley was born at Haggerston on 29 October 1656; he was therefore twenty-one years younger than Hooke and fourteen years younger than Newton. Educated at St. Paul's School under Dr. Thomas Gale (1635?–1702), he came up to Queen's as a commoner in the summer of 1673. He had already a fair knowledge of Latin, Greek, and Hebrew, and so precocious a knowledge of Astronomy that he was able to contribute a paper on Planetary Orbits to the *Philosophical Transactions*, written before he was 19. He also came up with astronomical instruments.

He was especially interested in rendering Catalogues of the Stars as accurate as possible. Realizing that to Flamsteed at Greenwich and to Hevelius at Danzig the Southern stars must be invisible, he, then aged 21, offered to go to the settlement of the East India Company at St. Helena, 16 degrees south of



HALLEY

the Equator, to determine Star positions—a worthy work for which Charles II gave him a Royal Letter of Recommendation. In return he named a constellation 'Charles's Oak'; a courtesy which Charles rewarded by the bestowal of the M.A. degree.

In 1676 he took with him a Sextant of $5\frac{1}{2}$-ft. radius with telescope sights; a 2-foot Quadrant for adjusting his clock; a 24-foot Telescope; 2 micrometers; and a clock. On his return in the autumn of 1678 he was made a Fellow of the Royal Society. Next May (1679) he travelled to Danzig to call on Hevelius, to show his 2-foot Quadrant with telescope sights. Both astronomers took observations by their respective methods. Halley was surprised at the accuracy of Hevel's observations, but Hevel was too old to appreciate the telescope-sights. A tragedy occurred in the very next September when Hevel's entire observatory was burnt; his new instruments of 1681 are said to have been inferior to the old.

During the next few years he travelled on the Continent, making acquaintances 1680–1; he married Mary Tooke, 1682; he built himself an observatory next his house at Islington, where he tried to correct Lunar Tables by observations through a course of 223 Lunations—an eighteen years' job; he studied the variation of the Magnetic Needle, 1683; and by good fortune in 1684 he visited Newton at Cambridge—a most important event: it gave Newton's *magnum opus* to the world. Without Halley the *Principia* would not have been thought of, nor when thought of written, nor when written printed, nor when printed paid for! He saw it through the Press, and paid for it out of his own pocket.

In 1685 Halley became Assistant Secretary of the Royal Society and editor of the *Philosophical Transactions* until 1692. Some of his more important contributions to that periodical included the first historical account of the Aurora borealis, in 1715 during the eclipse of the sun; the first Magnetic Map with lines of equal Variation in 1700; the discovery of stellar proper motions, i.e. that Sirius, Aldebaran, and Arcturus had changed their latitudes since Ptolemy's day. He noted star-disks as spurious, because occultations are instantaneous. He is accredited with the discovery of six Nebulae and two star clusters in Centaur and Hercules; with descriptions of improved diving apparatus; of the Table of Mortality; and Life statistics; and much mathematical work of value.

He has been lauded to the skies as 'the greatest of English Astronomers', and placed next to Newton above the scientific Englishmen of his time. Of his eighty-four papers in the *Philosophical Transactions*, a number open up novel lines of inquiry and show a genius no less fertile than comprehensive. 'While we thought', wrote a French admirer, 'that the eulogium of an astronomer, a physicist, a scholar, and a philosopher comprehended one whole subject, we have been insensibly surprised into the history of an excellent mariner, an illustrious traveller, an able engineer, and almost a statesman.'

He used to relieve slight fever with doses of quinine in water-gruel, which he called his 'chocolate'.

His complete biography has never been written. Rigaud collected materials for a Life, but much was scattered when the Radcliffe Trustees dispersed Stephen Rigaud's Library two years ago.

Among the physicians of mark who belonged to Queen's in the seventeenth century was George Bate, 1608–69, also of New College and St. Edmund Hall, who was an early Fellow of the Royal Society. He is remembered by the *Pharmacopoeia Bateana*, 1690, and for the service that he impartially rendered to both Royalists and Puritans during the troubled times. Beginning as a Puritan he became in succession Physician to Charles I, and in 1640 to Cromwell. The Restoration made him a Royalist once more and Physician to Charles II, to whom he 'praised Charles I with all the warmth of a client'.

George Smith, who took his D.M. at Padua in 1658, became an early F.R.S. Richard Browne, fl. *c.* 1625–94; L.R.C.P. 1676, was the author of the following works: *Medicina Musica: or a Mechanical Essay on the Effects of Singing, Music and Dancing on Human Bodies, with an essay on the Nature and Cure of the Spleen and Vapours*, 1674; *Apothecarys Prosody*, 1685; *General History of Earthquakes*, 1694; *Coral and Steel:*

a most compendious method of preventing and restoring health by R. B., M.D.

Sir Richard Blackmore, M.D. of St. Edmund Hall, in 1668 became physician to William III and Queen Anne. He died in 1729.

The most eminent of all, Sir John Floyer, flourished in the

Sketch found in the Bodleian by
Prof. J. A. Gunn.

next century. He was quite the most original physician of the period in which he lived. His works show independence of thought and the spirit of research, and several of them have become the starting-points of new methods in medical investigations. First and foremost his insistence on the value of a count of the *pulse-rate*, would alone entitle him to a high place of honour in the annals of medical practice. He invented a Pulse Watch for the purpose. Then he advocated *cold bathing*, arguing that the Romans bathed in Britain, and that when they stopped the practice, diseases occurred. He got a cold bath built near Lichfield. We understand that our City Council

ΦΑΡΜΑΚΟ-ΒΑΣΑΝΟΣ:

OR, THE

Touch-ſtone of Medicines.

Diſcovering the

VERTUES

Of { *VEGETABLES*, *MINERALS*, & *ANIMALS*,

BY THEIR

TASTES & SMELLS.

In Two Volumes.

By Sir *JOHN FLOYER*, of the City of *Litchfield*, Kt. M. D. of *Queens-College*, Oxford.

Saporum Speculatio plurima jucunda, & non minùs utilia in ſe continet. Willis *de* Anima Brutorum.

LONDON,

Printed for *Michael Johnſon*, Bookſeller in *Litchfield:* And are to be Sold by *Samuel Smith*, at the ſign of the *Feathers* in St. *Paul's* Church-Yard. 1687.

of Oxford are following his example by getting the Hinksey Reservoirs transformed into bathing-pools. We do not know whether they will advise their use as early as did Floyer, who advocated infant baptism by total immersion.

In connexion with Floyer's life at Lichfield it is worth recording that he induced Samuel Johnson to be touched for the 'evil' by Queen Anne. His collections included a part of the valuable library and manuscripts of Sir Joseph Williamson.

Other physicians of eminence were John Newington, M.D. 1728, who delivered the Harveian Oration for 1738 and practised at Greenwich; Addison Hutton, M.D. 1737, physician to St. George's Hospital; John Turton, Radcliffe Travelling Fellow 1761, F.R.S., physician to Queen Caroline; James Hervey, M.D. 1781, Guy's 1779, Harveian orator 1785.

In the eighteenth century Queen's educated a succession of intelligent Travellers who made a special study of the natural history of the countries they visited. One of the first of these was George Waldron, 1690–1730?, matriculated in 1706, who took advantage of his opportunities as a Revenue Officer in the Isle of Man to write a Natural History of that Island.

Another travelled scholar, Thomas Shaw, 1694–1751, D.D. and Fellow of Queen's 1727, started as Chaplain to the English rectory at Algiers, and became famous for his journeys in Northern Africa. He was elected into the Royal Society in 1734 and published *Travels relating to Barbary and the Levant* in 1738.

Even more famous was Thomas Pennant, who matriculated at Queen's in 1744, but migrated temporarily to Oriel, probably because of trouble between dons and undergraduates at Queen's, when the ringleaders were sent down on 14 May 1748. Pennant paid caution money at Oriel on 20 May 1748.

His great *British Zoology*, which no good library was without, was the standard work on its subject. He finished by regretting that it was not in his power to describe the Insects and Zoophytes, for, as he modestly said, his small acquaintance therewith forbade him to meddle with them. But he took the 'liberty', as he quaintly phrased it, of separating the Crustacea from the Insects. He considered that every object, no matter how humble, had a definite object in this world, viz. the good of mankind. There should be no false shame attending the devotee of Ornithology, or the chaser of an insect, or the searcher for cockles, or a man who pores over a blade of grass. We are too apt to look upon as useless what perhaps we should own to be of infinite advantage to us, did we see a little farther. We are also apt 'to ridicule those who employ their time and thoughts in examining what we were created and appointed to study. . . . In short, we are too apt to treat the Almighty worse than a rational man would treat a good Mechanic. . . . This is the effect of a partial consideration of Nature.'

'Zoology is the noblest part of natural history, as it comprehends all sensitive beings, from reasoning man, through every species of animal life, till it descends to that point where sense is wholly extinct and vegetation commences; and certainly none will deny that life, and voluntary motion are superior to a mere vegetating principle, or the more inactive state of the fossil kingdom.'

Gainsborough painted an admirable portrait of him. His friend the naturalist and antiquary, DAINES BARRINGTON, 1727–1800, a Justice in North Wales, is said to have induced Gilbert White to write his *Natural History of Selborne*, the second part of which is filled with his correspondence. And, eight years before the appearance of that immortal work, he had himself issued a volume of *Miscellanies. Essays on Natural History: Linnaean System, Torpidity of the Swallow Tribe, the Rein-Deer, Bat; Tracts on the Possibility of reaching the North Pole;* &c. Another friend of Pennant's, JOHN WALLIS, 1714–93, wrote on the Botany of Northumberland.

Of the contemporary physician HENRY HARRINGTON, 1727–1816, M.D. 1762, there is a fine mezzotint portrait by C. Turner. JAMES HERVEY proceeded M.D. in 1781, died in 1824.

The *Botany of Guiana*, 1805–7, was the work of another member of the College, EDWARD RUDGE, 1763–1846, F.S.A., F.L.S., who also excavated at Evesham Abbey. In February 1784 he made a successful ascent in a hydrogen balloon of

THOMAS PENNANT

fifteen feet in diameter. He started at 1.15 p.m. from Queen's College in the presence of a 'numerous Concourse of Spectators' and landed fourteen miles off at Pyrton at 2.45. The apparatus of casks in which he prepared the gas is described in *The Oxford Journal* for February 5, 1784.

Dr. William George Maton, 1774–1835, was an early Fellow of the Linnean Society who proceeded D.M. in 1801 while physician to the Westminster Hospital. He practised in Court circles with great success, becoming physician extraordinary to Queen Charlotte 1818 and to the Duchess of Kent and the infant Princess Victoria in 1820.

In 1839 the Savilian professorship of Astronomy was filled by a Fellow of the College in succession to Rigaud of Exeter. Unfortunately the nominee, George Henry Sacheverell Johnson, preferring the ease of Whyte's chair of moral philosophy and the deanery of Wells, retired after a three-years' pursuit of Urania, thus justifying the Radcliffe Trustees in appointing J. M. Johnson as their observer. Sacheverell Johnson became a Parliamentary commissioner for the University in 1854. A theoretical explanation of the flight of boomerangs had been offered by him at a meeting of the Ashmolean Society on June 7, 1833. He pointed out that when bodies with plane surfaces descend in resisting media, they take on a zigzag motion which he attributed to irregularities of the surfaces and in particular to the want of absolute planeness—producing an effect which would be counteracted to a certain extent by giving the bodies a motion of rotation. In conclusion he showed why the figure of the crescent should be superior to any other. Later in the season he read a paper on the *Irritability of Plants*.

An Eruption of Vesuvius in 1855 as well as the earthquake at Melfi, four years earlier, were described by the Rev. A. S. Farrar, while W. J. Stephens gave an account of the earthquake at Visp in the summer of 1855. The former had attended the lectures of Dr. Daubeny, whose work for vulcanology was well known.

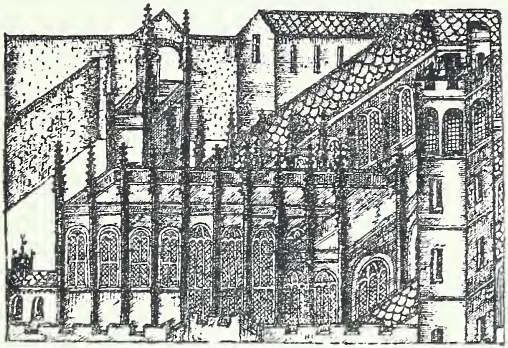
About 1882 Queen's offered to make special provision for the teaching of Natural Science in Oxford, a proposal to which practical effect was given when a building near the venerable brew-house was furnished as a College Laboratory, and placed in the charge of Dr. Chattaway of Christ Church.

Members of the Queen's College still bring back the fruits of their travels to add to the store of knowledge of the globe.

Dr. Herbert Weld Blundell was an authority on the geography of parts of Abyssinia, which he mapped for the first time. He travelled from Somaliland to the Sudan in 1898–9, returning with a large collection of birds, including seventeen new species. He mapped the Blue Nile from Tsana to the Sudan. With Prof. Langdon he was responsible for the successful exploration of Kish in Iraq.

And though archaeological rather than scientific the famous work of Sayce on the ancient empires of the East, Grenfell and Hunt on papyrology, and Griffith on Egyptology is not less epoch-making. Their achievements, to which those of Professor S. H. Langdon in Assyriology form a most worthy sequel, show the advantage of the continued endowment of one line of research by a college as contrasted with the interruption of scientific research at certain other colleges.

COLLEGIVM NOVVM.



7. NEW COLLEGE, 1379

This College, the very name of which connotes eternal youth, was the greatest and last of the Colleges to be founded before the close of the fourteenth century. The founder had had building experience as Clerk of the Works to the Crown in 1356. He built at Windsor under Edward III. When he came to Oxford he gave of his best. As Bishop of Winchester he was receiving the equivalent of £60,000 a year, and in 1365 Froissart declared that 'all thyng was done by him and without him nothinge done'. He turned the worst plague spot in Oxford, with its plague pit where lay 'filth, rotten corpses, and intestines of corpses', the dump of the refuse of the town, 'where thieves and malefactors used to lie in wait for opportunities of thieving, homicide, and other intolerable evils', into a splendid home for classical learning in which good Churchmen were to be trained. Of the original body of Fellows two out of fifty were permitted to study medicine so long as there was a Doctor of Medicine qualified to teach them; but if there were no such qualified doctor, then they were to study theology, and, in any case, Wykeham's medical students were not to neglect their theology. Greek was first taught here until 1488–9 by Vitelli, an Italian, and William Grocyn was one of his early pupils.

The earliest physician of eminence known to have been educated at New College was Thomas Bentley, *c.* 1485–1549, a native of Woodstock, and a great friend of Linacre, whose enthusiasm doubtless led him from the study of classics to that of medicine, and whom he succeeded as second President of the College of Physicians in 1525. Bentley graduated D.M. in 1518, in the year when Oxford was nearly depopulated by a terrible visitation of the plague. After practising in Oxford he became physician to the Duke of Buckingham, and after Linacre's death in 1524 physician to King Henry VIII. It is not unlikely that his portrait is to be seen in Holbein's picture among the figures on the left of the King. It is amusing to recall a tradition that about 1528 the sweating sickness appeared with great virulence and seized Anne Boleyn. Henry VIII 'roamed about the environs of London from spot to spot, with a few attendants only, to elude infection, and made his Will, at the same time writing tender letters to Anne Boleyn'. Bentley received a New Year's gift from the King.

Among astronomers Thomas Lydiat, Fellow of the College, 1525–44, was famous for his calculations for a new calendar. He held a remarkable view about the tides, averring that the flux and reflux of the sea are caused by subterranean fires, started in sulphurous or bituminous matter by 'the beams of the sun being reflexed upon the convex superficies of the sea', that is, by the surface of the ocean functioning as a great convex burning-glass. Against this view it was argued that there is no bituminous matter in Norway and yet the tides are high: whereas upon the coast of Naples, where sulphurous soil abounds, the sea does not swell to a diameter of above three or four feet when it is at its highest.

Of the doctors of medicine of the time Dr. Edward Atslowe is remembered through his having planned an escape for Mary Queen of Scots, for which he was racked twice in the Tower. Wood records that he was created D.M. in the house of Dr. Henry Baylie in the High Street leading to the Quadrivium by Dr. Th. Francis and Dr. Baylie by virtue of a commission. He disputed before Queen Elizabeth in September 1566. James Good, D.M. 1560, who married an Oxford lady and 'held secret correspondence by letters with Mary Queen of Scots', for which he was imprisoned, and Christopher Johnson, 1571, were also of this period.

The latter resigned his perpetual fellowship in 1560 to succeed Thomas Hyde as headmaster of Winchester, where he combined teaching with the study of medicine. After taking his D.M. degree in 1571, he repaired to St. Dunstan's parish in London and died in 1597. His professional writings included *A Counsel against the Plague* 1577, and *Question: Whether a man for preservation may be purged in the Dog-days or no?* The best known was Dr. Walter Bayley, who became Regius Professor of Physic and Physician to Queen Elizabeth in 1561. For the preservation of eyesight he advocated the use of a drink made with eye-bright, steeped in beer or mead or wine rather than in water. He wrote discourses on certain baths, on the medicinal waters in Warwick, and on three kinds of peppers in common use. It is narrated that Leicester tried unsuccessfully to induce him to poison Amy Robsart.[1]

After twenty-one years' tenure of the Physic Chair Bayley was succeeded by another member of New College, Anthony Aylworth, 1582–97, a number of whose medical books are still in the library, with those of Thomas Hopper.

In comparison with Bayley, Richard Haydock was an undoubted quack who pretended to have the power of preaching in his sleep, but his deception was eventually discovered by James I.

John Giffard, D.M. 1598, Camden's physician, became President of the College of Physicians in 1628. Dr. Thomas

[1] Sir D'Arcy Power, *Medico Chirurgical Transactions*, 1907. The titles of Bayley's works were, *A Brief Discourse of certain Medicinal Waters in the county of Warwick near Newman*, 1587; *A Discourse of Three Kinds of Pepper in Common Use*, 1588; *A Brief Treatise of the Preservation of the Eyesight*, 1616; *Directions for Health, Natural and Artificial, with Medicine for all Diseases of the Eyes*, 1626; *Explicatio Galeni de potu convalescentium et senum, et praecipue de nostrae Alae et Biriae paratione* (MS.).

Grent, physician to St. Thomas's Hospital, died in such great poverty that the College of Physicians in 1649 voted to his widow a moiety of the profits accruing from the second *London Pharmacopoeia.*

George Bate, 1608–69, came up to New College in 1622, but took his Arts degree from St. Edmund's Hall B.M. 1629. His life shows how a good physician can rise superior to the political changes of his time. Whether Charles I, Cromwell, or Charles II were in the ascendant, Dr. Bate always contrived to be the chief state physician. Although a 'concealed royalist' he flattered Cromwell. Upon the restoration of King Charles II in 1660 he renewed his interest with the royal party (by his friends' report he, by a dose, had hastened Oliver to his end), and was made physician to the King and F.R.S. He delivered the anatomy lectures at the College of Physicians in 1666. The *Pharmacopoeia Bateana* was compiled by him.

Henry Stanley, D.M. Padua 1637, incorporated at Oxford 1641. Samuel Collins, Fellow of King's College, Cambridge, 1637, was elected Fellow of New College in 1650, when he incorporated D.M.

The pre-foundation meetings of the Royal Society in Oxford were enlivened by the attendance of John Lamphire, while Francis Turner attended Sthael's Chemistry Courses and Robert Sharrock made a special study of the growth of plants. Another botanical fellow Philip Stevens, who proceeded D.M. as Principal of Hart Hall, was part author with William Browne of the *Catalogus Horti Botanici Oxoniensis* 1658. And yet one more, Coles, acknowledges the assistance he had from the Oxford circle of herbalists. 'I have not altogether walked alone', he tells us, 'in these my Travailes but have gone along with Mr. Steevens Principall of Hart-Hall in Oxford, Mr. Lydall, Mr. Brown, Mr. Wit, Mr. Hawley, Mr. Beeston, Mr. John Crosse the Apothecary, and divers other my good Freinds, being very eminent Botanicks, in the University of Oxford, conversed with and received advice from them; . . . and if I have failed of the best of our English men, Mr. Good-yeare, Dr. Bowle, Mr. Ashmole, the intelligence of


Æt. 45.
Gandy pinx.
M. V. de Gucht Sculp.
GUILH. MUSGRAVE,
Med: Doctor Oxoniensis, et
Regiæ Societatis utriusq; Socius.
MDCCXIIX.

our late times, Dr. How, their assistance had not been wanting to mine endeavour, if my humble deserts could have raised me to the felicity and Honour of their Acquaintance' (p. 241).

JOHN WINDEBANKE, 1618–1704, Fellow, D.M. 1654 in virtue of letters from the Chancellor (Oliver Cromwell). He practised at Guildford. WALTER HARRIS, 1647–1732, D.M. Bourges 1675, delivered four Harveian orations, became physician to William III, and held office as Lumleian lecturer for life from 1710. He wrote *Pharmacologia Anti-empirica*, 1683; *De morbis Acutis Infantum*, 1698; *De Morbis aliquot Gravioribus Observationes*, 1720; *De Peste Dissertatio, cui accessit Descriptio Inoculationis Variolarum*, 1721; *Dissertationes Medicae et Chirurgicae*, 1725.

The newly founded Oxford Philosophical Society attracted several members of the College. WILLIAM MUSGRAVE acted first as Secretary, then as Director of Experiments. He was a skilful anatomist who organized courses of dissection and conducted experiments on dogs to settle questions relating to the circulation. One successful operation involving the cutting of the external jugular vein was tried in the presence of Mr. Paige of the College. In 1685 Musgrave went to London as Secretary of the Royal Society but eventually took a medical practice at Exeter and published three treatises on arthritis. Like many other medical men he took an interest in the preservation of antiquities. A colossal head of the wife of the Emperor Lucius Septimus Severus, dug up at Bath, was one of the ornaments of his garden, while his *Antiquitates Britanno-Belgicae*, 1719–20, was approved by King George I, who presented him with a diamond ring. On his death-bed he expressed a wish to be buried in the churchyard of St. Leonards (out of the city) 'because he was of opinion that the burial of the dead in cities was unwholesome for the living'.

Among other topics that engaged the attention of the newly founded society was that of Magnetism in Drills, a discourse on which was read by JOHN BALLARD, who had engaged in a number of experiments on artificial magnets in March and April 1684. HENRY BEESTON, another strong supporter of the

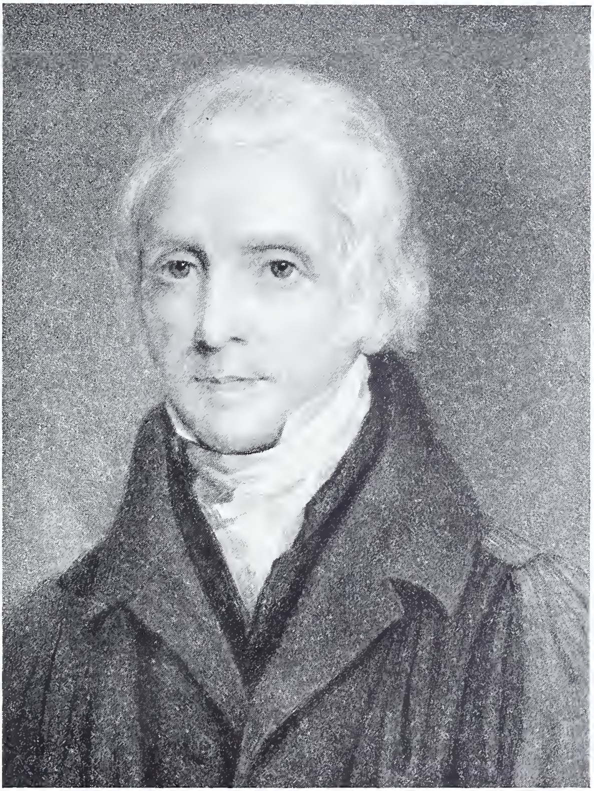
Philosophical Society, is remembered at New College as the Warden who had twenty-three children.

One of the enduring results of the foundation of the Philosophical Society in Oxford was the raising of scientific matters and methods in the public estimation. The first science to benefit was astronomy, and it so happened that New College was able to supply an observatory and astronomer's house close together. In 1704 the lease of Stable Hall, at the end of the cloisters in New College Lane, was given to the University in order that the house might be appropriated to the use of the Savilian Professors. Halley was the first to benefit by the provision. The second was Bradley in 1732, bringing with him his aunt and instruments from Wanstead. The third, Professor Bliss, placed his instruments near the north-west angle of the cloisters and fixed a meridian mark upon the buildings of All Souls College; thus Halley, Bradley, and Bliss, a noble line of astronomers, all Savilian Professors, all Astronomers Royal, made use of the New College observatory. Since the death of Bliss in 1716 the appointments to the Savilian Chair of Astronomy have mostly gone to Cambridge men.

During the eighteenth century the paucity of eminent members of the medical profession trained within the walls has been explained as the result of a system by which well-trained schoolboys from Winchester were guaranteed a provision for life as soon as they had succeeded to a scholarship at New College. Simon Burton, 1690–1744, D.M. 1720, became physician to St. George's Hospital and is remembered because he attended Pope in his last illness.

Early in the nineteenth century the College provided a third Professor of Physic, W. Woodforde, D.M. 1724, Regius Professor 1730; and later, through the medical interest of Warden John Oglander, a unique collection of materia medica has been preserved. It was formed by a Holborn apothecary of the name of Jobber for Mr. Clutton in 1729, and supplies a most important record of the drugs of that day.

Before the close of the eighteenth century Dr. Martin Wall, 1747–1824, who had had the advantage of medical

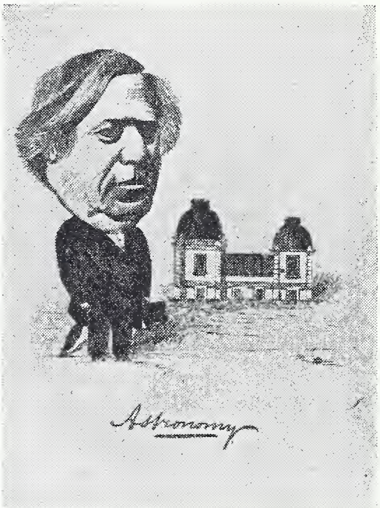


J. S. DUNCAN

training in Edinburgh under John and Hunter in London, took a D.M. degree in 1777. He was appointed Reader in Chemistry, 1781. He read courses of chemical lectures in the Old Ashmolean which he soon expanded into a *Dissertation on select subjects in chemistry and medicine.* At least one of his pupils, JOHN JAMES, considered his lectures as 'affording a firm and elegant basis for a complete skill in natural philosophy. . . . Chemistry is a science, teaching by experiment the effects of heat and mixture upon bodies.' These courses continued until 1785 when he was elected Clinical Professor. His portrait hangs in the College Hall. He edited his father's Medical Tracts, dedicating them to New College and Merton, 1780. His own work included *Clinical Observations on the Use of Opium in Low Fevers*, 1786. He was a friend of Thomas Percival, the author of *Medical Ethics.* Wall was known to Dr. Samuel Johnson, and a meeting is recorded at the Master's Lodgings in Pembroke in Boswell's *Life of Johnson.* He was also a friend of Parson Woodforde and is mentioned in the *Diary* of the latter. He was Treasurer of the Hospital from 1801–1824. *The Danger of Travelling in Stage Coaches*, 1810, was discussed by WM. MILTON, M.A. 1770, who planned Bristol harbour in 1791.

The second quarter of the nineteenth century was marked by the beneficent activities of the brothers Duncan. In the 'Museum', as the Old Ashmolean was then called, the scientific collections of the University had been allowed by their keepers to fall into a sorry state of neglect. In 1823 JOHN SHUTE DUNCAN, 1769–1844, Fellow of New College, was appointed Keeper. He was succeeded by his brother, PHILIP BURY DUNCAN, 1772–1863. The munificent activities of the two brothers are beyond all praise. Finding that the skins of animals collected by the Tradescants were decayed, and that new cabinets would be required, John caused an appeal to be made to Convocation, which was successful. The whole Museum was refitted, put in order, and provided with a catalogue. The reforms were helped by the fact that Dr. Paley's work on Natural Theology had excited a taste for the study of Natural History in the University. The popular lectures of Dr. Kidd on Comparative Anatomy, and those of Dr. Buckland on Geology, all tended in the same direction.

By 1836 the first division of the Museum proposed 'to familiarize the eye to those relations of all natural objects which form the basis of the argument in Dr. Paley's *Natural Theology*; to induce a mental habit of associating natural



CHARLES PRITCHARD AND HIS OBSERVATORY.

phenomena with the conviction that they are the media of Divine manifestation; and by such association to give proper dignity to every branch of Natural Science'. The study of Nature was welcomed by churchmen as a helpful branch of theological study, and supplied useful arguments with which to confute the Free-thinkers. An outcome was the series of *Bridgewater Treatises*, designed to 'justify the ways of God to man'.

Speaking of the Duncans, Archbishop Howley said, 'I question whether any two men with the same means have ever done the same amount of good.'

The University Commission of 1854 threw the New College

Scholarships open, W. A. SPOONER, whose name has become a household word, being one of the first to be elected in 1862. Fellowships were allocated to the Savilian Professors of Astronomy and Geometry, subjects chosen because the original statutes provided for the study of astronomy. From 1870 the former was held by Dr. CHARLES PRITCHARD, of St. John's College, Cambridge, the Founder of the Oxford University Observatory and inaugurator of the Photographic Astrographic Survey of the Heavens. Some of his earlier scientific apparatus that is now in the Old Ashmolean Museum dates from the time when he was headmaster of Clapham School, *c.* 1840. After a brief retirement to Freshwater he was appointed to the Savilian chair in 1870. Ten years later he invented a Duplex Micrometer for measuring star positions on photographic plates taken by the historic telescope presented to the University by De la Rue. He was succeeded by Professor H. H. TURNER, 1861–1930, who, failing the provision of a house near his work, devoted himself to the installation of Seismographic instruments for the recording and measuring of Earthquakes. During his term of office a New Star was discovered in Gemini in 1903, eighteenth in the history of the world. The star was photographed by his skilled and indefatigable assistant F. A. Bellamy, F.R.A.S., philatelist and would-be benefactor of Oxford (p. 323).

The College has recently put up a mural inscription in the Cloister, inscribed, 'In memory of Herbert Hall Turner, 1861–1930, Astronomer and Seismologist, a bold thinker and a generous friend, Fellow of Trinity, Cambridge, 1885–91, and as Savilian Professor of Astronomy, Fellow of New College, where he was trusted, honoured, and beloved'.

The higher Mathematics was taught with all the aberrations of genius by JAMES JOSEPH SYLVESTER, 1814–97, who had held professorships of Natural Philosophy at University College, Virginia University, the Royal Military Academy, and Johns Hopkins University, and had been awarded the Royal Medal in 1860, before he came to Oxford in 1883. His *Theory of Reciprocants* was made known during the Oxford period in

1885. He was the inventor of kinematical instruments such as the Plagiograph and the Geometrical Fan. He founded the *American Journal of Mathematics* and wrote *Laws of Verse* 1870.

To these professorships the second Commission added a third—that of the Wykeham Professorship of Physics in 1877, of which Professor TOWNSEND is the first and present holder.

Within the same period the members of a brilliant group of Zoologists, W. HATCHETT JACKSON, F. E. BEDDARD, F. A. BATHER, and G. C. BOURNE have achieved fame both through their own labours and through the successes of their pupils. The first-named, grandson of Charles Hatchett, 1765–1847, was the most learned and scholarly zoologist of his day, and it was chiefly due to his personal care that the Radcliffe Library became for a period of years before the war the most conveniently arranged scientific library in England with a staff whose attitude was always one of great helpfulness to students of science. It is sad to think that on Jackson's death the line of learned Librarians chosen by the Radcliffe Electors[1] should have become extinct in Oxford. In his later years Jackson officiated as science tutor at Keble College.

FRANK EVERS BEDDARD, 1858–1925, F.R.S., was for some years lecturer on biology at Guy's Hospital, and for more than thirty years took full advantage of his post as prosector of the Zoological Society to add greatly to our knowledge of vertebrate anatomy. The Isopod Crustacea brought home by the Challenger Expedition, whales, the colouration of animals, were all subjects for his pen, but his favourite group was the *Oligochaeta*, on which a monograph was printed by the Oxford University Press.

FRANCIS ARTHUR BATHER, 1863–1934, F.R.S., entered the

[1] The Electors to the Radcliffe Travelling Fellows and presumably to his Librarianship were named in Radcliffe's will as the Archbishop of Canterbury, the Lord Chancellor, the Chancellor of the University of Oxford, the Bishops of London and Winchester, the two principal Secretaries of State, the Lord Chief Justices of the King's Bench and Common Pleas, and the Master of the Rolls—all for the time being. It was a body quite distinct from the self-appointed body of Radcliffe Trustees, and one that gave Oxford a long line of eminent Librarians of the first rank.

W. HATCHETT JACKSON

J. S. HALDANE

H. H. TURNER

Department of Geology in the British Museum in 1887 and was placed in charge of the national collections of fossil Echinoderms, upon which, and especially the Crinoids, he made himself the leading authority of his time. His wide knowledge and application of museum technique was shared with countless other institutions through the medium of the *Journal of the Museums Association*, which he helped to found. His knowledge of Shakespeare and his standard of literary style and clear diction was very high, and much appreciated by many who read the reviews that he wrote for the *Times Literary Supplement*.

JAMES RITCHIE, 1864–1923, was lecturer, reader, and first professor of Pathology at Oxford, and Fellow of New College 1902–7, when he moved to Edinburgh, becoming Irvine professor of Bacteriology. His best-known text-books were Muir and Ritchie's *Manual of Bacteriology*, and the *General Pathology* written with M. S. Pembrey. His work on *Immunity* was widely read.

Fundamental researches upon the physiology of disordered respiration claimed the greater part of the working life of J. S. HALDANE, 1860–1936, who did more to combat the dangers arising from explosions in coal-mines than any one of his contemporaries. The study of the physiology of deep-diving and caisson disease, and especially of the action of carbon monoxide, led on to his being appointed director of a research laboratory founded by the Doncaster coal-owners. In Oxford Doctors Priestley, Boycott, and Douglas were associated with his various researches. A member of a family gifted with unusually keen intellects, he combined a power of forming sound scientific judgements with a delightful simplicity of manner that endeared him to his many friends.

GILBERT CHARLES BOURNE, 1861–1933, was a pupil of Professors Moseley and Weismann of Freiburg. As a young man, with S. J. Hickson and G. H. Fowler, he stayed on the coral atoll of Diego Garcia, making important first-hand additions to our knowledge of the conditions necessary for coral growth in the Indian Ocean. Papers on *Fungia* 1887 and

Heliopora 1896 followed. On his return he was elected to a Fellowship at New College and to the Directorship of the Marine Biological Station at Plymouth. His elementary *Introduction to the Study of the Comparative Anatomy of Animals*, 1900, epitomising the main features of the traditional Oxford teaching, had a great success. From 1906 to 1921 he occupied the Linacre chair in succession to Professor Weldon.

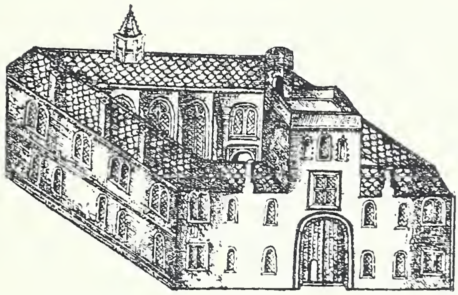
Since, by the University Commission of 1854, the two Savilian Professorships have been attached to New College, it may not be inappropriate to recall some of the original conditions formulated by Sir Henry Savile in 1619. Both Professors were expected to leave their Notes and Observations in writing in the University Archives, an arrangement designed perhaps to prevent them, or their successors, from reading the same old lectures over and over again. The Geometry Professor was expected to teach and explain the Measuring of Land, Music, and Mechanics at a proper season most convenient to him, while his Astronomy colleague was to teach and read on Optics, Dialling, Geography, and Navigation at proper times; but he was prohibited from the Doctrine of Nativities and Judicial Astrology.

All persons from two years' standing till one year after taking their Bachelor's degree were to attend the Geometry Professor, and then they were obliged to be present at the Astronomy lectures, until they took their Master of Arts degree, under 'pain of 6*d*. Mulct for their absence *toties*'.[1]

Whatever the successes or failures of New College may be, it can never be forgotten that it was Wykeham's example that inspired Chichele at All Souls and Waynflete at Magdalen.

[1] Ayliffe, *Ancient State of the University of Oxford*, 1714.

COLLEGIVM LINCOLNIENSE.



8. LINCOLN COLLEGE, 1427

BISHOP RICHARD FLEMING received permission from the King in 1427 to found 'a little College of theologists' to defend the orthodox religion against the 'swinish snouts' who 'presumed to feed upon its precious pearls'. His own orthodoxy was proved by digging up Wycliffe's bones at Lutterworth and by casting them into the river. Shortly after he had begun the building of the library he died, leaving his young foundation of Lincoln College without adequate endowment. But his efforts were admirably seconded by the second Rector, JOHN BEKE, who was more successful in securing gifts, including the valuable corn-mill at Iffley, burnt down in 1908, and not rebuilt.

In its early days Lincoln was given over to theological disputation and religious services. If a young student were but suspected of transgressing the rules, there was a four-tailed scourge, wielded by the Sub-Rector, ready to discipline him into better behaviour. Should that fail, he might be deprived of his Fellowship. He would be called a 'diseased sheep', and with that stigma and tainted with pestiferous heresy he would be turned out of the sheep-fold. Fellows had their rooms free, and were expected to live on sixteen pence a week. Natural Science did not thrive on such a régime. For two centuries we meet with no outstanding name in science, but in the seventeenth century, CHRISTOPHER BENNETT, M.D. of Cambridge, 1646, corrected Muffet's *Health's Improvement*, 1665.

For the practise of physic Lincoln prepared GEORGE ROGERS, 1618–97, D.M. Padua, who became President of the College of Physicians; EDWARD DAWSON, D.M. 1633; CHARLES PANTON, 1662–1711, physician at Bath Easton; ROBERT PIERCE, D.M. 1661, who practised at Bath, where he died in 1711.

And then came the more eminent JOSEPH GLANVILL, 1636–80, who migrated from Exeter College and graduated as a Divine in 1658. In *The Vanity of Dogmatising* he attacked the prevailing systems of scholastic philosophy and told the story of the Scholar-Gipsy, afterwards used by Matthew Arnold, and sketched an anticipation of the electric telegraph. He had been reading Van Etten's *Récréation Mathématique*, in which the possibility of the transmission of news by the use of a magnet is mentioned. But the world remained very sceptical about the matter, until Glanvill, who had had his mind opened by his 'philosophical considerations touching witchcraft', clearly showed how such telegraphy could be effected, and, as he said, 'without unwarrantable assistance from demoniac correspondence'.

'Let the friends that would communicate take each a dial, and having appointed a time for their sympathetic conference, let one move his impregnate needle to any letter in the alphabet, and its affected fellow will precisely respect the same. So that, would I know what my friend would acquaint me with, 'tis but observing the letters that are pointed at by my needle, and in their order transcribing them from their sympathized index, as its motion directs.

By some other way of magnetic efficiency . . . 'tis not unlikely but that present discoveries might be improved to the performance.'

His argument led up to the conclusion that it is impossible to know one thing without knowing all, because causes are so interdependent and in 'concatenation'. Man can only be aware of a very small part of the mysteries with which he is surrounded. His own body presents a host of difficult and unaccountable problems. The familiar experiences of sensation and memory are quite inexplicable. Dogmatizing is therefore the effect of ignorance, the consequence of a narrowness of spirit. The book appeared in 1661.

In 1664 he was elected into the Royal Society and produced an epoch-making work on witchcraft entitled *Philosophical considerations touching Witches and Witchcraft*, 1666, sometimes known as *Sadducismus Triumphatus*. He formed with Dr. Henry More of Cambridge a virtual association for 'psychical research'. He visited a house at Tedworth, Wilts., and heard drummings and saw strange phenomena, caused by a vagabond drummer who had been turned out of the house, and revenged himself by witchcraft. The story suggested Addison's 'Drummer'.

For several years towards the end of his life he held the living of Frome in Somerset, where he preached in the church of the famous bishop Ken.

Among his later works was *Plus ultra, or the progress and advancement of knowledge since Aristotle*, 1668. This second book aroused a stormy conflict between the new, or experimental, philosophy and the old Aristotelian school of philosophy, which can be followed further in the writings of H. Stubbe, who replied to Glanvill with his *Plus ultra, reduced to a non-plus*.

George Wheler, author of a *Journey in Greece*, 1682, came up as a commoner to Lincoln in 1666 armed with a letter of introduction to one of the senior fellows, Robert Clark, 'a man of excellent parts, temper and learning to be my tutor, ffor whom I thank God'. After a bad attack of the small-pox, he got to work not only in classics but 'made a good progress in Mathematics, Arithmaticks, Geometry, Geography, Astronomy, and Opticks. And, besides all this, looked into ye new; reading Cartesius and the Moderns, and some Anatomy. And by changing my studies, so as to make them a Divertisement to each other, I did get through a number of ye Latin classical authors.'

After a year, Clark left, and D. G. Hicks his new tutor encouraged Wheler in a taste for Natural Philosophy. 'And therein nothing pleased me more then to make dayly discoveries of ye wonderfull operations of God in the creation of the visible world.' His studies convinced him that the Earth was placed in the centre of the universe, with a diurnal but without annual motion. Like his successor, Warde Fowler, Wheler walked in the Physick Garden; and when in Greece he was particularly attentive to the native flora of which he enumerated several hundred. Among the plants that he introduced to English horticulture for the first time was *Hypericum olympicum*, a well-known St. John's Wort.

John Radcliffe held a Lincoln Fellowship for eight years after taking his Bachelor's degree from University College, qualified as a physician, and took patients in Oxford. But so provincial a practice was hardly commensurate with his great qualities, and in 1684 he moved to London. Starting with little capital beyond his phials, his skeleton, his herbal, his reading, and his ready wit, he soon worked his way to an income of twenty guineas a day, and won one of the greatest reputations in the world of medicine (p. 82).

The next physician of eminence to matriculate at Lincoln was William Wagstaffe, M.D. 1714, F.R.S., Anatomy reader at Surgeon's Hall, and physician to St. Bartholomew's Hospital. He wrote *A Letter showing the danger and uncertainty of Inoculating the Small-pox*, 1722. Later came H. Revell Reynolds, 1746–1811, but like Radcliffe he found it expedient to change colleges, and he went to Trinity College, Cambridge, where he graduated M.D. in 1773 and became physician to St. Thomas's Hospital, and to George III in 1797.

The munificent endowments left to travelling students of medicine by Radcliffe enabled another member of Lincoln, John Sibthorp, 1758–96, to pursue scientific studies in Edinburgh and Montpellier with such success that on his return to Oxford he was made Sherardian Professor of Botany in 1783 and Physician to the Radcliffe Infirmary in 1787. His chief contributions to learning dealt with the flora of the classical lands of the Mediterranean and the identification of plants described by the ancients. He critically examined the great Vienna Codex of Dioscorides and identified many of the illustrations in that fine herbal. Accompanied by a skilful artist, Ferdinand Bauer, he travelled round the Eastern Mediterranean studying the plants of Crete, the Aegean, Greece, Cyprus, and Asia Minor, and published the results in the *Flora Graeca*, one of the greatest botanical works in the world. He was elected into the Royal Society in 1789 and produced a local *Flora Oxoniensis* in 1794. When abroad he contracted a chill at Nicopolis which, with other hardships, evidently shortened his life. His name is perpetuated in connexion with the Sibthorpian Chair of Rural Economy that he endowed.

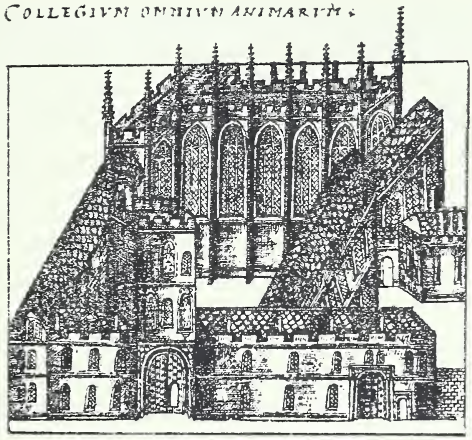
The best known of all members of the College, JOHN WESLEY, is known on occasion to have treated maladies of the body as well as of souls. He even practised the agelong treatment of mania by immersion. 'Set the patient under a great waterfall, as long as his strength will bear: or [presumably a waterfall was not easy to come by] pour water on his head out of a tea-kettle.' Another student of medicine, RICHARD FABER, proceeded D.M. in 1806, and became a member of the College of Physicians.

HENRY MATTHEWS TUCKWELL, 1834–1906, graduated First Class in the newly founded School of Natural Science and was elected to a Radcliffe Travelling Fellowship. After study in Paris, Berlin, and Vienna, he continued his father's practice in a house opposite the Magdalen elms, and soon established his reputation as one of the best of the local practitioners. He introduced mediate percussion with the use of the pleximeter, unfamiliar at that time in England; diagnosed a case of hydatids in a patient whose persistent bleeding at the nose had puzzled the infirmary staff; and dexterously managed a difficult case of spontaneous thrombosis. The virtual retirement of Dr. Acland placed him at the head of the medical profession in Oxford, when an attack of 'painless glaucoma' gradually destroyed his eyesight.

Sir ARTHUR HERBERT CHURCH, F.R.S., 1834–1914, in 1873 held a professorship of Chemistry in Cirencester Royal Agricultural College 1873–9, then the professorship of Chemistry in the Royal Academy of Arts and at Cooper's Hill. He was the leading authority on the chemistry of painting and gave valuable assistance in the work of preserving the paintings in the Houses of Parliament. He discovered turacin, a unique animal pigment containing copper, and also a previously unknown mineral containing cerium.

The enormously important study of the primitive tribes of Northern and Central Australia has been the life-work of Sir Walter Baldwin Spencer, 1860–1919, who coming up as a scholar of Exeter was elected to a fellowship at Lincoln. An early appointment to the professorship of Biology at Melbourne University in 1887 gave him all the opportunities of exploring a new and unknown country. The subject of one of his first papers was *The Giant Earthworm of Gippsland*, but soon the transcendant importance of the investigation of the aborigines of Australia, already studied by H. Ling Roth of Magdalen, led to his putting other work aside to do what could be done then, and for what he alone could do. He was editor of the Report of the *Horn Scientific Expedition to Central Australia*, and author of numerous anthropological memoirs. The National Museum of Victoria was under his direction.

If any recent members of Lincoln be singled out for special mention we must not omit the name of W. Warde Fowler, whose delightful scholarly books have transported thousands of lovers of birds and nature hitherto unexplored into paths of fragrance and beauty. Those who were privileged to be personally conducted round the homes of nesting birds in his Kingham garden in the springtime are never likely to forget the experience.



9. ALL SOULS COLLEGE, 1438

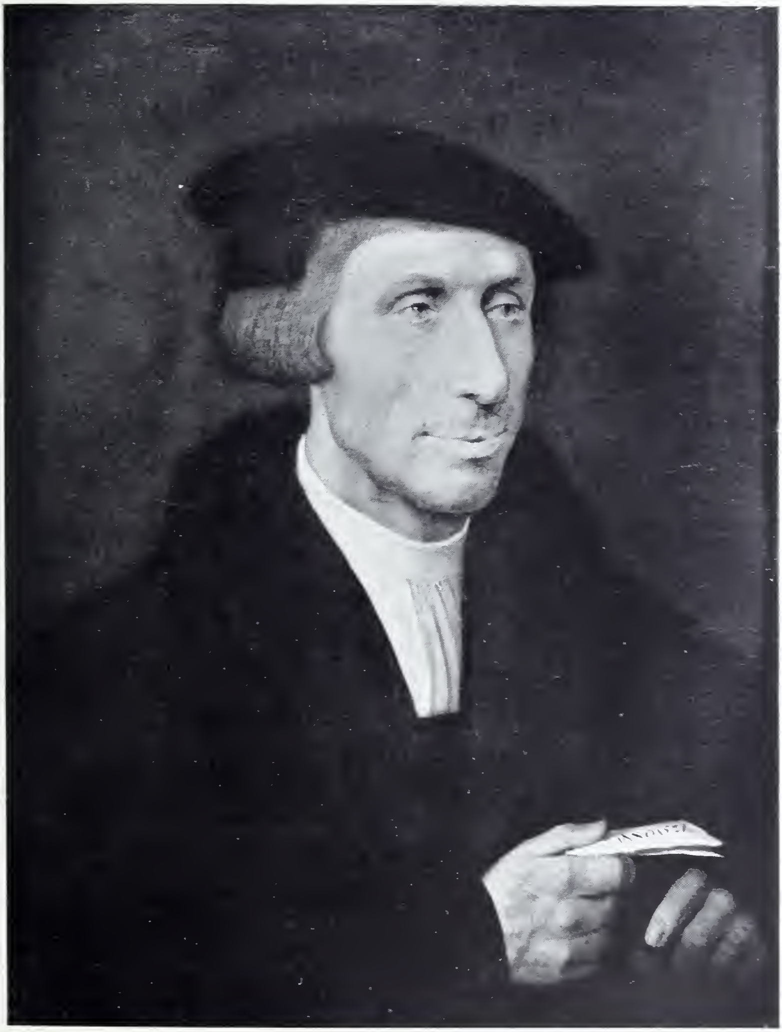
Barely ten years after the foundation of Lincoln College a Wykehamist and New College man, Archbishop Chichele, built a new college for a Warden and forty scholars, to pray for the souls of the King, the Archbishop, and of all the faithful dead. Twenty-four were to study Arts, Philosophy, or Theology, sixteen were to be Jurists, and all were to be Clerks of the First Tonsure and of good conduct. Priests and lawyers for the service of the State were to be the sole produce of this College, and a less hopeful nursery for medical or scientific studies cannot easily be imagined.

Nevertheless the site preserved early associations, and medicine by its paramount importance won its way through. Long before the end of the thirteenth century the 'Spicery' or haunt of the Apothecaries in Oxford had been localized 'in vico Catte Streete', close to where the cloisters of All Souls now stand. It was there that Tingewick of Balliol read Physic lectures, and Dochen, Lapworth, and other physicians practised. It is not unlikely that this environment was not without effect in causing All Souls to become a leading medical college.

Among its early alumni were Walter Hart of Merton, and NICHOLAS HALSEWELL, Fellow 1468. The continuance of the long succession of medical Fellows was undoubtedly due to the great and stimulating efforts of LINACRE, who, elected a Fellow in 1487, founded the great literary tradition that has always remained one of the distinctions of the medical men of Britain.

As a young man who had had a liberal education Linacre had the good fortune to accompany an embassy sent by Henry VII to the Court of Rome. In Florence he studied under Politian; he acted as Tutor to the children of Lorenzo the Magnificent; he acquired sufficient Greek to read Aristotle and Galen in the original; he made acquaintance with Hermolaus Barbarus, who brought Dioscorides to his notice. It has become a part of history that Linacre, imbued with the spirit of Italian Renaissance, transmitted it first to Oxford, and then to a wider sphere—to the Court of Henry VII. In due course he was appointed Court Physician to Henry VIII. His influence, becoming greater as time went on, enabled him to remedy one of the prime evils of that day. The sick and infirm had too often fallen into the hands of quack doctors and empirics, who were often illiterate monks licensed by bishops who were themselves without medical experience. Linacre in 1518 obtained the Royal Charter constituting the College of Physicians of London, and to preserve the standard of its members the qualifications of the first licentiates of that College were supervised by him. His last act was the founding of the lecturerships that bear his name: two of these were assigned to Merton College by his executor Bishop Tunstall, who gave as a reason that 'there were more physicians in that House than in any other in the University'. His bust adorns the Codrington Library.

Among the other early medical Fellows was RICHARD BARTLOTT, 'the first Fellow admitted into the College of Physicians, and who came to preside over that august body in 1527, 1528, 1531, and 1548. He died "very famous for his learning, great knowledge and experience in physic in the eighty-seventh year of his age" and was buried in the church of St. Bartholomew the Great. To All Souls he contributed



THOMAS LINACRE

From the portrait in the Royal College of Physicians

funds for the building of new lodgings for the warden and for daily masses for the souls of his wife Anne and himself.' Richard Master was a Fellow who 'because of popery' exchanged the study of theology for that of medicine. About 1549 a fever confined him to his bed for more than eighteen months. He proceeded D.M. in 1554, and five years later was appointed physician to Queen Elizabeth 'with the yearly fee of £100, besides bouche of Court'.

Of John Warner more is to be said. He was licensed to practise by the University at the time of being admitted to the B.M. degree in 1529. He was appointed by Henry VIII to be the first holder of his newly founded Professorship of Physick, 1546, having already in 1536 become Warden of All Souls. He was 'A learned man of his time, but published nothing and was a great intruder into ecclesiastical benefices and dignities' (Wood). His preferments included Prebendary of Winchester, 1541; Archdeacon of Cleveland, and of Ely, 1547; Prebendary of Ulfcomb at Salisbury. Though suspended during the reign of Queen Mary, he was restored and made Dean of Winchester in 1559. He died in Warwick Lane in 1564. Other notabilities were John Howell, D.M. 1555, and Richard Forster, D.M. 1573, 'nobilis mathematicus' who became the first Lumleian lecturer. He was the author of *Ephemerides Meteorologicae, ad annum* 1575 *secundum positum Finitoris Londoni,* 1575. Both Thomas Gwyn and Thomas Carpenter died of the plague of 1577. All left medical books which are still in the library.

Notwithstanding all this array of early medical talent, the Law was always present to their mind, and Warden Stokeley sent one of the Fellows to Cambridge to dispute whether Civil Law was not more excellent than Medicine.

By the visitation of 1549 a Reader in Natural Philosophy was provided for, but without much justification, and Warden Hovenden tried to make all the medical fellows take orders—rather a forlorn hope.

Interest in astrology never flagged: all the known facts and methods of science were pressed into its service, and several of the more able practitioners of the art acquired considerable wealth. Elected in the same year as John Warner John Robins, chaplain to Henry VIII and Queen Mary, was deeply versed in astrology. He is reputed to have been the ablest person of his time, not excepting his friend, Robert Recorde, whose learning was, however, of a more general kind. Robins made money: Recorde died a pauper.

Robert Recorde, ?1510–58, Fellow, was the greatest of our early mathematicians, the first to introduce algebra into English and to adopt the Copernican Theory, but finding the society of All Souls somewhat uncongenial, he proceeded to Cambridge to take a D.M. degree. On returning to Oxford about 1540 he taught arithmetic and mathematics, which he rendered clear to all capacities to a degree that had never previously been achieved. He is remembered as the Founder of the English School of Mathematics. Coming from near a South Wales mining district, he had special knowledge of metal-mining, and in 1549 was appointed Controller of the Bristol Mint, an association with coinage in which he was afterwards followed by Isaac Newton. But Recorde, like Marc Isambard Brunel, suffered the torture of a debtor's prison, wherein he died in 1558. His medical work now commands a high price in the book-market.

Sir Anthony Shirley, 1565–1635, at All Souls in 1581, was a daring adventurer who travelled in Persia, where Shah Abbas gave him the rank of Mirza.

The 17th century begins with a period of prosperity and extravagant feasting, followed by the inevitable consequences and a general lowering of the intellectual reputation of the College. To this period belong Sir Richard Napier, 1607–76, previously of Wadham College, 1626, nephew of the Astrologer of the same name who was the recipient of messages from Raphael. A Fellow of All Souls 1638, licensed to practise medicine 1633, D.M. 1642, F.R.C.P. 1664, he became 'a great pretender to virtu and astrology; made a great noise in the world, yet did little or nothing towards the public'. His book of nativities was acquired by Ashmole.

Sir Edward Greaves, 1608–80, younger brother of Professor John Greaves who measured the Pyramids, studied at Padua and Leyden, but took his D.M. at Oxford in 1641 and became physician to Charles II; Linacre Reader in Physics, 1643. He is believed to have been created a baronet by Charles I in 1645. Soon after, he and Dr. Charleton became the two travelling physicians to Charles II. He practised both in London and at Bath, and wrote *Morbus Epidemicus An.* 1643; *or the New disease, with Signs, Causes, Remedies, etc.* 1643.

But it was in the same century that members of All Souls came to acquire their highest reputation in the medical world. First we meet with Marchmont Needham, who, after a long and varied career as a controversial journalist, translated Kircher's *Theory of Contagion by minute Vermicules* (1658), thereby giving what is perhaps the first outline in English of the Germ Theory. In this résumé he states that Kircher was stimulated to write about the Pestilence of 1656, because it had puzzled the physicians in all their consultations about the causes and cure of it, and because he had convinced himself that 'contagion was due to those effluviums, atoms, corpuscles or ferments which do flow forth of all gross bodies . . . that the contagion was due not only to such atoms, corpuscles, etc. as are Inanimate, but by such also as were animated, living creatures, and were a sort of Invisible Worms or Vermicles. . . . These worms are so fine, that they insinuate themselves, not only into Clothes, Ropes and Linen, but also into Wood, Bones . . . even into Money—wherefore at Naples no Money was received in payment but was first well soaked and washed in Vinegar.' They may be made visible, he averred, by the most exquisite microscopes.

'All bodies are subject to putrefaction, and out of Putrefaction spring Animals. . . . That all putrid bodies should abound with an innumerable swarm of worms is a matter that was never known till the admired Invention of the Microscope: which I myself could never have believed, unless I had found it true by many years experience.'

Marchmont Needham, 1620–78, who was doubly an Oxford man, had led a hectic life. Born at Burford, he began life as a chorister and eventually became a Fellow of All Souls. For a time he had acted as Usher at the Merchant Taylors' School and an under-clerk at Gray's Inn, and when not involved in that controversial journalism for which he was famous, he devoted a considerable time to the study of medicine: otherwise he was what we should now term a free-lance journalist. He had drawn upon himself the disapproval of Anthony Wood, who accused him in 1643 of making 'weakly sport by railing at all that was noble . . . wherein his endeavours were to sacrifice the fame of some lord or person of quality, nay, of the King himself'. He was arrested twice in 1645 and 1646. In 1647 he sought the King's presence at Hampton Court, and then and there knelt before him and desired forgiveness for what he had written against him and his cause. Then by some new article in the *Mercurius Pragmaticus*, he offended the Parliamentarians and had to skulk near Minster Lovell and suffer three months' imprisonment in Newgate; but by turning his political coat once more he got appointed by Cromwell to be editor of the *Public Intelligencer*. About 1660 his position became again insecure, so he fled to Holland, but soon obtained pardon in England, where he entered on the practice of medicine until his death in 1678. In 1664 he produced his *Medela Medicinae*: a plea for the free profession and renovation of the art of Physic out of the noblest of most authentic writers.

Complaining of the neglect of chemistry for anatomy he showed among other things 'The insufficiency and uselessness of meer Scholastick Methods and Medicines, with a necessity of new. Tending to the rescue of Mankind from the Tyranny of Diseases; and of Physicians themselves, from the Pedantism of the old *Authors* and present *Dictators*.' He was here evidently referring to his 5th chapter, which is a translation of Kircher's Theory of Contagion by minute Vermicules (1658), *Scrutinium Physico-Medicum Pestis* 1658.

It is to the credit of Marchmont Needham of All Souls that this Germ Theory of Contagion of Kircher's was first published for English readers. It was an occasion, as Stubbs and

Bligh have remarked, on which the idea is greater than the fact of the moment.

Among the reforms effected in the University after the surrender of Oxford to the Parliament in 1645 were numerous changes in the personnel of the colleges. It was then that we meet with the great names of Thomas Sydenham and Christopher Wren. THOMAS SYDENHAM had served as a Captain of Cavalry in the Civil War, studied medicine at Montpellier, 1629, and by dint of careful study made his way into the forefront of English physicians. His Latin works were held in high esteem and much read on the Continent. He will always be remembered on account of his observations on epidemics, his first clear discrimination of other diseases, his cooling method of treating small-pox, his use of the bark in the treatment of ague, and his treatment of the gout.

In a different field lay the acute explanation of Sir THOMAS MILLINGTON, Sedleian Professor of Natural Philosophy, that the reproduction of plants is effected by a process of fertilization in which 'the attire (= anthers) doth serve as the male for the preparation of the seed'. Even so close an observer as Malpighi, armed with the power of his microscope, had failed to detect the real secret of the pollen and function of flowers. Millington had been Sydenham's chamber-fellow at All Souls and became President of the College of Physicians. More than a decade later Professor Camerarius of Tübingen established the truth of this discovery by experimental proof. Sir Thomas Millington came up from Trinity College, Cambridge, as a Fellow in 1649, and taking a D.M. degree in 1659 became President of the College of Physicians and Sedleian Professor, 1673–1704.

Sir Peter Pett, 1630–99, great-grandson of the shipwright, Commissioner for Navy, had the double but incompatible distinction of being Advocate General for Ireland and F.R.S. He was expelled from the latter for not performing his obligations to it.

The most eminent of all was CHRISTOPHER WREN, who had come up to Wadham at the early age of 14 years, already a

Latin scholar, a geometrician, and an inventor of most unusual powers. A fellowship at All Souls and the Savilian professorship in 1659 drew him from his astronomy chair at Gresham College, and all the signs were for a brilliant academic future. It is significant that at the time of his obtaining the Oxford appointment, his senior colleague, Nicolas Greaves, should have presented him with the most perfect set of astronomical instruments that had ever been made in England. Given as they were in memory of Wren's predecessors in the astronomy chair, Bainbridge and John Greaves, it is likely that they had originally been acquired and used by those observers as their own private property earlier in the century. On the death of John Greaves they would have come to his brother Nicolas. Rediscovered in 1936, they have now come back to the vicinity of Wren's old observatory in the Quadrangle of the Schools.

Wren's various achievements have often been enumerated. When at All Souls, Charles II expected him to prosecute a design for making a representation of the Moon in solido. It was finished and suitably mounted on a base of lignum vitae and placed among the curiosities in the King's cabinet. It showed the spots, hills, eminences and cavities and, if turned to the light, all the appearances that arise from the shadows of the hills. But Architecture was Wren's passion, and the great fire of London gave him his opportunity. Hardly had the ashes cooled before the King had accepted from him a plan for the reconstruction.

His plans for the new St. Paul's are treasured in All Souls Library. The Sheldonian Theatre, the Old Ashmolean, a gem of classical architecture, the great front of Christ Church 'attest his handwork and constitute the noblest of all the memorials which a son of Oxford has bequeathed to the nursing mother of his mind'. Yet how near he came to being one of the first of Oxford anatomists!

As a pupil with the training of a scholar he studied under Professor Willis and drew with fine draughtsmanship the illustrations of the anatomy of the brain which were the making of Willis's book. Among his anatomical researches we must mention his operation for the removal of the Spleen with safety. His description of that process includes the most detailed instruction as regards the ligaturing of blood-vessels, the application of antiseptic oils, and the adoption of other necessary precautions.

Before leaving Oxford to take up the duties of the Gresham professorship, he invented a method for the transfusion of blood from one animal to another. Boyle, who was living opposite to All Souls at the time, speaks of experiments 'started by Wren long before others thought of such a thing' (1659). He was evidently referring to Wren's interest in the possibility of injecting fluids containing remedial agents directly into the veins of animals.

Of epoch-making importance was his share in the application of the Microscope for the study of small and apparently insignificant things, a method of research that has developed into fundamental importance to civilization of to-day. His pioneer work is acknowledged by Robert Hooke, who when, by the advice of Dr. Wilkins, he was proceeding to engage on the microscopical examination of objects has left it on record that he did so 'with much reluctancy, because I was to follow in the footsteps of so eminent a person as Dr. Wren, who was the first that attempted anything of this nature; whose original draughts do make one of the ornaments of that great collection of Rarities of the Kings Closet. . . . But at last being assured both by Dr. Wilkins and Dr. Wren himself that he had given over his intention of prosecuting it, and not finding that there was any else designed the pursuing of it, I set upon this undertaking.'

From this suggestion, kindled by the Contagion theory of Kircher and Needham, the power of the Microscope has steadily progressed.

Meanwhile the real meaning of the physiological process of Respiration was being explained in Oxford by the united researches of Robert Boyle, Hooke, Lower of Christ Church, and John Mayow of All Souls. On considering the properties of nitre and its mode of foundation in decomposing organic matter Mayow reached the conclusion that there was some constituent in the air which he called 'nitro-aereal spirit'. His experiments showed the identity of the processes of chemical combustion and respiration in respect of this 'spirit' which, moreover, is concerned in the change of dark venous blood into bright arterial blood in the lungs. His essays on muscular action and on rickets are worthy of all praise.

The high honour of serving Queen Anne, George I, and George II as their physician fell to Sir John Shadwell, 1671–1747, son of Thomas Shadwell, the poet laureate. He proceeded D.M. 1700; F.R.S. 1701.

During the later part of the seventeenth century flourished Thomas Creech, through whose translations the theories of Lucretius became known to many men of science; Drs. John Hill and Peter Prideaux, both benefactors to the Library; and Dr. Richard Adams, who died as Principal of Magdalen Hall. But with Dr. Philip Coode, the Anatomy lecturer of the next century, the succession of the more eminent medical Fellows of the College appears to have waned. Yet many of the others continued to take an active and intelligent interest in natural history, as is shown by the acquisition of fine and large botanical and zoological folios, and scientific Transactions for the library. To this collection notable accessions came from Daniel Lysons and Ralph Freman of Hammels, both of Magdalen College.

The unusual subject of Netting was discussed by the Hon. and Rev. Charles Bathurst, LL.D., 1802–42, in a rare little book entitled *Notes on Nets, or the Quincunx practically considered*. 'To the Worshipful Company of Fishmongers, this volume is respectfully dedicated by the author; with the most sincere wishes that their splendid Hall and its occupants may ever continue to rank as they now do among the most distinguished ornaments of the Ancient Port and City of London.' Some of his information was obtained from Mr. Kirtland of the Old Ashmolean Museum.

One honoured name still remains to be mentioned. For six years, 1840–6, Sir Henry Acland was a Fellow, pursuing medical studies at St. George's Hospital with such success that he became Reader in Anatomy. This appointment removed him to Christ Church, where he created a Hunterian Museum on the banks of the Isis, out of which he modelled the new University Museum, which, replacing the Old Ashmolean Museum, has been for seventy-five years the principal focus of all the Sciences in Oxford. As Regius Professor Acland laid the foundations of our Oxford Medical School.

It has been suggested that the library of All Souls was the first in Oxford into which specialization was introduced. A professor of law has stated that 'without the arrangements which All Souls has made, legal studies in the University would have been difficult if not impossible'. But had this specialization followed on the scientific lines of the work of Wren, Mayow, Sydenham, Millington, and the other great alumni of the 17th century, it may be questioned whether All Souls might not have become a greater college than it is now.

Titles of Medical Disputations

The following titles of medical disputations give an idea of the low standard that prevailed at the beginning of the seventeenth century:

1605. Incantatio non valet ad curam morbi.

1608. An vita hominis sine respiratione consistere possit? Aff.

1608. An omnes corporis partes sanguine nutriantur? Neg.

1611. Aegri opinio de medico facit ad salutem.

1611. Medicamenta non sunt cibis conmiscenda.

1613. An liceat morbum morbo curare?

1615. An ciborum varietas sit praeferenda cibo simplici? Neg.

1618. An mulieres a melancholia magis vexentur quam viri? Aff.

10. MAGDALEN COLLEGE, 1456

THE site of Magdalen is of great biological interest. It is a nature-reserve, whose verifiable history goes back far beyond the Pleistocene era. In 1922 men digging gravel in the Grove reached at some four feet below the surface an extraordinarily rich bed of well-preserved bones and teeth of Mammoths, early cattle, deer, and a previously unknown species of British Bear, *Ursus Anglicus*. The bones were penetrated by the rootlets of some large elm-trees which obtained nutriment therefrom. As one of these was the largest timber tree in all Britain it is probable that it may have derived some stimulus from the phosphates in the bones. No early human remains were found.

A few yards to the south the Cherwell was crossed by a prehistoric ford which determined the position of Magdalen Bridge and the High Street. Close by, a Norman Crusader, Hugo de Malaunay, dedicated a Hospital to St. John. It was refounded by Henry III, and there for two centuries hungry wayfarers from beyond the river fed, and the sick and infirm were tended. Its rude walls are still standing among the later buildings of the College; still extant, too, is its gate with a wicket for the delivery of doles of bread. It brings back memories of the rest-houses of the East, perhaps of some similar institution in Syria or other land where Malaunay's crusading friends had received succour in time of need.

Two centuries later, in 1456, William Patten, Bishop of Winchester and first Headmaster of Eton, acquired the hospital, and, incorporating his eight-year-old foundation of Magdalen Hall, founded Magdalen College on the site. In 1467 he began to surround his newly acquired property with the battlemented Long Wall which still encloses the grove.

His sympathies lay farther in the direction of Science than those of the founders of New College or All Souls. In accordance with his intentions, a long succession of Fellows held office as Waynflete Praelectors of Natural Philosophy between 1484 and 1853. Even earlier, it may be, John Perch, the first known medical graduate of the College, whose memorial brass decorates the north wall of the ante-chapel, would have given teaching in medical subjects. In any case we may be certain that Perch was a Uroscopist, and resembled the fine sculptured figure of the physician in the Magdalen Cloisters.

Edward Wotton, 1492–1555, was the first Fellow of the College of Physicians to bring Zoology into the list of subjects on which a physician should be informed. He became a Demy in 1506 about the time when the quadrangle was being adorned with those hieroglyphic figures of animals, of which the river-horse, true to nature, carrying her young one on her back, is the most remarkable. By his *De differentiis Animalium* he obtained a famous name among learned men. Then, finding the history of Insects to be somewhat neglected, he collected materials for a monograph that he did not live to publish. Penny and Muffett, however, edited them for the *Insectorum sive Minimorum Animalium Theatrum*, printed eighty years after Wotton's death. By such works as this, and those of William Turner, the Cambridge Botanist, once proposed as President of Magdalen, materials were collected for the superstructure of English systematic Botany and Zoology. The interest thereby stimulated soon showed itself in more general works, such as the *Britannia* of WILLIAM CAMDEN.

Another distinguished member of the College was FLORIO, who was employed by Hakluyt to translate the Travels of Ramusio. In the preface to this translation he wrote: 'For here is a description of a country no less fruitful and pleasant in all respects than is *England, France, or Germany*, the people though simple and rude in manners, and destitute of the knowledge of God, yet of nature gentle and tractable . . . the voyage verye shorte, being but three weeks sayling from Bristowe, Plymouth or any commodious Porte of the W. Country, with a direct course to the coast of Newe found land.' A future source of wealth might be found, he went on to say, 'by transporting over beastes and cattell of Europe into those large and champion countreys'. The English have the best right to it since it was first discovered by John and Sebastian Cabot. So runs Florio's argument: he cannot claim to be the first English writer to advocate colonization,—Sir Humphrey Gilbert had argued it six years earlier and had already made the first English attempt at planting in North America in 1578—but Florio must be honoured as a very early English author to advocate a policy which has been fraught with such tremendous consequences to civilization. An interesting account of him is given in John Aubrey's *Lives*, who probably gained his information from Florio's grandson William Molins, son of James Molins, the noted London surgeon by his wife Aurelia, daughter of John Florio.

While at Magdalen in 1583 Florio received an interesting visitor, namely Giordano Bruno, who was then engaged on an attempt to construct a philosophy which should include the discoveries of modern science, represented in that day by the work of Copernicus. Bruno went so far as to extend the Copernican system far beyond our planetary system by declaring that the stars are all suns with planets revolving round them, worlds peopled like our own. Bruno was thus the first man in England to dispute the Aristotelian Physics, which he did at an historic supper-party, at which Florio must have been present, after a trip on the Thames. But for Bruno 'to display the treasures of his intellect to hidebound, ignorant Oxford doctors, was to cast his pearls before swine'.

Among the other holders of the Prælectorships were JOHN GULSTON, 1521–2, LAWRENCE HUMPHREY, 1552, HENRY BUSTE, D.M. 1566–71. Also THOMAS D'OYLIE, D.M., Fellow 1563, and physician to St. Bartholomew's Hospital. He travelled with Anthony, the brother of Francis Bacon, and died in 1603.

But of all the early physicians of Magdalen none is now more highly esteemed than NICHOLAS GIBBARDE, Demy in 1555 and D.M. 1576, who acted as Master of the Almshouse. His duties were to open the door at all hours to the poor, to see to the beds, coverlets, and sheets, to 'wasche honestlie all linnine as perteyneth to the church of the College', and to be responsible for the washing of table linen. For these duties he received a stipend of £4 13*s.* 4*d.* per annum. When he died, in 1608, he left a fine collection of medical folios to the College library, his 'rowe of bookes', 33 volumes in all, now a valuable example of the library of a physician in the days of Elizabeth.

Although the early physicians of Magdalen did not attain to the eminence of some of their contemporaries at other Colleges, their presence undoubtedly determined the foundation of the Physick Garden in 1621 on college land and this in turn stimulated the revival of Botanic studies at Magdalen. Chief among the Botanists were WILLIAM BROWNE, WILLIAM HOOPER, and WALTER STONEHOUSE, previously of Wadham, and their interest led JOHN GOODYER, the great Botanist of Petersfield, to bequeath his unique botanical library, with its manuscripts of Johnson, Lobel, Parkinson, and others to the College.

In the seventeenth century the physicians included THOMAS FOX, one of the six Fellows whom the college allowed to go out in law or physic: he proceeded D.M. and was admitted a candidate of the College of Physicians in 1623; SAMUEL THORNER, Extra-Licentiate of College of Physicians, 1658;

HENRY YERBURY; FRANCIS BARKSDALE of Magdalen Hall 1618, but D.M. as a Fellow of Magdalen 1649; TIMOTHY WOODROFFE, Extra-Licentiate 1653, who practised at St. Albans; ARTHUR DACRES, 1624–78, Fellow 1646, D.M. 1654, Gresham Professor of Geometry 1664; HENRY CLERKE, D.M. 1652, F.R.S. 1667, Anatomy Lecturer and President of Magdalen; ROBERT CONNY, son of a Rochester surgeon, D.M. 1685, who became physician to sick sailors at Deal. His improvements to Lithotomy were highly praised, several of his papers appearing in the *Philosophical Transactions*; ABEL CLARK, chorister in 1676, who practised at Witney, c. 1698; RICHARD SHORT, a Douai-educated fellow intruded by James II, who can therefore hardly be claimed as a bona-fide Magdalen man.

We now come to the parting of the ways. The older school tried to wrest the secrets of nature out of books; the new school were no less keen in their search, but they tried experiment. A fashionable method was by distillation. PETER MORWENT made a name for himself by translating from the Latin of Gesner a work on distillation to which he gave the alluring name *The Treasure of Evonymus, conteyninge, the wonderfull hid secretes of nature, touchinge the most apte formes to prepare and distul medicines for the conservation of health.* Distilling had a wonderful fascination for those early practitioners, and in no case more so than in that of SIMON FORMAN, 1552–1611. His note-books, now alienated from Ashmole's Museum for the History of Science to which they were given, contain many recipes for ailments, the cure of 'wondes', for purginge, for poisons, with notes on various 'appoticarie druges' in use at the time. Perhaps the most sensational of all his remedies was 'the medison I mad for my self 1610 the 12 of October, ad renovandum juventutem'.

'Myselfe did boill 2 snakes in my strong water when I distilled it, and after I drank of that water and yt made me to be fresh and take away all my gray hairs when I was 56 years old and many toke me to be about 40 or 42.' Treatises on the Plague and on Purging by him are also extant. His practice as an astrologer was seldom reputable, except when applied to the planting of herbs and roses in his Lambeth garden when the planets favoured in 1608.

But medical practice soon took a sounder course and it was always convenient to have a physician in residence, as, for

SIMON FORMAN.

instance, when SAMUEL SMYTH, B.M. 1620, relieved Mr. Walters when he ailed of the squinsie in 1614, and cured 'that sweet gentleman', Mr. Walter Buclande, also of the College.

PERCIVAL WILLUGHBY, 1596–1685, uncle of the eminent naturalist, was well-known as a successful obstetrician both in London and in Derby. Dr. THOMAS TRAPHAM, 1654–8, author of a *Discourse on the State of Health in the Island of Jamaica*, 1679, and DANIEL CAPEL, who wrote *Tentamen medicum de Variolis*, c. 1660.

HENRY SAYER, B.M. 1642, gave vomits 'with admirable success' to patients suffering from fever and plague, and is said to have induced sweating by a yellowish cinereous earth, obtained from the quarries at Headington. Cross was his apothecary.

We owe the first introduction of that most important of the instruments used in medicine, the clinical thermometer, to THOMAS SMITH, D.D., who had matriculated at Queen's College in 1657, but who came on to Magdalen when he was elected as Master of the College School. Having great skill in Oriental languages, he was called *Rabbi* Smith. He had visited Constantinople, and it was doubtless due to a visit to Paris that he became acquainted with M. du Val's invention of a thermometer 'which serves to show the duration, increase and diminution of feavors, it is but 3 inches long; 4 or 5 lines in diameter; ye inner pipe, which contains ye refin'd quicksilver is only half a line in diameter'. This account was given at a meeting of the Oxford Philosophical Society on May 13, 1684. He died in 1710, having, as Dr. Bernard said, 'added more to the honour of the Society of Magdalen College by what the world then read of him than any one that ever entered that Fellowship'. *A Conjecture about an under-current at the Straits' Mouth*, Phil. Trans., 1684, had been read by him to the Oxford Society in the previous December.

Their enthusiasm went far to stimulate FRANCIS DROPE to produce *A short and sure guide in the practise of raising and ordering Fruit-trees*, 1672; and THOMAS SHERLEY, M.D., to write *A Philosophical essay declaring the probable causes whence stones are produced in the greater world*, 1672, and *Cochlearia curiosa; or the Curiosities of Scurvy-grass*, 1676. These early associations of the 17th century were revived in the 19th, when Magdalen men began to occupy the Sherardian Chair and took a prominent part in the training of medical students.

On other lines we have the work of JOHN CHILDREY, *Britannia Baconica, or the Natural Rarities of England, Scotland and Wales. . . . With Observations and Deductions from them, whereby divers Secrets of Nature are discovered. . . . Usefull for all ingenious men of what Profession or Quality soever*, 1661.

In the production of architects the College can hardly claim to have trained many worthy of Waynflete's masterpiece, and even the work of the most prominent of these, Sir ROGER PRATT, 1620–84, has been well-nigh forgotten. He certainly owed more to an early sojourn in Rome, where he had been 'cohabitant' with John Evelyn in 1645. After his return to England, he built a palace for the Earl of Clarendon on the north side of Piccadilly, and Charles II appointed him Commissioner for the quick and orderly re-edification of the City of London after the Fire, a business that brought him into relation with Wren and Robert Hooke of Christ Church, who was acting as Surveyor for the City.

Among the Fellows who were admitted after the eviction of the Protestant Fellows by James II was one with latent medical interests, RICHARD SHORT from Douai, whither he returned at the Restoration. Six years later he proceeded D.M. at Montpelier, and devoted himself more particularly to the study of anatomy and operative surgery. After admission as L.R.C.P. in 1696, he practised among the London poor and died 1708. ROBERT WELSTEAD, 1673–1735, Demy 1689, F.R.S. 1718, author of *Tentamen de Variis Hominum Naturis, remediisque ad singulas accomodandis*, 1721; *De Adultâ Aetate Liber*, 1725; *De Medicina Mentis*, 1726.

Dr. THOMAS LISLE, Demy 1726, travelled up the Mediterranean as far as Smyrna and has left an account of a primitive chemical operation as practised near Cairo *c.* 1734, under the title *Method of making Sal Armoniac in Egypt*, evidently a survival of a method of the old Arabian chemists.

'Camel dung is put into large globular glasses about the size of a peck, having a small vent like the neck of a bottle, but shorter. These glasses are thin as a wafer, but are strengthened by a treble coat of dirt, the mouths of them being luted with a piece of wet cotton. They are placed over the furnace in a thick bed of ashes, nothing but the neck appearing, and kept there two days and a night with a continual strong fire. The steam swells up the cotton, and forms a paste at the vent-hole, hindering thereby the salts from evaporating, which, being confined, stick to the top of the bottle, and are, upon breaking it, taken out in those large cakes, which they send to England.'[1]

On his return Lisle became Rector of Wotton, Isle of Wight.

In the eighteenth century academic studies began to advance in the direction of Physics with corresponding sharpening of the inventive faculties.

EDWARD SAUL, Fellow 1698 to 1704, began with *An historical and philosophical account of the Barometer or Weather-glass*, 1730. SERVINGTON SAVERY invented the Divided Object-glass Micrometer which was adapted by Dollond to his best telescopes and was afterwards used in the construction of the great Radcliffe Heliometer, 1845, now one of the finest exhibits in the Science Museum, where it is on temporary loan. Savery's paper, published in 1743, was entitled 'A new way of measuring the Difference between the apparent Diameter of the Sun at the Times of the Earth's Perihelion and Aphelion with a Micrometer'.

GOWIN KNIGHT was a famous maker of strong magnets by a secret process for the Admiralty. For his experiments he received the Copley medal of the Royal Society in 1747, and his magnetic compasses of special accuracy were widely used on the ships of His Majesty's navy, just as Lord Kelvin's compasses were in our own time. His battery of magnets containing 240 bars each 15 inches in length was presented to the Royal Society by Dr. John Fothergill in 1776. In 1756 Knight was appointed Librarian of the British Museum in Montague House.

DANIEL LYSONS, M.D., contributed treatises on the effects of certain drugs, notably camphor and calomel, on continuing and intermitting fevers. He was a benefactor to All Souls Library.

The mechanical achievements of EDMUND CARTWRIGHT, 1740?–1823, must be shared between University College and Magdalen College; it remains only to add that his epoch-making inventions were made after his election to a Fellowship at Magdalen in 1764. He took out a patent for a Power Loom in 1785 and invented the Woolcombing Engine four years later.

[1] T. Shaw, *Travels*, 1757.

By the use of these two machines the small village of Bradford, of assessable value of £200 in 1700, was converted into a city of £1,500,000 in 1900. Mechanical spinners and weavers were first adapted in Lancashire to cotton, a much more docile material than wool, which continued to be combed by hand. In 1791 Messrs. Grimshaw of Manchester contracted for 400 Cartwright looms, but soon after 24 had been set to work, an incendiary set fire to the mill, which was burnt down. The adoption of Cartwright's methods laid the foundation of Bradford's industrial prosperity, recognized by the erection of the great Cartwright Memorial Hall at a cost of £50,000.

His other mechanical inventions included a tread-mill for working cranes; a steam-engine; the 3-furrow plough; a gas-explosion engine, forerunner of the internal combustion engine, but the explosive was gunpowder. In 1809 the Government recognized his very great services by awarding him £10,000 for his invention of mechanical weaving.

George Smith Gibbes, D.M., Fellow 1793, was appointed Physician Extraordinary to Queen Charlotte 1819, and was knighted by the Regent in 1820. He has left some interesting observations on the conversion of animal matters into a substance resembling spermaceti, or, as we should now call it, adipocere, *Philosophical Transactions*, 1796. He resided at Bath, and contributed many papers to the scientific journals of the first two decades of the 19th century.

A great advance was made when Dr. Charles Daubeny, 1795–1867, born at Stratton in Gloucestershire, came up as a Demy to Magdalen from Winchester in 1810. From 1815 to 1818, while a medical student at Edinburgh, he found time to attend, as Darwin did ten years later, Jameson's fertile courses on Geology and Mineralogy. He was appointed Aldrichian Professor of Chemistry in 1824. At least 1,000 members of the University attended his lectures, and his scientific work and interests were on so wide a scale that they exercised a profound influence on the development of the teaching of science within the University. For a time volcanoes and their chemistry were his hobby, but in 1833 he turned laboratory methods to the investigation of the relation of living plants to the soil in which they grew, with the result that he was elected Professor of Botany in 1834. It was in Naples that he began those studies of a volcanic region which were continued by his successor at Magdalen until 1895, when the College stopped further research. The geology of certain States of North America was studied by him in 1839.

When the British Association came into existence at Cheltenham in 1831, Daubeny, the sole representative of this University, was one of the principal organizers, and was responsible for inviting it to visit Oxford in the following year. Possibly, too, he suggested the title 'Association', which was adopted for the British Medical Association in 1832.

The transcendent interest of the British Association Meeting in 1847 led to new provisions for scientific study in Oxford. Daubeny's early teaching was given in the basement of the Old Ashmolean Building; but in 1848, finding the accommodation insufficient, and his researches upon the growth of plants needing the conveniences of a Garden, he erected adjacent to the Physick Garden a new scientific institution, which included a chemical laboratory, geological and mineralogical museums, and a scientific library. His policy was soon to be imitated by the University, for the Commissioners of 1852 recommended that a 'Great Museum' to include all the scattered scientific collection sunder one roof and close to lecture-rooms, laboratories, and a scientific library should be founded forthwith.

At his death in 1867 Daubeny left a trust fund to provide for the adoption of such measures as might be found necessary to prevent his great collections from falling into decay and to render them as useful as possible for the purposes of instruction to which he had devoted his useful and active life.

A further contribution to our knowledge of the local flora of Oxford was furnished by Richard Walker, Demy 1812, in 1833.

William Henry Corfield, 1843–1903, became the first professor of Hygiene and organiser of the International Congress of Hygiene and Demography in 1891. *The Treatment* *and Utilisation of Sewage* 1887, *Water Supply, Sanitation*, and *Typhoid Fever* were the principal subjects upon which he wrote. In all he rendered notable services to the cause of public health. It is of interest to recall that one of his first scientific observations was upon the Lithodomus borings in the Aymestry limestone of Silurian age.

Eminent as an historian of Medicine was FRANK JOSEPH PAYNE, 1840–1910, who proceeded D.M. in 1880. The tenure of Radcliffe and Burdett Coutts scholarships enabled him to continue his early studies in Paris, Berlin, and Vienna. On returning to London he became connected with St. Thomas's Hospital, where he paid special attention to Dermatological conditions. His chief writings were a *Manual of General Pathology*, 1888; *Harveian oration*, 1896; *Life of Sydenham*, 1900; *Fitzpatrick Lectures on the History of Medicine*, 1903–4.

The construction and use of large telescopes was the work of WILLIAM PARSONS. In 1844 he ground, polished, and set up near his house at Parsonstown in Ireland the speculum for a great six-foot reflector, the largest telescope in the world, with which notable discoveries of nebulae were made.

Among their medical contemporaries who made contributions of value to science were THOMAS ALLEN, M.R.C.S., and Dr. GEORGE CORFE, who published works on the cholera and on the kidney respectively.

The University Commission of 1857, recognizing the Founder's original sympathy with the study of Natural Philosophy, recommended the foundation of three scientific professorships, one each in Chemistry, Mineralogy, and Physical Geography, an indication that the Commissioners had been duly impressed by the work accomplished by Daubeny and Buckland. The Act of 1877 established a chair of Chemistry only, the other two being earmarked for Pure Mathematics and for Physiology. The Commissioners also arranged for professorships of Mineralogy and Botany, and contemplated the possibility of substituting a professor of Mechanics for the professor of Pure Mathematics. No new foundations have had a more profound influence on the growth and development of

DR. EDMUND CARTWRIGHT

CHARLES GILES BRIDLE DAUBENY

PROFESSOR OBADIAH WESTWOOD

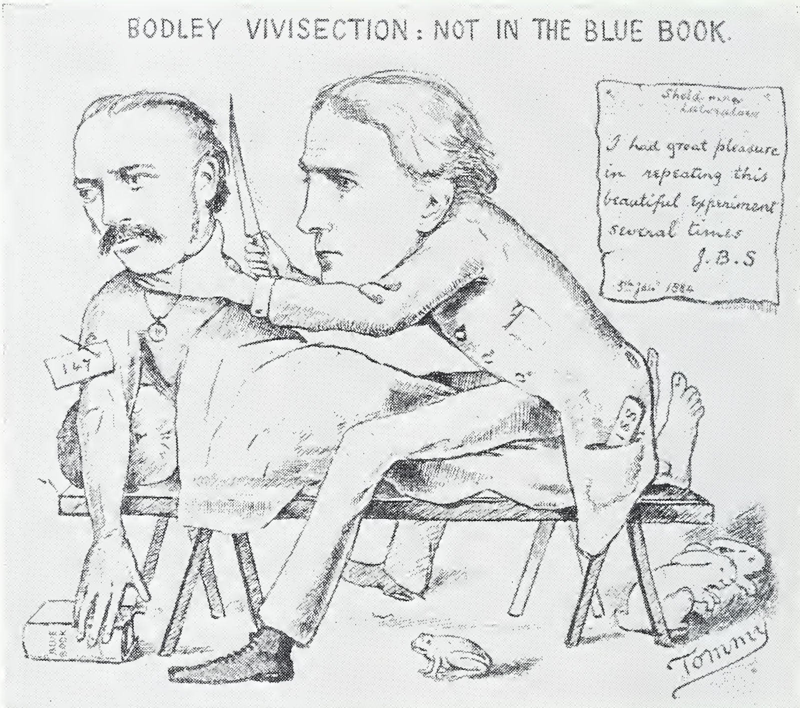
the Oxford Medical School. In 1882 Professor Burdon-Sanderson was appointed to the new Waynflete Chair of Human Physiology and Histology—a first step towards the establishment in Oxford of medical education on modern lines.

Under the ordinances of the same Commission, although he was not originally a member of the University, the distinguished entomologist and antiquary, JOHN OBADIAH WESTWOOD, 1804–93, was elected to an honorary fellowship in 1880, one of the very few persons who were not Magdalen men to be admitted to that distinction. He was the first Keeper and Professor on the Hope foundation for entomology, a science which he greatly adorned by his extraordinary skill as an accurate and artistic draughtsman. He was an outstanding example of the many men of science who, by devoting their leisure to the study of antiquities, have become recognized authorities upon archaeological subjects. How rarely it happens that a man who has been trained as an archaeologist ever accomplishes any notable work in any of the natural sciences.

JOHN SCOTT BURDON-SANDERSON had been trained at Edinburgh under Professors Balfour, Goodsir, and Bennett, the latter having been the first teacher to place the microscope in the student's hand. After post-graduate study in Paris in 1851 with Claude Bernard, whose influence on Sanderson's later work was most marked, he held a number of medical appointments in London. In 1867 he delivered the Croonian Lecture on the influence exercised by the movements of respiration on the circulation of the blood. In 1870 he acted as Professor of Practical Physiology at University College and worked in a private laboratory over a stable in collaboration with Lauder Brunton, Ferrier, and Klein. Finally, when he was Jodrell Professor of Human Physiology, the Physiological Society was founded at his London house in 1876.

On arriving at Oxford in 1882 he found no University laboratory available for his researches, but Edward Chapman accommodated him in the Daubeny Building at Magdalen, in the room in which he and CHARLES YULE had previously organized physiological teaching. It was here that his assistant, Francis Gotch, did valuable work on the electrical excitation of the leaf of *Dionaea muscipula*, with an Elliot Thompson Galvanometer specially provided.

The story of Sanderson's Homeric struggle for a new physiological laboratory and the unimaginable bitterness with which the Bodleian Librarian and other opponents fought his proposals, on the ground that vivisection might be practised there, has often been told. Eventually, a favourable Decree was carried by a small majority, and £10,000 was allocated to the work. In the new work Sir Henry Acland, who had always interested himself in the study of Pathology and Bacteriology, was most helpful, and when, in 1895, Sir Henry retired from the Regius Professorship, Burdon-Sanderson most appro-



T. H. T. HOPKINS

EDWARD CHAPMAN

SIR FARQUHAR BUZZARD

PRESIDENT B.M.A. 1936

Photo. Lafayette

priately succeeded him. It was through his statesmanlike handling of affairs that Arthur Thomson was chosen as Anatomy Reader, and that the University received benefactions from Mr. Ewan Frazer and Mrs. Ogilvy, which made the Pathological Laboratory and a Readership in Ophthalmology a possibility. Burdon-Sanderson resigned the Regius Professorship in 1903, and died two years later. His name will always be gratefully remembered in the Oxford Medical School.

And so, to a less wide circle, will that of EDWARD CHAPMAN, M.P., for twenty-five years Science Tutor at Magdalen, Secretary when the British Medical Association visited Oxford in 1868, and first Deputy Chairman of the Great Central Railway who introduced cross-railway travel, one of the greatest boons for convalescing visitors to the southern coast of England. Invalids travelling, say, from Manchester to Bournemouth or Folkestone have good cause to bless his name. At Magdalen he successfully applied the tutorial system to the needs of scientific students. Among his pupils were S. O. RIDLEY, JEFFERY BELL, J. E. BLOMFIELD, H. CHOLMELEY, sub-editor of the *Lancet* 1895–1909, G. A. BUCKMASTER, A. GOSSAGE, A. F. STANLEY KENT, and the present Regius Professor of Medicine, Sir FARQUHAR BUZZARD.

The activities of Magdalen men of the next generation have already been sketched in outline in connexion with the *History and Register of the Daubeny Laboratory* in which they received the earlier part of their tuition in Oxford. It was of them and their contemporaries that the War took the heaviest toll.

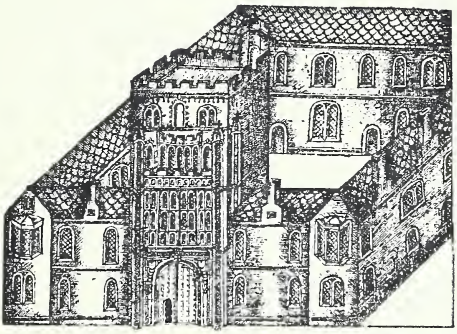
The Imperial Forestry Institute at Oxford was largely due to the keen interest in the need of afforestation on scientific principles that was taken in that subject by LORD LOVAT, 1872–1933, whose earlier work had included an exhaustive treatise on the *Grouse Disease*.

A minute study of blood platelets was a part of the work of Dr. HUBERT J. BURGESS FRY, 1886–1930, whose researches on the coagulation of the blood in fishes and tunicates led on to a search for immune reactions which might ultimately serve for the treatment of cancer. He elaborated a flocculation method.

THE COLLEGES OF THE SIXTEENTH CENTURY

The close of the fifteenth century saw the passing of medieval Oxford with its numerous small and ancient Halls, and its almost exclusive aim of training for the Priesthood, the foundation of new Colleges, and the advent of a great and increasing body of undergraduate commoners who came up without right to any college endowments. The new Tudor Colleges to be founded were Brasenose, Corpus, and Cardinal Colleges.

Collegivm Ænei Nasi.



11. BRASENOSE COLLEGE, 1508

Bishop William Smyth, Chancellor of Oxford in 1500, 'as well by Heavenly inspiration as by human judgement' consulted with Richard Sutton, a lawyer, and in 1508 obtained from University College a lease of Brasenose Hall for the very reasonable rent of £3 a year, and of Little University Hall adjoining. To these four other Halls were soon added, and by 1516 the new foundation was nearly ready for occupation on their site. A finishing touch was put in 1890 by the addition of the totem of the College, the historic door-knocker.

The statutes prescribed that students were to study sophistry, logic, and philosophy as a training for theology, but they also contained the new provision that most of the education was to be given by special lecturers *within* the college walls. Each scholar was to be placed under the care of a *Tutor*—a most important step in the development of the college system. During the first hundred years persons interested in science were few and far between. There was Humphrey Lloyd, 1527–68, noted as an antiquary and physician. He represented East Grinstead in Parliament and wrote *Commentarioli Descriptionis Britannicae Fragmentum*, 1572, which was translated by

Thomas Twyne under the title *The Breviary of Britain.* And Richard Caldwell, who took a D.M. degree in 1554, and becoming President of the College of Physicians in 1570, with Lord Lumley founded a lectureship on surgery in the College, which thereupon voted £100 for the improvement of the College buildings. He translated Horatio More's *The Tables of Surgery, briefly comprehending the Whole Art and practice thereof*, 1585. Also Thomas Hearne or Heron, M.D., and Richard Caldwell, who took a D.M. degree in 1554. Also Philemon Holland, the translator of Pliny, to whom English students of natural history owe much. He was a contemporary of Alexander Nowell, the Dean of St. Paul's, who became Principal in his old age, but is better remembered for his passion for fishing and for his accidental invention of bottled beer. On digging up a bottle of ale that he had buried in the ground, he found 'not a bottle but a gun, such the sound of it when opened'.

The first members of real scientific eminence were the brothers John, 1545–1607, and Henry Savile, 1549–1622. The first was an original member of the Society of Antiquaries, the second matriculated here in 1561, won a Fellowship at Merton four years later, lectured on Mathematics, and founded the professorships which immortalize his name. Then came Edward Brerewood, 1565?–1613, at Brasenose in 1590, who became the first Gresham Professor of Astronomy in 1596. His *de Ponderibus et Pretiis veterum Nummorum* was published posthumously. Robert Burton, too, began his academic career at B.N.C., but soon migrated to Christ Church. He is described by Charles Lamb as a 'fantastic old great man', by whom Melancholy was 'philosophically, medicinally and historically cut up'. The present author, writing at Folly Bridge, likes to remember that it was in his merry B.N.C. days that Burton, when he wished to laugh profusely, would go down to Folly Bridge to listen to the bargees swearing in the stream. In the summer time there is now but little laughter at Folly Bridge, for there is no stream—only that of tourists.

THE CHILDE OF HALE

The first Gresham professorship of Astronomy was bestowed in 1596 upon Edward Brerewood, 1565–1613, while Briggs was appointed to the chair of Geometry.

About 1617 Brasenose received a notable visitor in the person of John Middleton, 1578–1628, who was brought up by Sir Gilbert Ireland, who had matriculated there in 1578. Middleton, better known as the 'Childe of Hale', was a giant of 9 ft. 3 in. in height, with a hand from the carpus to the end of the middle finger 17 in. long, and the palm 8½ in. broad.[1] A life-size painting of the hand was seen and recorded by Pepys on 9 June 1668 as one of the sights of Oxford, and the Brasenose boat has been called *The Childe of Hale* for more than a century.

The College in 1644–5 became wellnigh ruined by its loyalty to the King, but one who seems to have lived in its quadrangle has brought it extraordinary renown. Elias Ashmole, perhaps the most remarkable antiquarian adventurer of the century, started as a son of a Lichfield sadler, and aided by his three successful marriages, came to acquire great reputation as a virtuoso, herald, and astrologer. He was singularly successful as a collector of the manuscripts of Dee, the astrological books of William Lilly, the library of Booker, the Natural History Museum of the Tradescants, and finally succeeded in inducing the University to build a new institution for the cultivation of studies in Natural History and Chemistry. For which he was rewarded by being given the Diploma of a Doctor of Medicine.

The better physicians of the period were William Quartermaine, 1618–67, who migrated to Pembroke, whence he proceeded D.M. 1657. He seems to have served as surgeon to the fleet, and Pepys entertained him on board ship in May 1660. He was appointed Physician-in-ordinary to Charles II and F.R.S.; Thomas King, admitted B.M. in 1650, having studied at Leyden; Thomas Arris, D.M. 1651 and M.P. for

[1] Plot, *Natural History of Staffordshire*, 1686, and R. Stewart-Brown, *Trans. Hist. Soc. Lancs. and Cheshire*, 1935, from whom our figures have been borrowed, and, with the leave of the College, reprinted.

St. Albans in 1661, the eldest son of that distinguished surgeon Edward Arris; PETER GERARD, D.M. 1669; JOHN SMITH, D.M. 1659, author of *The Portrait of Old Age*, 1666; and TH. FRANKLAND.

Like Wadham and some other Colleges, Brasenose owed some of its most famous members to Parliamentarian influence. Among others was Sir WILLIAM PETTY, 1623–82, who became Vice-Principal in 1651. His lodgings served as a rendezvous of the Founders of the Royal Society with whom he was extremely popular, being as Aubrey said, 'beloved by all the ingeniose'. Their inventive faculties were soon turned to the improvement of the economic condition of the kingdom. Early in his career Petty, justly esteemed as an almost universal genius, addressed letters on education to Hartlib, 1647–8, giving excellent advice as to the foundation of an institution for clinical study. In 1648 he described the newly invented art of double writing, to which he added, in 1667, a history of dyeing and in 1682 a political arithmetic concerning the population, housing, and hospitals of London and Paris. About 1661 he turned his thoughts to the science of shipbuilding, beginning with experiments to test the force and motions of wind and sea, and of the behaviour of vessels of various shapes, an investigation that was encouraged by the honour of a knighthood by Charles II, our 'most navarchal Prince'. He responded by proposing 'diverse things for the improvement of shipping, a versatile keel that should be on hinges, and concerning sheathing ships with thin lead' (Evelyn's *Diary*, 20th November 1661). In October 1662 he developed the great idea of twin ships called Double Bottoms. The experimental ship, *Invention*, was a platform on two parallel cylindrical floats; his second, launched in July 1663, within a few weeks made crossings from Dublin to Holyhead, beating the ordinary packet-boat, for which Petty won a wager of £50. No. 3, the *Experiment*, after royal christening by Charles II, sailed for Oporto, but got lost in a dreadful tempest in the Bay. A model of a Double Bottom, now in the possession of the Royal Society, was presented by Mr. Haughton in 1685 in the name of Mr. John Worlidge at Petersfield, having been made by his brother, a goldsmith of Portsmouth. A larger model at Gresham College measured four feet seven in length.

Petty's observations on the London Bills of Mortality, the first statistical work ever published, give him a share in the parentage not only of Statistics, but in the allied science of Political Economy. Incidentally, he desired to co-ordinate taxation and representation; he advocated union with Ireland; suggested a County Council for London, a Ministry of Health, isolation hospitals, and three acres per head as an ideal distribution of land. He even foreshadowed the monomark and the war-tank of 1916.

Born at Romsey in Hampshire in 1623, he had received his early education in watching the local cloth-makers and other artificers at work, until he had mastered their methods. At the early age of 12 he had learnt Latin and a smattering of Greek. At 13, with a fortune of 4*s.* 6*d.*—of which 6*d.* had been won at cards—he sailed, with a little stock, to Normandy. The accident of a broken leg kept him there for a couple of years, when he returned to England with £4, a good knowledge of French, arithmetic, and all the practical geometry and astronomy necessary for navigation. Service in the King's navy followed: he then proceeded to the study of medicine on the Continent and established himself on his return in a practice in Oxford, becoming D.M., F.R.C.P., Fellow and Vice-Principal of Brasenose College, and Professor of Anatomy.

A public dissection by these early anatomists was rather a sporting event, for there was always a chance that their subjects might come to life. The story of his revival of Ann Green has often been told. On this particular occasion Willis and Petty had secured for their anatomical demonstration a 'recent subject', the body of a woman who had been hanged in December 1650 on the gallows-tree in the Parks, according to Routh, or in the Castle Yard, according to Watkins, for the murder of her child. It was found, however, on unpacking her, that some vital heat still remained. The care and skill of the Professor and his assistants were accordingly turned to the means of restoring life, which by bleeding, spirits, and warmth they succeeded in doing. In 1652 he joined up as Physician to Cromwell's Army of Occupation in Ireland, and when a land-survey was wanted he made the well-known 'Down' survey, which was not only the first to be made but remained in satisfactory use for many decades. Incidentally, he acquired a certain amount of land by fair dealing. In 1686 he published the Dublin Bills of Mortality.

A less reputable Vice-Principal, THOMAS FRANKLAND, V.-P. in 1664, is remembered in medical history because he forged his Diploma as an Oxford D.M. and ended an otherwise blameless theological career in jail.

Several communications on the natural history of Lancashire were addressed by CHARLES LEIGH, 1662–1701, to the Oxford Philosophical Society about 1684. He appears to have been interested in some salt works and in the natron and nitre of the ancients. His experiments on digestion and his *Phthisiologia Lancastriensis, cui accessit Tentamen Philosophicum de Aquis Mineralibus* have been published, 1694. He had great faith in the efficacy of Peruvian Bark in cases of Intermittent Fever, and wrote on Epileptic fits. In 1698 he replied to Colbatch concerning the cure of viper-bite by acids. The chronicles of the *County of Chester* were compiled by FOOTE GOWER, D.M. 1728, the father of the Rev. Foote Gower, D.M. 1757.

A brilliant succession of medical men came to the College during the eighteenth century, and doubtless the following list might be extended.

EDWARD NORRIS, D.M. 1695, F.R.S. 1698, accompanied his brother Sir William on an embassy to the Great Mogul. FRANCIS BELLINGER, L.R.C.P. 1708, author of *A Discourse concerning the Nutrition of the Foetus in the Womb*, 1717, and *A Treatise concerning the Small Pox*, 1721. RICHARD MIDDLETON MASSEY practised at Wisbeach, D.Med. of Aberdeen, F.R.S. 1712, died 1743. JONATHAN GOULDSMITH, 1694–1732, D.M. 1724, F.R.S. 1730. PEIRCE DOD removed to All Souls, D.M. 1714, F.R.S. 1729–30. He was a determined opponent of inoculation; in 1746 he published *Several cases in Physic*,

A HAND OF THE CHILDE OF HALE

By the courtesy of Brasenose College and Mr. R. Stewart-Brown, F.S.A.

Small-pox and Fever in which he expressed his views against inoculation so strongly as to provoke a satirical reply from Dr. Barrowby of Trinity and two others, *A Letter to the real and genuine Peirce Dod, M.D., actual physician to St. Bartholomew's hospital with a full answer to the mistaken case of a natural small-pox after taking it by infection. By Dod Peirce.* THOMAS WILBRAHAM, who also migrated to All Souls, was elected F.R.S. 1741–2 and physician to Westminster Hospital.

In more recent times we note the names of the Rev. FRANCIS WILLIS, 1718–1807, of Lincoln College and B.N.C., who was a pupil of NATHAN ALCOCK. In 1769 he established a mental hospital near Lincoln, where he treated mental cases with such success that, though considered by his contemporaries as 'not much better than a mountebank', he was called in to attend George III during his first attack of madness in 1788. His treatment, 'largely owing to its gentleness', was completely successful, as it also was in the difficult case of the Queen of Portugal. His portrait by John Russell, R.A., hangs in the National Portrait Gallery, and has been engraved.

JOHN LATHAM, 1761–1843, was 'up' in 1778–82 and again in 1787 for a year on his appointment as physician to the Radcliffe Infirmary as a colleague of Dr. Robert Bourne of Worcester College. In London he became physician to the Middlesex and St. Bartholomew's Hospitals and a very influential Censor and President of the College of Physicians. He wrote *On Rheumatism and Gout* in 1796, and on *Diabetes* in 1811. His college contemporary JOHN MAYO, D.M., who also became physician to the Middlesex Hospital, removed to Oriel, whence he took his Master's and Doctor's degrees. A little later came JAMES HAWORTH, B.A. 1786, physician to St. Bartholomew's Hospital, the first Radcliffe Travelling Fellow, 1791, to visit the New World. JOHN SCOTT, 1773–1849, D.M., a competent orientalist, was for ten years physician to St. Thomas's Hospital.

John Latham's second son, PETER MERE LATHAM, 1789–1875, became one of the most skilful physicians and successful teachers that this University has ever turned out. In 1823 he was placed in medical charge of the inmates of Millbank penitentiary, who were suffering from epidemic scurvy and dysentery. Becoming physician at Bart's in the next year, he raised the clinical teaching there to an epoch-making value. *Lectures on Diseases of the Heart*, 1845, and his *General Remarks on the Practice of Medicine*, 1861–3, are among his better-known works.

A second Dr. FRANCIS WILLIS came up to B.N.C. in 1810, became a Fellow of the College of Physicians in 1821, and died at his private asylum, Shillingford House near Stamford, in 1859. He was the father of Dr. Francis Willis, D.Med. 1864, of St. John's.

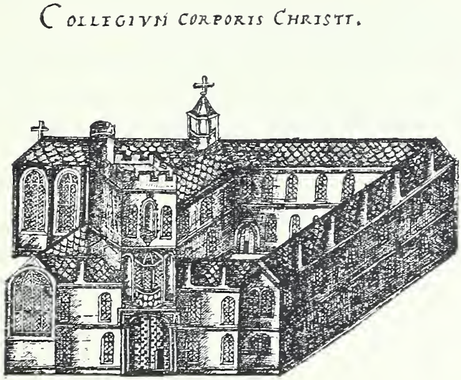
The Downing Professor of Medicine, Dr. CORNWALLIS HEWETT, B.Med. 1814, D.M. 1822, incorporated at Brasenose in 1814.

JAMES CLAUDIUS PAXTON, Radcliffe Travelling Fellow, b. 1818, B.Med. 1847, was endowed with artistic gifts which he turned to the illustration of his lectures on Anatomy. A fine wax model of a dissection of the side of the face was presented by him in 1826 to the Old Ashmolean Museum, to which it has now been restored after the lapse of a century.

ANDREW CROSSE, 1784–1855, an amateur experimentalist on electro-crystallization and metallurgy, caused a stir in 1837 by announcing that he had observed the appearance of mites in connexion with a Voltaic Battery he was using.

Among the more recent alumni were ARNOLD WILLIAM REINOLD, F.R.S. 1843–1921, Fellow of Merton 1866, Lee's Reader in Physics 1869–73, Professor of Physics at the Royal Naval College, Greenwich; and author of an essay on the *Properties of Thin Films*, Phil. Trans. Also W. R. FISHER, Indian Forestry Dept. 1869; Director of Imperial Forest School at Dehra Dun, at Cooper's Hill 1890–1905, and at Oxford 1905–10, editor of Vols. 4 and 5 of Schlich's *Manual of Forestry*. The distinguished physicist ARTHUR W. RUCKER took his degree in 1871.

A professorship of Engineering Science was attached to the College in 1908 of which C. F. JENKIN was the first holder.



12. CORPUS CHRISTI COLLEGE, 1516

THE College System which was inaugurated with such brilliant results at Merton was adapted at Corpus to the new learning of the Renaissance. The founder, RICHARD FOXE, tutor and counsellor of kings, the friend of Wolsey and Erasmus, controlled a vast fortune which he, perhaps on the advice of Bishop Oldham, the founder of Manchester Grammar School, used to establish a College for the 'Increase of learning' and for the 'good of the church and commonwealth', wherein 'the scholars, like clever bees night and day may make wax and sweet honey to the honour of God and the advantage of themselves and all Christian men'. This picturesque zoological metaphor was adopted by others, and Erasmus described Claymond of Magdalen, the first President of Corpus, as 'head of the College of the bees'. In Foxe's beehive lecturers on Greek were to make it 'one of the chief glories of Britain' and draw to Oxford more scholars than had ever been drawn to Rome. To this end it was well endowed with Readers in all the liberal Arts.

The founder's rule for his scholars was on the strict side. Classical and theological studies, with no more than twenty days of vacation in the year, were expected from everybody. This tradition materialized again in 1853 when Corpus agreed to maintain a Professor of Latin and extend the benefit to the

University. Advanced scholars or Fellows might go abroad to improve their scholarship.

Amongst the great men brought up under this régime we find Bishop JEWEL, REGINALD POLE, RICHARD HOOKER, 1567, JOHN REYNOLDS, THOMAS JACKSON, President 1631–40, General OGLETHORPE, the lawyers STOWELL and OWEN, Lord TENTERDEN, COPLESTON, KEBLE, and ARNOLD. All well-known though unscientific names; but it was impossible for the honey of Science not to find a place in the College of such bees. There were naturalists amongst them.

The taste for natural history displayed by these early folk shows that their interest had been stirred by the books they read, and that chief among these were Pliny's *Natural History*.

The first President, JOHN CLAYMOND, while still a Demy of Magdalen in 1483, had written four volumes of Notes and Observations on the Natural History of Pliny. In this he resembled John Free of Balliol, who at a rather earlier date also compiled a volume of excerpts from the same author. It was another instance of early zoological interests, of which an outward and visible sign is the zoological carving over the adjoining entrance gate of Merton College.

Two of the first great names are those of VIVES and LUPSET, public lecturers who were lodged here by Wolsey while he was building Cardinal College. History was made when JUAN LUIS VIVES, 1492–1540, a Spaniard who had been lecturing on Pliny's Natural History at Louvain, came to Corpus as a Fellow in 1523. Many years earlier Roger Bacon had laid stress on the importance of obtaining knowledge by experiment, but his doctrine remained unheeded. It was not until Vives appeared that any one in Oxford seriously taught that learning, if it is to be of value, must be obtained at first hand. Vives advised a student of science to learn from persons who have first-hand knowledge 'for this is what Pliny and other great authors undoubtedly did', and above all, 'let him not only keep eyes and ears intent, but his whole mind also, for great and exact concentration is necessary in observing every part of nature'. He wrote a set of verses for the Sun-dial erected by Kratzer by St. Mary's Church in 1523. Owing to his restless southern temperament, perhaps coupled with the gout, Vives soon retired from Oxford to Bruges.

We may mention here one of the treasures in the Corpus Library, a presentation autographed copy from Bishop Tunstal, of his fine mathematical book *De Arte Supputandi*, 1522, printed on vellum.

Corpus has always been noted for its Sun-dials. The eminent Professor of Astronomy, NICHOLAS KRATZER, made at least three, one in stone for the garden at Corpus, a second for St. Mary's Church, and a third for Wolsey, now in the Lewis Evans Collection. As tutor to the sons of Sir Thomas More he had taught them 'all the astronomy he knew', and when the portraits of More and his friends were painted by Holbein, Kratzer was amongst them. Thus the science and art of Horology or Dialling was fairly started in England. It did more than flourish for 200 years as an academic study, it raised the standard of punctuality among the people. Kratzer made his own instruments. A still more elaborate dial was designed by ROBERT HEGGE, *c.* 1599–1629, 'a prodigy of his time' who died at the early age of 30 leaving a manuscript *Treatise of Dials and Dialling*.

> 'A dial is the Visible map of Time, till whose Invention twas follie in the Sun to play with a shadow. It is the anatomie of the Day; and a scale of miles for the journie of the Sun. It is a sphere stolen from Heaven whose little circle is the Sun's day labour. It is the booke of ye Sunn on which he writes the Storie of the day. It is the traveller's Ephemerides; and an enimie to envious Time that would steal away and have none to take notice of her. Lastly Heaven itself is but a general Dial, and a Dial it in a lesser volume.
>
> (R. Hegge, *Horologium Sciothericum*.)

The fine pillar dial surmounted by the pelican was designed about 1581 by CHARLES TURNBULL, the author of a *Treatise on the Use of the Celestial Globe*, 1573. It is by far the most elaborate dial now extant in Oxford, for in addition to the larger dials on the eight surfaces of the head of the column, there are numerous small dials, of so small a size as to be invisible from below.

The dial and figures on the column are stated to have been added by Hegge. The repainting, which had been executed under the direction of W. W. Fisher, weathered away in the course of some twenty years, so that in 1936 it was again possible to read some of the original inscriptions, and to restore them had the weather been favourable.

The study of Seismology in England may certainly be considered to have been inaugurated on 13 April 1580, when T. T. published *A shorte and pithie Discourse, concerning the engendring, tokens and effects of all Earthquakes in Generall: particularly applyed and conferred with that most strange and terrible worke of the Lord in shaking the Earth, not only within the Citie of London, but also in most partes of all Englande: which hapned upon Wensday in Easter weeke last past, which was the sixt day of April, almost at sixe a clocke in the evening in the yeare of our Lord God*, 1580. T. T. was THOMAS TWYNE, 1543–1613, son of a Canterbury schoolmaster, and father of Brian Twyne. He became a Fellow of Corpus in 1564, and, graduating M.B. in 1593, practised at Lewes until his death. He translated *The breviary of Britayne*, 1573, from Humphrey Llwyd. The earthquake was one of the most severe ever felt in London. Stones fell from the Temple Church and from St. Paul's Cathedral. It was most severe along the Belgian littoral, a distribution that points to a submarine origin. Twyne was also author of a *New Counsel against the Plague*, translated from Peter Drouet, and *Physick against Fortune, as well prosperous as adverse*, 1579, translated from F. Petrark; also of numerous astrological works, which brought him into touch with Allen and Dr. Dee.

Among the more reputable physicians was HENRY WOTTON, D.M. 1567, who matriculated at Christ Church but became a Fellow of Corpus as Greek Reader, with so good a knowledge of medicine that the College of Physicians petitioned the governors of St. Bartholomew's Hospital in his favour in 1584. Also JOHN CLEMENT, who had the good fortune to be taken into the family of Sir Thomas More as tutor to his children. About 1519, having been appointed Wolsey's reader in Rhetoric and professor of Greek, he settled in Corpus and attracted the largest classes that the Schools had ever received. Within the next few years he took up the study of medicine and in 1528 was admitted an Elect in the place of Halswell in the College of Physicians. In 1529 he attended Henry VIII when he lay sick at Esher. He died in 1572 in Mechlin, where he had practised for many years. A temporary migrant from Cambridge was George Walker, 1552.

In view of the probable medical needs of the Fellows one physician was permitted to reside in College, and, by Poynet's interpretation of the Statutes, was exempted from the obligation of taking Holy Orders. In a list of twenty-one *Medicinae Deputati* elected between 1559 and 1837, we find the names of P. Bourne, M.D. 1614, author of *Pseudo-Medicorum anatomia*, 1624; James Hyde, 1656, Regius Professor of Medicine and Principal of Magdalen Hall, admitted a scholar 1632 under Jackson's presidency; John Parys, 1661; John Betts, 1654, a papist, author of *De Ortu et Natura Sanguinis*, 1669, and the *Anatomia Thomae Parri*. Other physicians of the time were Josiah Lane, Fellow, in practice in Wallingford, who took a D.M. in Leyden 1664; where, too, studied Arthur Parsons, who graduated B.M. at Groningen 1678, his thesis being *de Calculo Renum et Vesicae*, and D.M. Oxon. 1693. He practised at Taunton. Thomas Sutton, D.M. 1692.

Among their patients was Mr. Robert Bacon, M.A., of the College, who had a petrified glandula pinealis, which was dissected by Sir Edmund King, and described in the *Philosophical Transactions* for 1686.

It was soon realized that no great advance could be made without collections of natural history specimens for comparison, and in this the lead was taken by the Botanists. The College Library still owns the copy of the Herbal of Dodoens, 1616, between the leaves of which William Clayton dried and preserved the leaves of his herbs. William Creede also made a collection. 'The number of ye plants which I collected and gum'd in my book ye first year 1676 was very near thirteen hundred.'

William Vivian, 1728–1801, was Regius Professor of Physic from 1772 until his death. He was the son of the Rev. William Vivian of Little Petherick, Cornwall, and came up to Corpus Christi College as a Scholar in 1742. He practised in Oxford as a physician and had a large practice in the neighbourhood. He was elected to the Radcliffe Infirmary at its opening and was its Treasurer from 1788–1801. Vivian is remembered as having attended the Principal of Brasenose, Dr. Cawley, who was suffering from dropsy, and was one of the first cases to be recorded in medical literature as having been relieved by digitalis. Digitalis no doubt was used as a simple amongst the country people, for it was owing to Vivian having heard of a carpenter who had been cured of dropsy by taking digitalis root that the Principal was induced to try it.

In the next century Sir Ashton Lever made collections on a far larger scale, which contributed to stimulate popular interest in the study of nature, which is also shown by the many finely illustrated quarto and folio volumes that were published by subscription at this time. Starting with a collection of live birds in a Manchester aviary, Lever, in 1774, founded a Museum in Leicester Square, which remained one of the sights of London until its contents were finally distributed by sale in 1806.

The beginning of the eighteenth century had been a dark and troubled period in the annals of Corpus, but under the long Presidency of Randolph, 1748–83, the standard of College teaching so materially improved that in 1761 the father of Maria Edgeworth could recall that 'scarcely a day passed without my having added to my stock of knowledge some new fact or idea'.

The doctors of the time were Swithen Adee, D.M. 1733, F.R.S., F.S.A., who practised in Oxford, where he died in 1786, aged eighty-one; Samuel Musgrave, 1732–80, Radcliffe Travelling Fellow and author of *Lectures on Pleurisy*, 1779. George Williams, a Wykehamist elected to a Hampshire scholarship, became a Fellow, proceeded M.D. in 1788, was elected physician to the Radcliffe Infirmary in the next year, and Professor of Botany in 1796. Later he was appointed Radcliffe Librarian in 1811 and died at his house in the High Street, 'universally esteemed and lamented', aged seventy-one. A lengthy memorial inscription in Corpus records the affection in which he was held.

Two and a half centuries after Kratzer had improved punctuality in Oxford, another astronomer came to Corpus and obtained for Oxford an observatory equipped with such perfect instruments of the first class that by his industry he came to be able to measure heavenly motions with an accuracy of one second in a century.

Dr. THOMAS HORNSBY, 1733–1810, was born in Oxford on 28th August 1733. As a young Fellow he determined the latitude of Oxford with a small mural quadrant which is still in existence. On June 6, 1761, and on June 3, 1769, he observed two transits of Venus at Shirburn Castle, the house where George Parker, the second Earl of Macclesfield, was encouraging scientific studies (see p. 308).

A second transit of Venus on 3rd June 1769—he had in the meantime succeeded Bradley as Savilian Professor of Astronomy—enabled him to deduce a Solar Parallax of 8.78″, which is almost identical with the best modern results. A remarkable achievement when we remember the poor equipment on the top of the Schools' Tower where he observed. But his difficulties helped him to make a successful appeal to the Radcliffe Trustees for a suitable observatory for the Savilian Professor of Astronomy. And so, with the additional title of Radcliffe Observer in 1772, he made the plans for and laid the foundation stone of the great Observatory at a cost of £28,000. It was not completed until 1794.

In 1782 he was appointed Sedleian Professor of Experimental Philosophy and gave excellent lectures, his apparatus being valued by Edward Nairne at £375 14*s.* 6*d.* He became Radcliffe Librarian in 1783. The observations of Hornsby are among the most accurate of those made during the eighteenth century. With instruments made by John Bird about 1772–3 he obtained an unparalleled number of observations between 1774 and 1803, but left himself no time for reducing them, and the Radcliffe Trustees were content to leave them unreduced for more than a century. The great Quadrant with which he made his observations is now one of the most impressive exhibits in the History of Science Museum. Its pair, through lack of space, is in London.

His astronomical papers include a *Discourse of the Parallax of Sun*, *Phil. Trans.* liii. 467; *Transit of Venus 1769*, *Phil. Trans.* lv; *Account of observations of Transit of Venus and of Eclipse of Sun, made at Shirburn Castle and at Oxford*, lix; *Quantity of the Sun's Parallax as deduced from Observation of the Transit of Venus on 3 June 1769*; *Enquiry into Quantity and Direction of the Motion of Arcturus*, lxiii. 93. And in 1798 he noted the common proper motion of the stars of Castor, but failed to infer their physical connexion. He was the editor of volume i of Bradley's *Astronomical Observations*, 1798.

Hornsby was succeeded in the Sedleian Chair in 1810 by George Leigh Cooke, also of Corpus.

If the close of the eighteenth century witnessed a triumph for Astronomy, the beginning of the nineteenth was no less important for Geology, when the facts of Palaeontology were being interpreted in masterly fashion by Cuvier. His studies of fossil elephants, of the forerunners of horses, and the finding of marsupials in Paris were epoch-making. But he remained of opinion that man did not actually live with these animals until after the last great catastrophe or flood. His theory of successive catastrophes found immediate acceptance, for it afforded a certain scientific basis for the Mosaic account of the flood.

Cuvier by his commanding personality attracted many to the study of geology and palaeontology, and instilled enthusiasm into a large circle of his more intimate friends and scientific disciples. And especially so in England, where more than in any other country theological doctrines had always affected geological conceptions. The English School, Greenough, Babbage, Sedgwick, and others agreed that the Flood was the latest of Cuvier's 'World Catastrophes'.

The most argumentative and influential member of this party was Professor WILLIAM BUCKLAND, 1784–1856, born at Axminster 1784: he entered Corpus in 1801, and in 1809 was ordained and elected Fellow. In the interval he had attended the lectures of Dr. Kidd on Minerals and Chemistry, and of Sir Christopher Pegge on Anatomy.

From 1808 to 1814 he devoted his vacations to geological tours on horseback, first to the Chalk Downs of Berks and Wilts, to Corfe Castle and the Isle of Purbeck; then to S. Devon and the granite formations on Dartmoor; then to the Midlands and Northern England; gaining experience, in 1813 he published a paper on the Coasts of the North of Ireland, and drew attention to the huge flint cups in the chalk called *Paramoudras,* which Buckland was the first to identify as sponges. In 1813 he succeeded his teacher Dr. Kidd as Reader in Mineralogy, and in 1818 he was nominated Chairman of the Oxford Gas Company and elected F.R.S., and after ten years of intensive study of the geology of various parts of Britain, no one was considered more competent to fill the Prince Regent's newly founded Professorship of Geology than Buckland. His field-lectures on strata were a speciality. His notices reflected his enthusiasm. 'To-morrow the Class will meet at the top of Shotover Hill at 10 o'clock', or 'The Class will meet at G.W.R. Station at 9 o'clock. When in the train between Oxford and Bristol, I shall be able to point out the different formations we shall cross.' Indoor Lectures were delivered in the Old Ashmolean. The picture is well known.

In the following year he went to Paris and called on Cuvier, who kissed him on both cheeks. There he heard of the death of Sir Joseph Banks, and on returning to his garden he planted Banksia Roses to his memory. In his best-known work, *Reliquiae Diluvianae*, 1823, he assembled observations on Cave Faunas, in particular those on bones found in Kirkdale Cave, where at least 75 hyaenas had been huddled up, with hundreds of bones showing tooth-marks of animals which had cracked

them to get the marrow. That there might be no doubt about the marks, Buckland procured Billy, a living hyaena, and having given him marrow-bones to crack and gnaw, found to his delight that Billy's toothwork was identical with that of the cave-animals that had lived thousands of years before the flood. Billy is now in the Museum of the College of Surgeons, and Buckland proceeded with work at Stonesfield on the earliest mammals found in this country.

Buckland, like many a lesser light, had to face the belittling ridicule of his contemporaries, and it must be admitted that he frequently spread a feast for their wit, as, for instance, when he attempted to eat his way through the animal kingdom, a research less original than reviving early experiences in the antediluvian history of the human race. It was many years after Lord Abingdon's hunt had killed a stag in the College. Rumour stated that the most defeating articles in the menu were a blue-bottle fly and a mole.

Buckland became a Canon of Christ Church in 1825, and seven years later presided over the second meeting of the British Association in Oxford. The importance of the occasion was marked by the presentation of honorary degrees to Dalton, Faraday, Robert Brown, and David Brewster, a galaxy of talent that was described by Keble as a 'hodge-podge of philosophers'. His education hardly enabled him to realize that electricity will be a moving force long after the 'Christian Year' is forgotten.

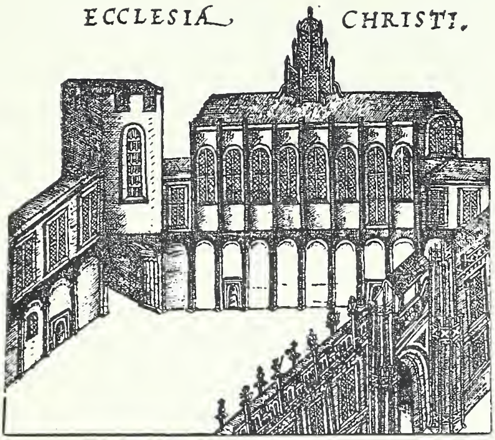
Buckland thrilled his hearers by a lecture on the Giant Sloths of South America. No one realized the importance of the priceless records of the rocks which he was accumulating steadily in the Old Clarendon Building more vividly than he, or as a consequence, a well-ordered geological museum. But at about the time when he was appointed Dean of Westminster he began to despair of getting Oxford to do more in that direction, and retired from active life in the University. He had, however, made the name of Oxford Geology famous all over the world, and Oxford Geologists still mourn the distribution of his great collections.

No one in England had done more to consolidate the science of Geology and to make Palaeontology into a science than Buckland. In his methods he followed the sage advice of his predecessor, Vives.

A century ago, on February 6, 1837, Mr. Holme of C.C.C.

read a paper before the Ashmolean Society on the formation and habits of British aquatic coleoptera.

Nearer our own time flourished the ornithologist P. L. Sclater, F.R.S., for many years Secretary of the Zoological Society, who was admitted a scholar in 1845. Also Henry G. Madan, a good physicist and skilful experimentalist, who obtained a First Class in 1861 and became a Master at Eton and a Fellow of Queen's. Also our late Poet Laureate, Robert Bridges, 1844–1930, who worked both in St. Bartholomew's Hospital and at Great Ormond Street until the age of 37, when he retired from active medical practice.



13. CHRIST CHURCH, 1532

Every College in Oxford has contributed to the rich variety of our national inheritance, but none is more deeply ingrained with its history and its origin than Christ Church. Clerics, Chancellors, and Kings have rocked its cradle. Blood, language, religion, its peculiar position, the Cathedral it has swallowed up, all have contributed to give this House its special character and to enrich its many contributions to our national life. Christ Church men have given notable service to their country; they have given of their best, and freely.

The Scientific History of Oxford goes back for eight centuries before Wolsey's Foundation. In 735 died St. Frideswyde, a noted and most successful medical practitioner. In her practice she is said to have used the water of Binsey well to restore the sight of a blind girl of seven years of age, and she was no less successful in curing Stephen of York of a fever that had baffled the leeches. Her thirteenth-century shrine in the Cathedral is embellished with carvings of herbs that are marvellously natural and accurate in detail.

Wolsey's first lecturers, Kratzer and Ludovicus Vives, and others prepared the way for their famous successors in the

Elizabethan Age, one of the most notable of whom was Richard Hakluyt, 1552?–1616, of Westminster School, who became a Student of Christ Church in 1574. He was a great reader of travels in all languages, and gave lectures on them, claiming to have been the first to show 'the new, lately reformed maps, globes, spheres and other instruments of this art, for demonstration in the common schools'. The publications of the Hakluyt Society and a tablet in Bristol Cathedral preserve his memory.

The new College undoubtedly attracted men of learning from elsewhere. One, a Henry Sumpter, arrived from King's College, Cambridge, but was not well treated, for he is said by Venn to have been cast into a cave where salt fish was kept under the College. The Oxford M.A. given him in 1526 hardly recompensed him for such treatment, for he died soon afterwards.

Sir Robert Dudley, Duke of Northumberland, 1573–1649, had the reputation of being very learned in the mathematics. To him the town of Leghorn owes its prosperity, for he drained the marshes behind it. In 1620 he was created Duke of Northumberland by the Emperor of the Holy Roman Empire. His fine work, *Dell'arcano del Mare*, was prized by navigators. He invented a medicinal powder compounded of Scammony, Antimony sulphide, and Tartar—known as 'Pulvis Warwicensis'.

His contemporary Robert Fludd, 1574–1637, the Rosicrucian, of St. John's in 1591, travelled on the Continent for six years as tutor to young members of noble families. On his return he migrated to Christ Church and took the degree of D.M. in 1605. In 1606 he was examined by the College of Physicians, who reported that although he had not fully satisfied the examiners, he did well enough to be allowed to practise medicine. Their hesitation is understandable because Fludd started with the idea that the Bible contains a sufficient guide to modern science, and as a Rosicrucian he was convinced that he could not only solve the problems of the alchemist, but ensure the gratuitous healing of the sick. He was in fact a faith-healer, who had so great an influence over the minds of his patients that he produced a 'faith natural', which aided the 'well working' of his drugs. He kept an apothecary under his roof, also an amanuensis to whom at all hours of night and day he dictated his numerous and elaborate treatises on things divine and human. The illustrations in his *Macrocosmi Historia* depicting optical experiments still serve as figures in modern physical text-books after three centuries of use.

EDMUND GUNTER, 1581–1627, matriculated at Christ Church in 1600. An essay on a *New Projection of the Sphere* brought him to the notice of William Oughtred, Henry Briggs, and other mathematicians. As a B.D. he was presented to the living of St. George's, Southwark, and designed his Quadrant, 1618. He also improved the Cross-staff, and showed how to take a back observation. His Tables of logarithmic sines and tangents to 7 places of decimals appeared in 1620 and were soon followed by his Rule engraved with log. lines for numbers, sines, and tangents of arcs. 'The honour of the invention of logarithms, next to the Lord of Merchiston and our Mr. Briggs, belongs to Master Gunter who exposed their numbers upon a straight line' and thus contrived a Slide-rule.

The abbreviation 'Log' was due to him, as were the terms 'Cosine, Cotangent, and Cosecant'—for the sine, tan. and sec. of the complement of an arc. He discovered the Magnetic Variation in 1622.

When in 1624 he was commissioned to write a *Description and Vse of His Majesties Dials in Whitehall* he in his preface humbly entreated his Majesty 'to accept these poore fruits of my younger Studies, when I was Your Maiestie's Scholler in Westminster and Christchurch: and I shall be ready to doe all services in this kinde or better in the Church; as Your Maiesty shall be pleased to think me worthy.'

Coming up from Westminster in 1589 DANIEL OXENBRIDGE studied medicine, and later practised at Daventry and London, where he was elected F.R.C.P. in 1627. He proceeded D.M. in 1620, in the same year that the Oxford degree was conferred on Peter Chamberlen, the eminent inventor of midwifery instruments.

Another Rosicrucian who devoted much time to the study of occult sciences was William Backhouse, 1593–1662, who came up as a commoner in 1610. He gave the greatest encouragement to Ashmole's alchemical and astrological bent and even adopted him as his son. On March 10, 1652, Ashmole noted in his Diary: 'This morning my father Backhouse opened himself very freely, touching the great secret.' Needless to say there is no hint as to its nature.

Wood adds that he was the inventor of the 'Way-wiser' in the time of George Villiers, the first Duke of Buckingham. His manuscripts on the Philosophers' Stone were inherited by Ashmole.

In 1621 a number of members of the House performed a scientific play that was written by Barton Holiday for the edification of James I at Woodstock on the 26th of August.

A leading part was taken by Astronomia, the daughter of Physica, who—wearing white gloves and pumps, an azure gown and a mantle seeded with stars; on her head a tiara, bearing on the front the seven stars, and behind stars promiscuously; on the right side, the sun; on the left, the moon—incurred the enmity of Magus and his wife Astrologia who attempted, fortunately without success, to strangle her. For this attempted crime of jealousy they were banished from the commonwealth of the Sciences.

The heaven of Astronomia is terra incognita which Geographicus longs to explore, and Geometres, aided by the occult art of Magus, attempts to measure. The plot is complicated by the more natural passion that Arithmetica has for Geometres, while the conflicting attachments of Grammaticus, Logica, Poeta and his servant Melancholia, Medicus and his servant Sanguis, Historia, Rhetorica, and Musica all cause confusion in the commonwealth of learning. An amusing scene is where the gipsies Physiognomus and Cheiromantes pick Poeta's pocket, but find nothing therein but a copy of Anacreon and a manuscript translation of Homer. It was surely a wonderful forecast of much that is modern in the music of to-day when Melancholia obtained the hand of Musica and took Phantastes into his service.

King James I, however, looked askance and might have uttered the royal 'We are not amused' when Phlegmaticus entered with a 'hat beset round about with tobacco-pipes', exclaiming, 'Fore Jove, most meteorological tobacco . . . a tobacco-pipe is the chimney of perpetual hospitality', and then sang a song which must have sorely wounded the feelings of the royal author of the *Counterblast to Tobacco*.

While Charles II in 1669 was working in his laboratory—a 'pretty place' as Pepys called it when he saw there a great many chymical glasses none of which he could understand—a humble member of Christ Church was originating a new kind of pottery at Fulham. John Dwight, the discoverer, had been 'register' or 'scribe' to four successive bishops of Chester, and in the late 1660's had started on a hard-fired salt-glaze stoneware pottery of a type much imported from Germany and Flanders. In April 1671 the King granted him a Patent on the strength of the statement in his petition: 'That he had discovered the Mistery of Transparent Earthenware, commonly knowne by the names of Porcelaine or China, and Persian Ware, as also the misterie of the Stone Ware vulgarly called Cologne Ware; and that he designed to introduce a Manufacture of the said wares into our Kingdom of England, where they have not hitherto been wrought or made.'

The results did not justify the statement so far as porcelain was concerned, but Dwight did succeed in bringing the manufacture of stoneware to a perfection unknown before in England. Its merit was recognized by the Company of Glass-sellers, who contracted with the inventor to buy only of his English manufacture and refuse the foreign.

He caused statuettes and figures to be modelled—a thing not done elsewhere, to which he gave the colours of iron, copper, brass or like agate stones. A fine extant example is a half-length effigy of his daughter, Lydia Dwight, who died in 1673. He also made a hard translucent ware that he used for the ornamentation of grey stoneware jugs and flasks. Some of his statuettes were distinctly porcellaneous. Plot praised his mastery of Cologne Ware, and M. L. Solon says 'nothing among the masterpieces of Ceramic Art of all other countries can excel the beauty of Dwight's brown stoneware figures, either for design, modelling or fineness of material'.

He kept his money in stone crucibles in his furnace, where an important discovery of pocket-books and accounts (*c.* 1691) was made in holes and corners of his ovens and kitchen at Fulham which had been bricked-up. His son SAMUEL was at the House in 1687–91 and wrote a few medical books.

When Wolsey was planning his great Foundation at Christ Church he contemplated a magnificent staff of 180 persons living on an income of £2,000 a year; including six public professors, one of whom was to teach medicine and might marry and live out of college. Two of the more eminent physicians were Dr. TH. FRANCIS, physician to Queen Elizabeth, who presided over the College of Physicians in 1571, and Dr. MARBECK, physician to Queen Elizabeth, and afterwards Provost of Oriel College. Francis was among those who changed their vocation from theology to physic in 1550, and to such good purpose that in 1551 he lectured as deputy to the Regius Professor John Warner. He became Provost of Queen's in 1561, and subsequently court physician to the Queen. And yet a third, JOHN FRYER, then a young master of King's College, Cambridge, was transferred to Cardinal Wolsey's new college. Unfortunately his strongly expressed Lutheranism led to his being 'committed prisoner to the master of the Savoy, where he did much solace himself with playing on the lute'. The master said 'He that playeth is a devil, for he hath departed from the Catholick faith'. However, he obtained a D.M. degree at Padua and became President of the College of Physicians in 1549–50. He died of the plague in London in 1563.

Among the lesser medical lights were CHARLES BOSTOCK, D.M. 1640; Sir JOHN BABER, 1625–1704, elected student 1642, and ejected by parliamentary visitors, B.Med. 1646, D.M. Angers 1684, physician-in-ordinary to Charles II; EDWARD

Harding, as Extra-Licentiate 1661, practised at Northampton; Charles Vermuyden, Licentiate 1662; Stephen Skinner, c. 1622–67 practised at Lincoln: a man of much learning; Robert Dale, Extra-Licentiate R.C.P. 1663, in practice at Stourbridge; Nath. Hodges, 1629–88, Fellow Trinity College, Cambridge, *Loimologia*; John Master, D.M. 1672, friend and assistant of Dr. Thomas Willis; Andrew Griffiths, M.A. 1679, in practice at Shrewsbury 1680, who proceeded to the doctorate at Cambridge in 1686; Francis Eedes, D.M. 1674.

But medical knowledge remained in a backward state, for even after the publication of Harvey's great discoveries there were still many who believed with Robert Burton that the left side of the heart is the 'seat of life' which begets 'spirits and fire', whereas the great aorta 'takes air from the lungs' (*Anatomy of Melancholy*, 1621).

In 1624 Richard Tomlins of the City of Westminster founded a Lectureship in Anatomy, which was to be held by the Professor of Physic who was expected to conform to certain directions. It was contemplated that the body of an executed person should be procured if possible immediately after the Lent Assizes and be prepared and dissected by a 'skillful chirurgion'. The Reader was to stand by and lecture on the subject, explaining the situation and the office of the natural, vital, and animal parts. In Michaelmas Term he was to 'reade the Sceleton or History of the Bones', and all physic students and chirurgions were expected to attend. Dr. Thomas Clayton, Regius Professor 1611, was the first Tomlins Lecturer.

To help medical education still further the Physick Garden was founded in the old Jews' burial-ground opposite Magdalen College.

Some of the students prospered, and among them was Martin Llewellyn, 1616–82, a Westminster student of the House, who took an M.A. in 1643 when fighting for the King. Five years later he was ejected from Oxford by the Parliamentary visitors and going to London he prosecuted 'his genius as much to Physic as before he had to poetry'. Indeed, with such success that Charles II appointed him his physician in 1660, and Principal of St. Mary's Hall. In 1664 he moved to High Wycombe, where he practised; and is believed to have written *Wickham Wakened: or a Quaker's Madrigall in Rime doggrell*, 1672, against a Quaker practitioner who had interfered with his practice.

An outstanding genius was THOMAS WILLIS, 1621–75, an Iatro-chemist, who referred all disease to chemical processes. In this he was the chief apostle in England of the doctrines of Francis Dubois, better known as Sylvius. He adopted the three primary chemical qualities of Paracelsus—salt, sulphur, and mercury. Salt is the cause of fixity in bodies, and is the residue left after burning; Mercury is the spirit which volatilizes their constituent parts, and is isolated by distillation. Sulphur causes colour and combustibility, and unites the spirit to the salt. Their whole theory of medicine rested on this basis.

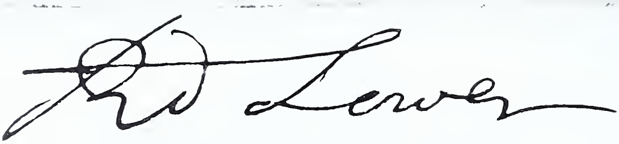
During the process of digestion an acid ferment is produced in the stomach; which together with the sulphur of the food, forms the chyle. The chyle ferments in the heart; or, salt+sulphur are set on fire there. By this combustion the *vital flame* which permeates all life, and the *vital spirits* which are distilled in the brain, are produced. *Fevers* are due to an efflu-vescence in the blood: *spasms and convulsions* are explosions of salt and sulphur: *gout* is due to coagulation of blood: *scurvy* is caused by blood becoming '*vapid*'.

Like Sylvius, Willis made a reputation by research on the structure and blood-supply of the brain; but his work was superior in many ways to that of his great Flemish contemporary. His speculations on the part played in Pathology by the nervous system or 'animal spirits' anticipate some of the best results of the Vitalistic school. His observations on the action of drugs have been affirmed to be second only to those of Sydenham.

He lived opposite Merton College and practised medicine there. He was appointed Sedleian Professor of Natural Philosophy in 1660. In 1664 he discovered the famous medicinal

THOMAS WILLIS

From an engraving in the Hope Collection



From 'Early Science in Oxford', vol. ix spring at Astrop near Brackley; in 1666 he moved to St. Martin's Lane, London, and soon acquired a most lucrative practice. He was consulted as to the ill-health of the children of James II, and gave great offence when he said that he attributed their ulcers and early deaths to 'mala stamina vitae'. He was never called for afterwards, and he died in London in 1675.

His principal publications were *Diatribae duae de fermentatione, altera de febribus*, 1659; *Dissertatio de urinis*, 1659; *Cerebri Anatome*; *De ratione motus Musculorum*, 1664; *Pathologiae Cerebri*, 1667; *Exercitationes medico-physicae duae* (1) *de sanguinis accensione* (2) *de motu musculari*, 1670; *De anima Brutorum*, 1672; *Pharmaceutice rationalis*, 1674.

Great as the achievements of Willis were, they were surpassed by his success as a teacher—witness his pupils, Wren, Lower, Mayow, and Locke.

Richard Lower, born at Tremeer in 1631, was admitted a Westminster student of Christ Church in 1649. In his work he was closely associated with Willis, becoming a skilful anatomist, but did not take a medical degree until 1665. His *magnum opus*, the *de Corde*, 1669, is a masterpiece in which the structure and physiology of the heart are better described than ever before. The discovery which more than any other has contributed to his fame was the correct explanation of the difference between arterial and venous blood. From time immemorial anatomists had held that there were different bloods; or that, if there was a change, from the dark blood in the veins to the bright blood in the arteries, the change was brought about by the action of the heart. Lower showed that they were the same blood and that the difference of appearance was simply due to exposure to air in the lungs. To prove the case he made use of the artificial respiration experiment of Hooke, who had demonstrated that the essential object of the lungs was to expose blood to the air.

The final explanation of the inner significance of breathing was due to a member of All Souls, John Mayow, who had assisted Lower with his dissections and had almost certainly been present at one of Lower's early transfusion experiments. Lower first performed a *Transfusion* on dogs in Oxford in 1665 and on a human subject two years later, by means of tubes specially devised by him and connected by portions of veins specially dissected from an animal for the purpose.

In 1672 he gave a true explanation of catarrhal defluxions, viz. that they did not come from the brain.

A most eloquent testimonial to his capabilities came from Dr. Willis, who praised him as 'a Doctor of outstanding learning and an anatomist of supreme skill. The sharpness of his scalpel and of his intellect, I readily acknowledge, enabled me to investigate better both the structure and the function of bodies, whose secrets were previously concealed. With him as my companion and collaborator, scarcely a single day passed without some anatomical dissection.' He also drew and most carefully revised the engravings with which Willis's book was illustrated. 'He saw to it that the plate contains scarcely any small line or most slender channel, the shape and exact character of which were not proven by reference to several animals, killed for that particular purpose.'

The last member of this famous group of doctors, John Locke, was also a student of the House. It is said that he avoided taking Orders. After a brief tour abroad he settled down in Oxford as a medical man. Indeed, in 1666 he was 'in a better way of becoming a great physician than a great philosopher', and between 1667 and 1670 commenced writing several books on medicine, of which fragments and tables of classified contents are still preserved. In a *De Arte Medicina* he intended to consider: 'i. The present state of the faculty of medicine as it now stands in reference to diseases and their cure. ii. The several degrees and steps whereby it grew to that height it has at present arrived to, which I suppose are these following: 1. Experience. 2. Method founded in philosophy and hypothesis. 3. Botanics. 4. Chymistry. 5. Anatomy. In all which I shall endeavour to show how much each hath contributed to advancing the art of physic, and wherein they come short of perfecting it. iii. What may yet further be done towards the more speedy and certain cure of diseases, i.e. by what means and method the practice of physic may be brought nearer to perfection.'

Several of his cases and prescriptions have been printed by Dr. E. T. Withington in *Janus*, 1909.

His knowledge of medicine introduced him to Lord Ashley before that nobleman had lost favour at the Court; he

Since yu command me I here send yu what
I proposd above a twelvemonth since for the reforming of
our year, before the addition of an other day increase the error
& make us, if we goe on in our old way differ the next year
~~differ~~ eleven days from those who have a more rectified Calendar.
The remedie wch I offer is that the intercalate day should be
omitted the next year & soe the ten next leap years following
by wch easy way we should in 44 years insensibly return to the
right. & from thence forwards goe on according to the new Stile.
This I call an easy way because it would be without any preju=
dice or disturbance to any ones civill rights, wch by the loping off
of ten or eleven, days at once in any one year might perhaps receive
inconveniencies: the only objection that ever I heard made against
rectifying our account.

John Locke

Oates 2 Dec 99

treated him for chronic abscess or suppurating hydatid cyst of the liver, and cured him. But this friendship brought him into disfavour with the powers that were, and led to his expulsion from the House in 1684 by Royal Mandate.

Henry Stubbes, 1632–76, physician and journalist, matriculated at Christ Church in 1651, becoming second Keeper of the Bodleian in 1657. He could speak Greek fluently, but wrote so 'pestilently' against the clergy and universities that the Dean of Christ Church expelled him from his studentship and from the library. He wrote against the Royalists to please his patron Sir Harry Vane. On leaving Oxford he took to the practice of physic at Stratford-on-Avon; he went to Jamaica in 1661, where until 1665 he practised as King's physician, and thereafter in Stratford, Warwick, and Bath. His chief writings were on *Indian Nectar, or a discourse concerning Chocolata*, 1662; *The Miraculous Conformist: An account of marvellous cures performed by the stroaking of the hands of Mr. Valentine Greatrakes*, 1666; *Philosophical Observations made in his Sailing from England to the Caribbe-Islands, and in Jamaica*, 1667–8; *Discourse concerning Phlebotomy*, in opposition to George Thomson, pseudo-chymist, a pretended disciple to the Lord Verulam, 1671. The Royal Society and Glanvill were attacked by him in 1670 in *Legends no Histories; or a Specimen of some Animadversions upon the History of the Royal Society*, but fortune gave the spokesman for the Society the last word. Stubbes was drowned near Bath, and his funeral sermon was preached by the Rev. Joseph Glanvill, F.R.S., who had become rector of Bath Abbey.

But the greatest of them all was Robert Hooke, whether he be regarded as mechanic, physicist, biologist, geologist, administrator, or operator.

His work on the Air-pump for and with Boyle in the High Street will be mentioned later (p. 305). His method of using the Microscope, his manifold discoveries with it, and his descriptions of them published in *Micrographia* have justly led to his being dubbed Father of Microscopy. To him we owe means for the measurement of weather, time, and longitude. His anchor-escapement brought about a revolution in clock-making, his balance-spring still regulates the timekeeping of our watches. His reflecting instrument suggested Hadley's Sextant. Hooke's Law is the basis of the theory of elasticity. Most branches of study owe some vital essential to his researches. His astronomical methods and observations proved incentives to Halley and Bradley. He gave to zoology the first description of a member of the great order of Foraminifera. Geologists have to thank him for the argument that fossil shells are the remains of organisms that were once alive,

IOHANNES FREIND M.D.

Serenifsimæ Reginæ CAROLINÆ Archiatrus

Cui suas Artes sua dona lætus
Et Lyram, et Venæ Salientis Ictum
Scire concessit, celerem et Medendi
Delius Usum.

and not, as Plot believed, the result of an inanimate process of crystallization. He inferred that the relative positions of land and sea were constantly changing. ''Tis not improbable', he wrote, 'that many Inland Parts of this Island, if not all, may have been heretofore all cover'd with the Sea and have had Fishes swimming over it.' In short he may be regarded as the originator of the idea of Stratigraphical Geology in that he sought in fossils the means of establishing a chronology of events in the Earth's history. The study of Fossil Botany originated with him.[1]

As a biologist he undertook many physiological experiments on the Circulation. He began, as Wren did, by injecting remedial agents into the blood-stream of living animals. Then he injected blood from one dog into another. Pepys, for instance, entered in his Diary for Nov., 1666: 'This noon met Mr. Hooke who tells me the dog which was filled with another dogs blood at the College, is very well, and like to be so for ever.' *Respiration* he also studied by a crucial experiment. He found that an animal could be kept alive by blowing air with bellows through the lungs. He found that birds, which will not thrive in rarefied air, will live in compressed air. Another subject of research was *Skin Grafting*. He made attempts with feathers of birds, and with the spur of a cock transplanted on to its comb.

Among his microscopic triumphs were the recognition of striation in *Muscular Tissue*, and of the structure of *Moulds* which he considered a cause of *Putrefaction*. He figured the first example of the important microscopic group of Foraminifera. He was the first to publish excellent much magnified drawings of those minute pests of mankind, the flea and the bug. How persistent they have been is shown by the domestic bills of Gibbon, the historian, and by the accounts of Tiffin, 'Bug-destroyer to His Majesty' in 1827, and not less by the

[1] *The Life and Works of Hooke* have been printed as vols. 6 and 7 of *Early Science in Oxford*. Evidences as to Hooke's varied occupations are always worth noting, e.g. a bookseller's catalogue recently offered a document concerned with the rebuilding of houses on Ludgate Hill; it was signed by Hooke and Jo. Oliver, his fellow surveyor for the City of London, and dated 4 July 1670.

many modern urban areas wherein nearly all the houses are infested with bugs, and the insects are being moved from old slums to new estates. *Cimex lectularius* is still an occasional exhibit at the Conversaziones of the Royal Society.

Continued bad health gave him constant opportunities of studying diet. Senna tea was a favourite beverage—surprising that he lived to be 67 years! It is satisfactory to note that the tercentenary of his birth was celebrated in Oxford by an exhibition and by the publication of his long-forgotten Diary, which reveals him as a notable architect and the sociable friend of Wren and of many of the great men of his day.

Although it is generally recognized that Robert Hooke was the greatest mechanical genius of his day in Britain, it has not been generally recognized that, but for his unselfish and unremitting labours, the Royal Society might have ceased to exist. There was a time in its history when if Hooke was not able to produce an experiment there would be no meeting.

In Oxford Dr. Fell, who occupied the Deanery for a quarter of a century from 1675 to 1700, did more than any of his predecessors to place the printing press on a businesslike footing, and Fell type is still in use to-day. He set up Great Tom in its Tower, and was accused of partiality for Christ Church men. It was with the help of Dr. Fell, acting on the suggestion of John Ray, that Willughby's great work *de Historia Piscium* was printed at Oxford in 1686.

At the time of Plot's resignation of his Ashmolean Professorship of Chemistry and Keepership of the Museum, George Smalridge, 1663–1719, was considered as a possible successor. He had been a contemporary of Joseph Addison at the Grammar School at Lichfield, where he had attracted the attention of Ashmole, who paid school fees for his further education at Westminster and Christ Church. Smalridge, who had evidently made up his mind to enter the Church, justifiably considered that ignorance of chemistry would be a sufficient bar to his accepting office at the Old Ashmolean. He did better. He became Dean of Christ Church and Bishop of Bristol. In 1689 he published *Auctio Davisiana* and took orders. He was buried in the Cathedral, 'one of the most learned and excellent persons in the kingdom'.

His letter referring to the Old Ashmolean appointment is in the Bodleian. It is endorsed 'Recommended by Mr. Ashmole to look after the Museum' and concludes as follows:

> The place I am not at all fond of; I did not seek it; but it is offered, and it is not in my power to refuse it: which you will easily judge when you know my circumstances. Mr. Ashmole has been, and still is, my worthy Patron. I have received a support from him for many years. When he first intimated to me that he designed this place for me, I received it coolly, but was checked for it. He designs it as an ease to himself; and therefore, if I should reject it, I forfeit any title to his other favours. I am conscious how little I am qualified for it: but the chemistry I shall have nothing to do with, and it will not be very difficult to get some knowledge of the things in the Museum sufficient for my purpose.
>
> I thought fit to communicate to you the true state of my case, that I might be excused if your advice in this case had not that effect upon Me, which in others it may justly challenge. If the place had not been compatible with Orders I had rejected it. I have sent you a letter which came to me last Post. I will bring yours to Mr. Sikes's Chamber at Night.
>
> I am, Your most humble servt. G. S.[malridge]

The orientalist Dr. EDWARD POCOCK, domiciled at Aleppo, was so highly respected by the natives that he was chosen for an umpire amongst them to settle their differences.

The first of the eminent physicians of the House, whose floruit came in the eighteenth century, was JOHN FREIND, 1675–1728, brother to the headmaster of Westminster School. Having seen service with Peterborough in Spain he proceeded D.M. in 1707. He was Gulstonian lecturer, Harveian orator, and physician to Queen Caroline, and will always be remembered as the Historian of *Physic . . . to the beginning of the Sixteenth Century*, printed in 2 volumes, 1725–6.

RICHARD FREWIN, King's Scholar at Westminster, 1693, and D.M. from Christ Church, 1711, was a notable benefactor. He made a herbarium and left manuscript notes on the medicinal uses of the plants; he attended Dean Aldrich on his death-bed; he left £2,000 in trust for Physicians of the Radcliffe Infirmary and his house, Frewin Hall, to the Regius Professor of Medicine; his letter on *Variolae cohaerentes*, 1710, is printed in John Freind's *Hippocrates De Morbis Popularibus*, and his miniature portrait is in the Radcliffe Library. He must not be confused with Dr. Thomas Frewen of small-pox fame.

Dr. Freind.

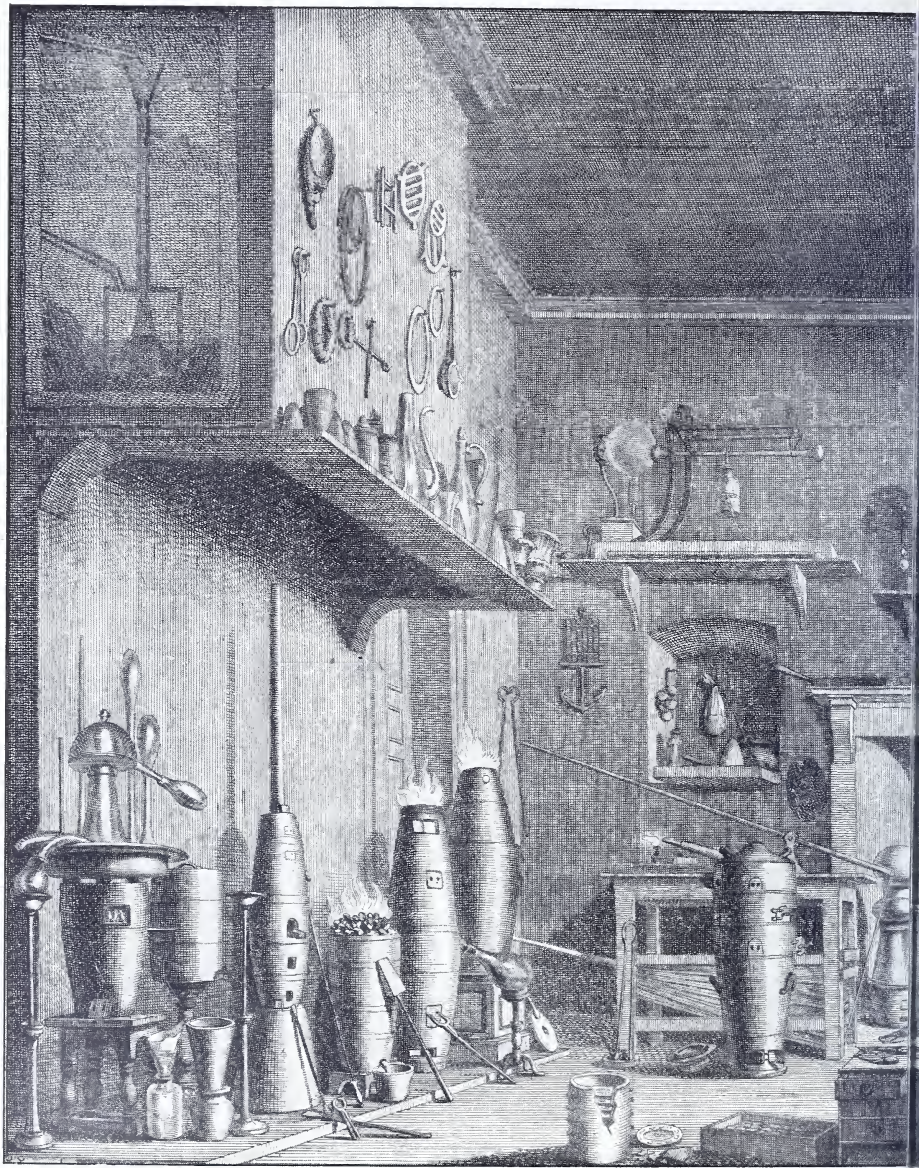
For the educationist J. T. Desaguliers, see p. 301.

Many physicians received their early education at the House in this century. The more notable included the following:—

Noel Broxolme, elected one of the first Radcliffe Travelling Fellows in 1715; D.M. 1723; physician to St. George's Hospital and to the Prince of Wales. Samuel Dwight, L.R.C.P. 1731, practised at Fulham and wrote *De Vomitione*, 1722; *De Hydropibus*, 1725; and *De Febribus Symptomaticis*, 1731.

Matthew Lee, 1695–1755, practised in Oxford 1739. Physician to Frederick, Prince of Wales. In 1750 he founded an anatomical lectureship with a stipend of £140 a year; and provided funds for the Anatomy School mentioned below.

Picture of Blowing-machine *Globe Frictional Electric Machine*



Sand-bath *Furnaces* *Bellows*

THE CHEMICAL LABOR

Glass-furnace *Barometer*

Blast-furnace *Air-pump* *Rolling- and Grinding-mills* *Chemical Balances*

ORY OF W. LEWIS, 1763

John Wigan, born 1694, son of W. Wigan, Rector of Kensington, went from Westminster School to Christ Church in 1714, D.M. 1727, F.R.C.P. 1732, when he resigned the Principalship of New Inn Hall and settled in London. He accompanied Sir Edward Trelawny to Jamaica, where they married two daughters of John Douce, the painter. He died there in 1739. Robert Hopwood, D.M. 1726, Harveian Orator. Charles Peters, Radcliffe Travelling Fellow 1725; D.M. 1732; physician-general to the Army 1739.

Bonnell Thornton, 1726–68, B.M. 1754, enjoyed a higher reputation as a poet than as a physician, but Sir Lucas Pepys, Bart., 1742–1830, became one of the most successful physicians of his day. He was appointed physician-in-ordinary to the King, and physician-general to the Army 1794, and presided over the College of Physicians 1804–10.

John Burges, 1745–1807, D.M. 1774; while at St. George's he formed a great collection of Materia Medica which he left to Mr. E. A. Brande: it is now in the College of Physicians.

William Lewis, D.M. 1745, F.R.S., anticipated Wollaston by his researches on Platinum. Cf. 'Experimental Examination of a white metallic substance found in Gold Mines of the Spanish West Indies, known by name of Platina', *Phil. Trans.*, 1754; *Experimental examination of Platina*, 1757.

In 1750 anatomical studies came to be more closely associated with the House through the munificence of Dr. Matthew Lee, who provided for the building of a College Anatomy School in Skeleton Corner so as to supersede the earlier Anatomy School next the Bodleian Library.

Dr. John Parsons as first Lee's Reader, *c.* 1765, read there until he became first Lichfield clinical professor at the Radcliffe Infirmary in 1780. Apparently the printed *Lecture Notes* of Nicholls of Exeter appear to have remained in use, for F. H. Egerton, who attended Parsons's course in 1777 (see p. 95), added the following descriptions to them:

Notes 'on a preparation of an ossified artery in the possession of Dr. Parsons in the Anatomy School; the case of Countess of Desmond having a third succession of teeth; Heberden's recent description of Angina Pectoris; Wilson's report of the extraction of the Spleen first performed upon a soldier who was wounded in the battle of Dettingen.' In the course Parsons showed a preparation of an indurated and schirrous pancreas and the bladder-stone of Strap, executed for murder in March 1775 at Oxford. Drs. Hunter, Drake, Hewson, and Bishop Cumberland are all quoted, and Lower's transfusion experiment is described.

The talented family of the Gregorys held most of the medical and mathematical chairs in Scotland. JAMES GREGORY, 1753–1821, entered into residence at the House in 1767, living in the deanery under the immediate care of his cousin. After a tour on the Continent in 1774–5, he received various academical honours and drew up a *Conspectus Medicinae Theoreticae ad usum Academicum*, and finally succeeded the famous Dr. Cullen as Professor of the Practice of Physic in Edinburgh.

Sir CHRISTOPHER PEGGE held classes in the Anatomy School from 1801 to 1822.

SIR JOS. BANKS, 1800.

Sir JOSEPH BANKS came up as a gentleman-commoner in 1760 with a taste for Botany acquired through reading Gerard's Herbal. F.R.S., 1766. The great event of his life was when he obtained leave to accompany James Cook on the *Endeavour*, 1768; the object of the expedition being to observe the Transit of Venus in the Pacific, due on the 3rd of June 1769. But they accomplished far more. They made history. They circumnavigated New Zealand for the first time; they charted the Great Barrier Reef and sailed between New Guinea and Australia, thus disproving the existence of the Great Southern Continent. In 1778 Banks was elected President of the Royal Society until his death in 1820. A munificent patron of science, rather than an original worker, Banks's own contributions were confined to *A short account of the causes of the disease called blight, mildew and rust*, 1805, and to work on the *Merino Sheep*, 1809. He trusted to Solander, a favourite pupil of Linnaeus and Librarian of the British Museum, to publish his botanical discoveries, while he bequeathed his collections to Robert Brown, who transferred them to the British Museum. Banks was the encourager of all manner of good works.

The African Association owes its origin in a great degree to his care. And under it the pioneer expedition of Mungo Parke has gone far to help found the most important African colony of Nigeria. Banks's achievements are now being celebrated by the demolition of his town house at 32 Soho Square, where he lived from 1777 to 1820.

John Grosvenor, 1742–1823, was the son of the sub-Treasurer of Christ Church, and after an apprenticeship in Worcester settled in Oxford as Chirurgus privilegiatus, and attached himself to the anatomical school at Christ Church, where he was paid £40 per annum for dissecting and lecturing in the absence of the lecturer. It appears odd in these days that as a practising surgeon it was his duty when necessary to make post-mortem examinations. Grosvenor introduced into his practice what he called the method of friction for the restoration of stiff joints and for restoring injured limbs to their proper function. Surgeons from various parts of the country, including Hey from Leeds, came to see his methods. For this system he introduced into the Infirmary a 'rubber nurse' whom we should now call a masseuse, and to him therefore belongs the credit of the introduction of massage into the Infirmary as a routine method of treatment. His system was continued by Cleoburey after Grosvenor's death. The method was described and published in 1825 by Cleoburey in a book under the title of *The System of Friction practised by John Grosvenor Esq.* In his later years Grosvenor turned to journalism and became the proprietor and editor of *Jackson's Oxford Journal*, now merged in the *Oxford Times*.

Sir Henry Halford, Bart., *né* Vaughan, 1766–1844, D.M. 1791; physician to the Middlesex Hospital; attended George IV, William IV, and Queen Victoria. He published an *Account of what appeared on opening the Coffin of King Charles I*, 1813. He presided over the College of Physicians for the last twenty-four years of his life. His *Essays and Orations* were published in 1833.

Edward Ash, F.R.S., held a Radcliffe Travelling Fellowship in 1790 and proceeded D.M. in 1796, but his retiring habits and an advantageous marriage to a cousin made it unnecessary for him to struggle in professional life.

Henry James Cholmeley, 1777–1837, elected to Ch. Ch. in 1796. D.M. 1807. Physician to Guy's.

John Kidd, 1775–1851, Westminster and Christ Church, 1793, was trained at Guy's Hospital, 1797–1801, as a pupil of Astley Cooper. D.M. 1804. In 1801 he came to Oxford as Chemical Reader, being promoted to be first Aldrichian Professor in 1803, which he held until his appointment as Regius Professor of Medicine in 1822 when he resigned in favour of Daubeny. He was physician at the Radcliffe Infirmary 1808–26.

He delivered public courses of lectures on Mineralogy and Geology before Chairs in those subjects were endowed, and in 1809 published *Outlines of Mineralogy*, which was reviewed in the *Quarterly Review* in an article which the editor, Gifford, altered, because it was 'very splenetic, very severe and much too wantonly so', adding 'Kidd is an honest and unassuming man, and is not to be attacked with sticks and stones like a savage'. With the help of his friends he greatly increased the geological collection in the Old Ashmolean Museum, and as Lee's Reader those of Anatomy and Pathology at Christ Church.

On the death of Sir Christopher Pegge in 1822 he became Regius Professor of Physic and drew up 'Dr. Kidd's Examina-

JOHN KIDD, 1835

F. W. HOPE

tion Statutes for the M.B. degree'. To illustrate Paley's Natural Theology he published an *Introductory Lecture to a course in Comparative Anatomy*, 1824, following it up with a Bridgewater Treatise on the same lines, 1833. In 1834 he was appointed Radcliffe Librarian, an office he retained until his death in 1851, making the Library 'as convenient as possible to the few readers who then made use of it'. But for him we might still see the Regius Professor of Medicine wearing the wig, the large brimmed hat, and the gold-headed cane of the eighteenth century.

With Daubeny, Philip Duncan, and W. Buckland, Kidd took a prominent part in improving the teaching of science in Oxford; he regulated the almshouses at Ewelme, and enhanced his reputation during the cholera epidemics of 1830 and 1848; he wrote on the *Anatomy of the Mole Cricket* and a geological *Essay on the imperfect evidence in support of a Theory of the Earth*.

Geologists at the beginning of the 19th century formed a small but enthusiastic family party, whence sprang the Geological Society in 1807. The Oxford contingent of this family played a most important part in laying the foundations of the science in Britain, and therefore merit special consideration. One of the senior of them was Wm. D. Conybear of Christ Church. It is narrated that 'before the age of 12 he had written a novel, a play and sundry poems . . . copies of which luckily fell into my hands when I was 16, and were committed to the flames'. His father, Rector of St. Botolph, Bishopsgate, had a country house in Bexley, where Conybear became interested in the *Chalk* which had been reached by shafts through 60 feet of Eocene deposits, and yielded many fossil shells.

His further studies were aided by Stukeley's *Itinerarium Curiosum*, 1776, by which he traced 'the line of sands underlying the chalk escarpment, and the ranges of calcareous freestone from Bath by the Cotteswolds, through the Midlands, etc.'. In Kent he used Packe's *Chorographical Chart of East Kent*, 1743. He made himself well acquainted with the fossils of the various strata, so that, as he said, 'I was prepared at once to seize the general fact of the successive distribution of these ancient genera when first laid down as an admitted fact in the progress of geology', 1809.

The earlier geological work of William Buckland has been mentioned in our account of Corpus, p. 197. When he became Canon of Christ Church in 1825 he turned the resources of his garden to the prosecution of science. One of his pupils was Philip Barker Webb, 1795–1854, of Harrow and Christ Church, who became distinguished as a Botanist, and collected natural history objects in Spain and other Mediterranean countries.

Oxford owes her first Chair of Zoology to the munificence of Frederick W. Hope, 1797–1862, who in addition to presenting his great entomological collection, now invaluable for the study of Evolution, founded the professorship to which J. O. Westwood was appointed in 1861.

Among the medical alumni of the early nineteenth century were Richard Simmons, 1782–1846, D.M. 1809, Gulston lecturer 1812, who bequeathed his collection of minerals to the University and pictures to the National Gallery; and James Tattersall, 1780–1855, D.M. 1811, F.R.C.P. 1813.

Among Pegge's pupils must be numbered William St. Clare, D.M. 1812, son of a Blackburn doctor, and James Arthur Wilson, 1795–1882, Radcliffe Travelling Fellow 1821, senior physician to St. George's Hospital 1829–57. And all physicians will recall with pleasure the name of William Macmichael, 1784–1839, D.M., the Radcliffe Travelling Fellow who published anecdotes about the result of his *Journey from Moscow to Constantinople in the Years 1817 and 1818*, and some ten years later delightful notes on his benefactor Mead and the other eminent physicians who had owned *The Gold-Headed Cane*, some of whom also appear in his *Lives of British Physicians*, 1830.

Samuel Goodenough, 1743–1827, was elected to a Westminster studentship in 1760, and from 1772 to 1798 he carried on a school at Ealing. When the Linnean Society was founded in 1787 he was one of the framers of its constitution. In 1802, by the influence of the Duke of Portland, whose children had been his pupils, he was presented to the Deanery of Rochester, and to the Bishopric of Carlisle six years later. His chief botanical work was a memoir on the *British Carices*, 'a genus of aquatic plants left by all former botanists in obscurity and confusion'. He published a note on the Porbeagle Shark, *Linn. Trans.* iii.

Dr. Tupper, D.C.L., 1810–89, was distinguished as an inventor. F.R.S. 1845. He 'remained the butt of the critics for over half a century without being soured'.

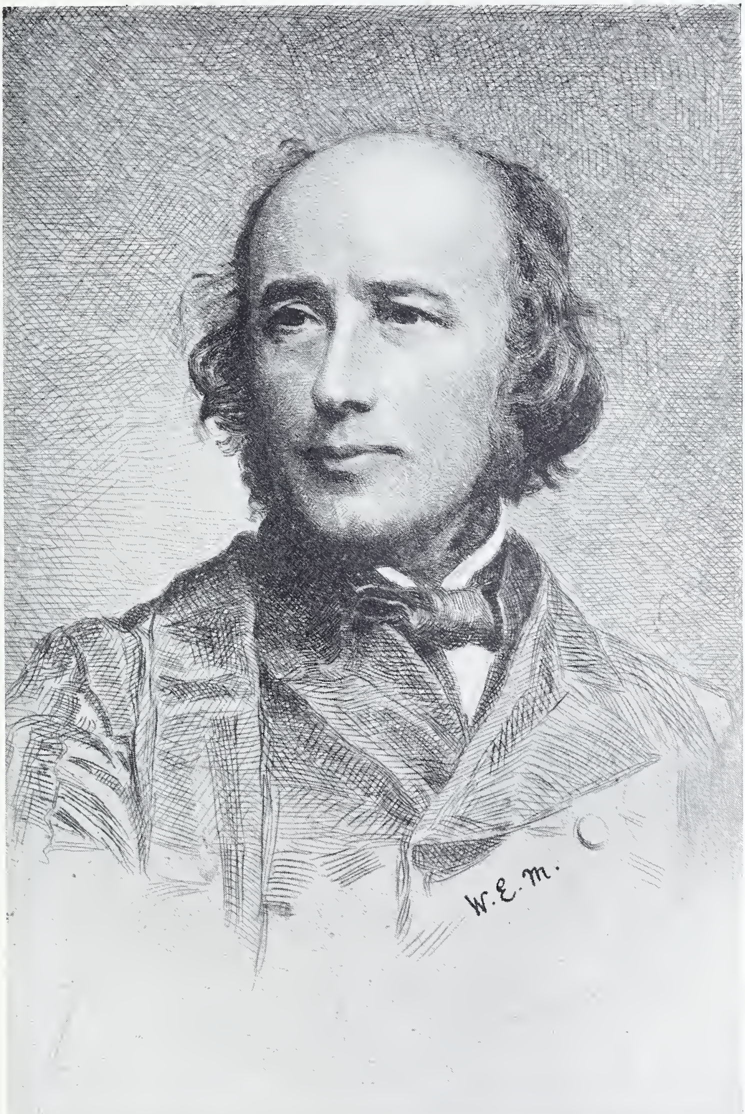
Cuthbert Collingwood, 1826–1908, continued medical studies at Edinburgh and at Guy's Hospital, but came back to Oxford to qualify B.M. While acting as Physician to the Northern Hospital in Liverpool he studied the songs and migration of birds in 1861–2 and reported on marine dredging in the Mersey. His *Rambles of a Naturalist on the Shores and Waters of the China Sea*, 1868, recounted observations made on board H.M. vessels *Rifleman* and *Serpent*.

Charles Lutwidge Dodgson, 1833–98, began his literary career with *A Syllabus of Plane Algebraical Geometry*, 1860, which was followed by *The Formulae of Plane Trigonometry* and his election to a Senior Studentship at Christ Church in 1861. He continued to lecture on mathematics until 1881 with such success that it was expected that he would be elected to a University chair in that subject. In spite of his shyness and dislike of publicity he, as 'Lewis Carroll', achieved fame in greater measure than his contemporaries. He was an expert photographer in the days of wet plates and collodion. A part of his outfit was preserved by Mr. Minn, who presented it to the Museum of the History of Science. His wit was inimitable: witness his parody of a Euclidian definition: 'A discussion may be raised on any point at any distance from that point.' He was buried at Guildford within the same week that his friend Dean Liddell was buried in the Cathedral.

Henry Acland came up to Christ Church in 1837 and was placed under the tutorship of Liddell. On a particular occasion his befriending of his contemporary, John Ruskin, lead to their almost romantic lifelong mutual friendship. Threatened with a malady of the brain, he went on a cruise in one of H.M. ships, of which one of his father's friends was Captain. On returning to Oxford convalescent he became a Fellow of All Souls, and worked at St. George's Hospital. Sir Benjamin Brodie, however, told him that if he settled in London he would not live to be forty, so he again returned to Oxford in 1845 to take up the post of Lee's Reader in Anatomy. In preparation for this work he went dredging round the Shetlands, amassing material for anatomical preparations and slides, and returned to Oxford with fourteen large packing-cases to create a small Hunterian Museum on the banks of the Isis. At that time the attitude of Oxford to science was not so much hostile as contemptuous. It is true that the existence of science was asserted by thirteen salaried professors, a Museum, a Physick Garden, and an Anatomy School; but the professors did not lecture: the Museum contained little beyond a verminous giraffe, a lode-stone, a mummy, King Alfred's jewel, and a fine twelfth-century Bestiary which was shown to visitors who could pay sixpence. The new Reader having to put his own house in order, furnished it by expanding the fourteen packing-cases into fifteen-hundred preparations, labelled and arranged, and he gave microscope demonstrations at evening 'At Homes'.

The excellence of Acland's lectures was acknowledged by his pupils. Charles Pearson wrote: 'he had no time to give us any real instruction, but turned us loose into the Christ Church Museum, with directions to study the preparations, and with a cupboard full of unarticulated human bones to assist us in practical anatomy. Unluckily our only text-book was a popular handbook of comparative anatomy by Agassiz . . . but we learnt something about first principles and analogies, which is not generally taught in the medical classroom.'

In 1847 the idea of the University Museum was mooted. Woodward was chosen as architect. In 1851 plans at an estimated cost of £30,000 were brought before the University, but a proposition to allocate funds was defeated. Again in 1855



SIR HENRY ACLAND

By the courtesy of the artist, W. E. Miller

W. T. Thiselton-Dyer

a new effort was made, whereupon the opponents to the scheme printed the following circular:

> The Babylon of the new Museum is again before us!
> Have we any students in Natural Science? No.
> Do we require this new Museum? No.
> Have we one farthing justly wherewith to build? No.
> Have we one farthing justly wherewith to endow? No.
> Are these the times for setting about such a folly? No.

The squib was ineffective; the Museum scheme was passed, and the foundation-stone was laid by Lord Derby in June 1855. Ruskin, delighted at Acland's success, wrote, 'The Museum is in your hands, as it must eventually be. It will be the root of as much good to others, as I suppose it is rational for any single living soul to hope to do in its Earthtime.' In 1860 Anatomical collections which had come into the charge of the new Lee's Reader, George Rolleston, were moved to Acland's Museum in the Parks, and the old Anatomy School was handed over to the Readers in Physics and Chemistry as their Laboratory. Here A. G. Vernon Harcourt, B.A., 1858, was placed in charge, and after 1872 was joined by R. E. Baynes from Wadham.

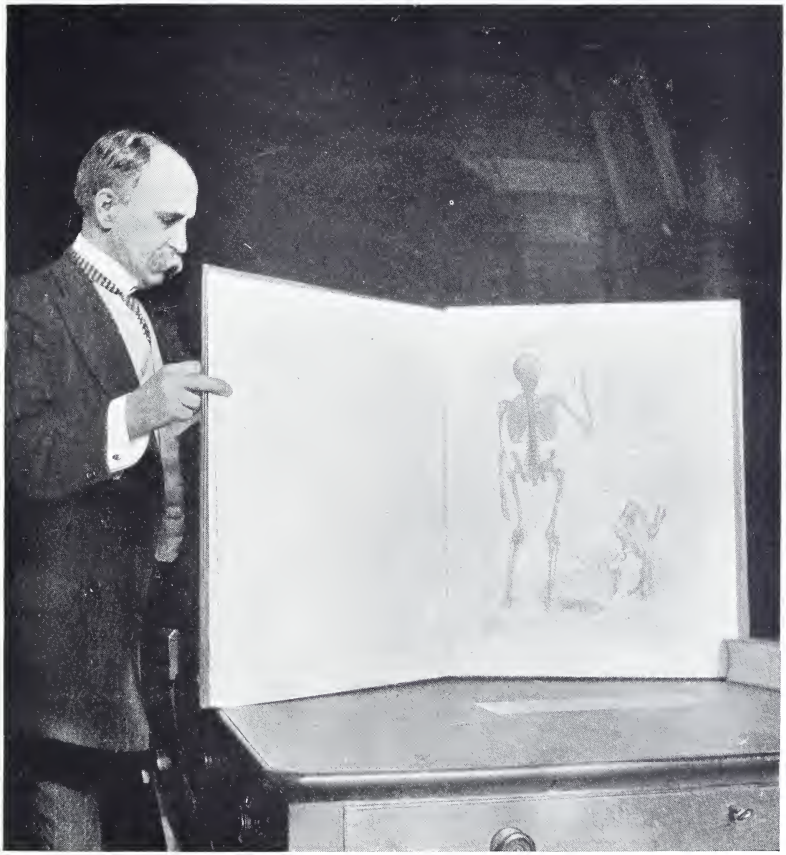
Among the more eminent members of the House at this period were W. S. Church, 1860; C. S. Tomes, 1866, the eminent dentist; W. Thistleton-Dyer, 1867, Director of the Royal Gardens, Kew; Sir John Conroy, 1868, Science Tutor at Balliol; Sir E. Ray Lankester, 1868, Director of the Natural History Museum; W. M. Stocker, of Cooper's Hill and B.N.C.; Sir Archibald Garrod, 1884, Regius Professor of Medicine. (The dates are when they were placed in the first class in the Natural Science School.)

Sir W. Thistleton-Dyer, 1843–1920, entered King's College with the intention of studying medicine. For some reason he changed his plans and in 1867 obtained a First Class in Natural Science, having come under the influence of Daubeny and Rolleston. In 1875 he was appointed Assistant Director of Kew under Dr. J. D. Hooker, whose daughter Dyer married two years later.

Dentistry in its highest and most scientific aspect was the life-work of Sir Charles Sissmore Tomes, 1846–1928, himself the son of a Fellow of the Royal Society, who early made himself known by various papers published in the *Philosophical Transactions* and elsewhere. His *Manual of Dental Anatomy, Human and Comparative* (1898) passed through six editions before 1904.

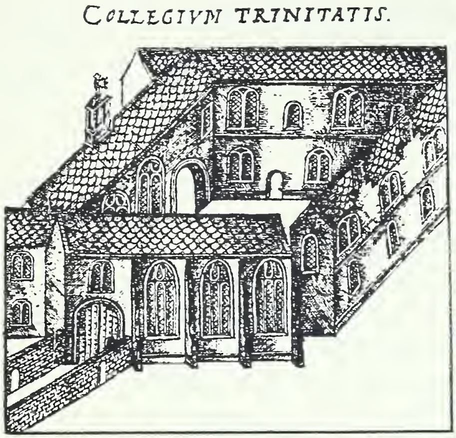
Among those who were led to forsake the retorts of chemistry for the allure of a wider field was James Edward Quibell, 1867–1935, the well-known inspector of Egyptian Antiquities and excavator at Saqqara, who became Keeper of the Cairo Museum from 1913–25.

None of his contemporaries will ever forget the charming personality of the greatest physician in Oxford in our time, Sir William Osler. In the Christ Church Library his memorial to Burton remains as a memorial to himself. His *Bibliotheca Osleriana*, in part modelled on the *Bibliotheca Universalis* of Conrad Gesner, 1545–9, is 'The greatest achievement of the humanistic movement in medical bibliography' (John Fulton).



OSLER AND THE 'TABULAE SEX'

From a snapshot taken in July 1912



14. TRINITY COLLEGE, 1555

About the year 1286 five acres of land outside the north wall of the City were conveyed by an Abbess of Godstow to the Benedictine Abbey of Durham. She described the site as being *super Canditch extra muros*, 'where monkes had formerly studied and inhabited for many yeares'. There, Durham Hall stood for two centuries until Henry VIII's commissioners sold its dilapidated buildings, 'monkish dog-kennels' as they were called, to the wealthy Sir Thomas Pope, who had already acquired large estates in Oxfordshire. Sufficient of the old buildings were retained to form the buttery and other rooms at the north end of the Hall of Trinity College. Wren added a north wing to the Garden Quadrangle, and is believed to have suggested details for the chapel traditionally attributed to Dean Aldrich: certainly the statues of Astronomy, Geometry, and Medicine (Minerva Medica), which in addition to Theology surmount the tower, suggest his influence. The Founder made provision for regular courses of reading, lectures and disputations, and even suggested that the study of planetary motions might be carried on during the vacations.

In the time of Laud great changes were made in the frontage of the College. In these days of incessant traffic blocks and over-filled car-parks it is not easy to recall the days when Oxford had only one real street, the High Street. On the north side of the City Wall were the Canditch and a maze of small cottages, beyond which stood Balliol and Durham Colleges. Laud pulled down these cottages, opening up Broad Street, an effort of town planning that has never been wholly justified owing to the bottle-necked entrance and exit, but fortunately the picturesque Trinity cottages were spared.

An early scientific member of the College was THOMAS ALLEN, the mathematician and astrologer, who, by reason of some aversion to taking orders, migrated to Gloucester Hall about 1572, under which head his further career will be described. Soon after came THOMAS LODGE, 1558–1625, the second son of Sir Thomas Lodge, Lord Mayor of London. As examples of his versatility before embarking on the study of medicine we may cite his early *Defense of Poetry, Music and Stage Plays*, 1580, and *An Alarm against Usurers*, 1584. Then, after a brief experience as a soldier, he took a number of long voyages, and on his return to London in 1590 he published *Rosalynde*, a romance from which Shakespeare drew largely for the plot of *As You Like It*. About 1596 he changed his religion, and studied physic at Avignon so successfully that he was able to incorporate a D.M. at Oxford in 1602. After setting up in practice in Warwick Lane, the plague of 1603 provided him with material for a 'Treatise' thereon which he dedicated to the Lord Mayor and Corporation, also an edition of *Present remedies against the Plague, written by a learned physician for the health of his country*, 1594. He died of plague in 1625, and goes down to fame as a man of letters rather than of medicine.

The fine old Hall on the west side of Trinity gate still bears the name of Dr. KETTELL, President in 1599. He was the first of three Presidents who have shown interest in Natural Science. His lectures, timed by an hour-glass, were calculated to make mathematics comprehensible to the meanest intellects. To show the men how to inscribe a triangle in a quadrangle he suggested that a pig should be brought into the quadrangle and the college dog set at him, 'Then come I and take the dog by the tayle and the hog by the tayle and so you have a triangle in a quadrangle, Q.E.F.' It is recorded that he especially disliked Trinity men to wear their hair long, 'He would bring a pair of scissors in his muffe, and woe be to them that sat on the outside of the table'. One scholar's hair he shortened with the bread knife.

Henry Gellibrand, 1597–1636, took mathematics farther. He constructed a dial over the College Library, became Gresham Professor of Astronomy, and was a friend of Briggs, whose *Trigonometria Britannica* he completed in 1633. He also wrote an *Epitome of Navigation*. Laud prosecuted him for bringing out an almanac in which Protestant martyrs were substituted for Romish Saints. Many details concerning his contemporaries at Trinity are preserved by John Aubrey in his *Lives*. The genius of one of them, Francis Potter, 1594–1678, 'lay most of all to the mathematics'. He turned his mechanical genius to draw landscapes in perspective, but was not so successful as Sir Christopher Wren, who designed a more perfect instrument. But it must be remembered that Potter lived in an age when mathematics were scarce looked upon as academic studies; he himself only understood common arithmetic, and in geometry went no farther than the first six books of Euclid. Yet 'he had such an inventive head that with this foundation he was able to doe great matters in the mechaniques and to solve phenomena in Natural Philosophy'. For instance, he made a notable improvement in an engine for raising water from a deep well at Kilmanton Parsonage (Aubrey's sketch of the machine is in MS. Aubrey, 6, f. 60). He also engraved for Aubrey a silver quadrant designed to serve for all latitudes, which was graduated by a beam compass of his own construction, an accurate instrument by which an inch could be divided into a hundred or a thousand parts. Only two were ever made.

Of special medical interest is the fact that Potter in 1649 had an idea that diseases might be cured by the *Transfusion* of Blood out of one man into another. He stated that the hint came to him when reflecting on the story of Medea and Jason.

His first trial was made on a hen with the craw of a pullet, but met with no success owing to inability to 'strike the vein so as to make him bleed in any quantity', and the experiment was abandoned until again repeated by Lower of Christ Church.

Aubrey, mentioning that he first saw Dr. Harvey at Oxford in 1642 after the battle of Edgehill, states that he often came to Trinity College to visit GEORGE BATHURST, who found space in his rooms for the fowl that incubated the eggs 'which they did dayly open to discerne the progress and way of generation'.

The art of raising water on a large scale was successfully practised by Sir EDWARD FORD, 1605–70, who came up as a gentleman-commoner in 1621, and left for the wars without taking a degree. After a chequered military career, ending in imprisonment, he was commissioned to improve the water-supply of London. He first designed an engine to supply all the streets with Thames water in 1656, and finally constructed water-works near Charing Cross and at Wapping. His great water-engine in view of Somerset House was demolished by order of Queen Catherine, wife of Charles II. He was the author of *A Design for bringing a Navigable River from Rickmansworth in Hartfordshire to St. Giles's in the Fields*, 1641.

NATHANIEL HIGHMORE, 1613–84, already in residence as a scholar, also made the acquaintance of Harvey at Trinity College. They became friends, and in 1651 Highmore, who had settled in practice at Sherborne, dedicated to Harvey his first work on human anatomy. Therein he showed himself familiar with pathological appearances as well as with normal structure, with the anatomy of dogs and sheep, and of an ostrich. Though perfectly sound in his views as regards the circulation of the blood, his physiological remarks are sometimes medieval. Thus he believed in an *alexipharmaca dispositio vitalium* which enabled an Oxford student of his acquaintance to devour spiders with impunity. His name is familiar on account of his discovery of a cavity in the superior maxillary bone, to which his attention had been drawn by the case of a lady patient who had an abscess there. The cavity is known as the *Antrum of Highmore*. He is also remembered through his description of


Effigies
Nathanaelis Highmorj
in Medicina Doctoris
ætatis suæ 63. anō Dom: 1677
A. Blooteling f.

William Derham D.D.
Canon of Windsor.
F. R. S.

the 'mediastinum testis', or *Corpus Highmorianum*, which supports the vessels and ducts of this organ in their passage to and from the substance of the gland.

Botanists owe to him an early study of the germination of seeds, published in 1651. His figures show the manner in which the seed-leaves of the bean, colewort, ash, pea, and maple at first lie within the husk of the seed, then break forth and spring up from the surface of the ground. This investigation prepared the way for the work of Malpighi. Highmore became a magistrate for Dorset, where he also practised as a physician but never took fees from the clergy.

Dr. THOMAS WHARTON, 1614–73, came to Oxford from Pembroke Hall, Cambridge, as tutor to John Scrope, the Earl of Sunderland's heir. He studied medicine under Dr. John Bathurst, and returned to Trinity in 1646 when the Parliamentarians occupied Oxford. He was created D.M. by Sir Thomas Fairfax. As an anatomist he was supreme—'Eminentissimus anatomicus, gravissimae auctoritatis in anatomia, et bonae fidei laudisque optimae, non magnus ratiocinator sed unice fidens cultro anatomico' (Boerhaave). He was for a time 'the most beloved friend of Ashmole' and became physician to St. Thomas's Hospital. His name is attached to the duct of the submaxillary gland that passes saliva into the mouth, which he described in *Adenographia*, 1656. He also made a special study of the minute anatomy of the Pancreas.

When the plague appeared in London he determined to remain at his post to attend to his own patients, as well as to the poor of St. Thomas's Hospital. For these and other services, and more particularly for attending the Guards when they fell ill, he was promised a lucrative appointment as physician-in-ordinary to the King. When the time came this appointment was given to some one else and in lieu Dr. Wharton was granted an honourable heraldic augmentation to his paternal coat of arms. For this he had to pay a £10 fee to Sir William Dugdale. His chief work was *Adenographia, seu Descriptio Glandularum Totius corporis*, 1656. Three other physicians of Trinity were JOHN CLARK, D.M. 1660; JOHN

DEIGHTON, in practice at Bristol; JOHN ETWALL, B.A. 1685, admitted Extra Licentiate of C.P. 1688.

SETH WARD, born 1617, incorporated at Trinity from Sidney Sussex College, Cambridge, after being appointed Professor of Astronomy, 1649–61. It is reported that he lectured on Geometry when President of Trinity, and to make his propositions clear to his pupils, he drew his diagrams in black, red, yellow, green, and blue, to avoid the perplexity of the letters A, B, C, &c. RALPH, another member of the BATHURST family who was also interested in medicine, taking a D.M. in 1664, served as Physician to the Navy, and became an original Fellow of the Royal Society. Then, abandoning medicine on the Restoration, he was appointed Chaplain to the King in 1663 and President of Trinity in the following year. Ralph Bathurst never entirely lost his interest in science, for he served as an active member in the foundation of the Oxford Philosophical Society in 1683.

The Transpiration of plants was demonstrated by JOHN WILLS, who, in June 1669, compared the weight of water which the sprig of a flourishing mint-plant took up from a glass of water in sunshine with the smaller weight of water that was evaporated in similar circumstances, but without the mint. By subtracting the second weight from the first, he found that the mint-sprig expired half an ounce of water a day, or more than the total weight of the sprig. He also argued that plants with moist leaves, like Butterwort or Sundew, suck up moisture faster than the sun can exhale it, and so become bedewed all over at noonday.

The Geological Treatise of J. A. DeLuc, F.R.S., who had lived in England for thirty-six years but wrote it in French, was translated by his friend HENRY DE LA FITE and published in 1809. It was said to show 'the conformity of geological movements with the sublime account of that series of operations which took place during the Six Days or periods of time'.

Among those who passed into the next century were WILLIAM DERHAM, 1653–1735, Vicar of Wargrave, 1682, and

F.R.S., 1702, the author of *Physico-Theology*, 1713, and editor of the works of Robert Hooke and John Ray. His son, William Derham, became President of St. John's, 1748–57. Richard Hall, 1670–1728, D.M. 1701, Harveian Orator 1724, is remembered at the College of Physicians for his benefaction of £500 for the purchase of books.

Salisbury Cade proceeded D.M. in 1691 and was admitted a Fellow of the College of Physicians in 1694. He was physician to St. Bartholomew's Hospital for twenty years and died in 1720. Denton Nicholas took his D.M. degree in 1694 and was admitted F.R.C.P. two years later. Richard Hale, M.D. 1701; John Mountford, M.D. 1712, 1731; William Barrowby, 1682–1751, M.D. 1713, F.R.S. 1721, physician to St. Bartholomew's Hospital.

Thomas Lawrence came up in 1727; M.D. 1740; lectured on anatomy; President of the College of Physicians 1767–74; died of a paralytic seizure in 1783. He was the physician and intimate friend of Dr. Johnson, who said that he was 'one of the best men whom I have ever known'. He wrote a *Life of Harvey* and also of his friend Dr. Frank Nicholls; also *Praelectiones Medicae XII de Calvariae et Capitis Morbis*, 1757, and *De Natura Musculorum*, 1759.

Antony Addington, M.D. 1744. Practised at Reading until 1754, when he removed to London. He was physician to Lord Chatham. In November 1788 he received a royal command to examine the King's health and to consult with the King's physicians. He expressed the view that the King would recover, which was, in fact, the case. Dr. Addington died in 1790. He wrote *An Essay on Scurvy, with the method of preserving Water sweet at sea*, 1753.

John Ash, 1723–98, became the founder of the Birmingham General Hospital.

While the Ashmolean was still a scientific institution William Huddesford, 1732–72, became Keeper, 1755–72. There is a tradition that his election to the Keepership of the Museum involved Oxford in a great loss, because Sir Hans Sloane, having no high opinion of his scientific attainment, changed his mind about a gift of £20,000 that he had designed for Oxford. Had this gift materialized the foundation collections of the British Museum would probably have come to Oxford instead of to London. Huddesford, however, republished the catalogue of Edward Lhwyd, *Lithophylacii Britannici Ichnographia*, 1760, and induced the Oxford University Press to print Martin Lister's *Synopsis Methodica Conchyliorum* in the same year.

The position of medical studies was materially improved when James Ogle, scholar at Trinity in 1811, returned there to teach Mathematics and Medicine. He practised at the Radcliffe Infirmary, became Aldrichian Professor of Medicine in 1824, and clinical lecturer in 1830. He helped Kidd and Daubeny to secure the new examination statute for medical degrees in 1833. By their arguments the University was forced to recognize that something more than theory must be required from all persons desiring to be licensed to practise medicine. Bachelors of Arts were given 'the opportunity of qualifying' in medicine without having taken the M.A. degree, as the Laudian Statutes had required.

William Alexander Greenhill, 1814–94, was educated at Rugby, under Arnold, and at Trinity College, Oxford. Greenhill's enthusiasm for scholarship was formed by Arnold at Rugby. After graduation in 1837 he continued his medical studies in Paris and in London and returned to Oxford in 1839, when he was elected a Physician to the Infirmary. As part of his duties from 1844 to 1850 he was Medical Officer to the Oxford Board of Health. Greenhill's early training in the Classics still claimed his interest, and we have as a result his editions of the medical classics such as Sydenham's *Works*, a translation from the Arabic of *Rhazes on Smallpox*, and several other books. He migrated from Oxford to Hastings in 1851 for reasons of health, where he bought a practice. He died in 1894.

The Rev. Frederick Jervis-Smith, 1848–1911, originally of Pembroke College, imbued with the spirit of Francis Potter, but with greater mechanical skill and a better knowledge of

JOHN W. OGLE, 1852

F. JERVIS-SMITH

H. G. J. MOSELEY

mathematics, used his appointment in 1885 as Millard Lecturer at the College to introduce the subject of Engineering Science into the University. He has many inventions to his credit; the best remembered are a tram-Chronograph for measuring the speed of flying bullets, subsequently much used in the Physiological Laboratory. By his invention of Inductoscript, he came near to the discovery of X-rays. He was a pioneer of Wireless Telegraphy, of which he arranged the first installation in Oxford between his house in Norham Gardens and the Millard Laboratory in Trinity College.

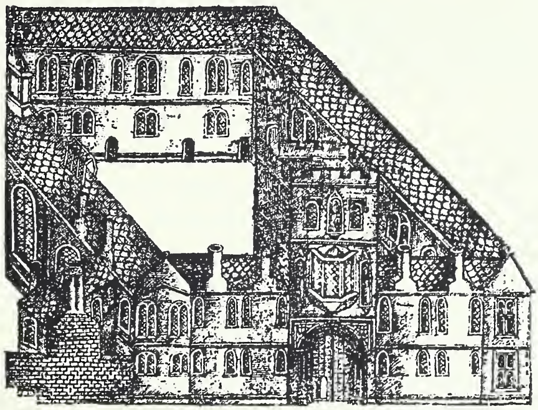
If Pembroke gave Jervis-Smith to Trinity, Trinity gave D. H. Nagel to Balliol.

It is not generally known that a small work on *The Flora of the Island of Arran*, 1859, was the prelude to a marvellous succession of academic and political successes on both sides of the Atlantic that fell to the lot of James Bryce, 1838–1922, whose book on *Transcaucasia and Ararat* was widely read.

For three generations Henry Moseleys have been in the van of scientific progress. Henry Moseley, 1801–72, F.R.S. 1839, was the learned Professor of Natural and Experimental Philosophy at King's College who deduced the formulae by which the dynamical stabilities of ships of war have been calculated. The work of Henry Nottidge Moseley has been noted under Exeter College. The names of the third, Henry Gwyn Jeffreys Moseley, 1887–1915, also recall the achievement of his maternal grandfather the marine zoologist, John Gwyn Jeffreys, 1809–85, the chief authority on Mollusca of his time, who believed that the shell-fish of to-day are the direct descendants of those which inhabited British seas during the period of the Crag. He was a pioneer in deep-sea exploration, dredging in great depths off the west-coast of Ireland and in the Bay of Biscay. His youngest daughter married H. N. Moseley, and their only son, a Millard scholar of Trinity, graduated with honours in 1910, and was appointed lecturer in Physics in Manchester under Professor E. Rutherford. Gifted with unusual powers of rapid and continuous work, he was stimulated to continue the work on X-ray spectra in which some preliminary observations had been made by the Braggs. By the use of a specially made apparatus, presented by Prof. Townsend to the Museum of the History of Science, Moseley found that all the chemical elements gave similar types of spectra, and that the frequency of vibration of corresponding spectral lines was proportional to the square of a number which varied by unity in passing from one element to the next.

His results brought out the new and surprising fact that the leading properties of an element are determined not by its atomic weight but by a whole number defining its nuclear charge. This, now known as Moseley's Law, has been accepted as one of the most fundamental of the Laws relating to the physical properties of matter.

He was killed in action at Gallipoli at the age of 27 on 10 August 1915.



15. ST. JOHN'S COLLEGE, 1555

ST. JOHN'S COLLEGE, like Trinity, was founded by a wealthy London merchant, who bequeathed to it a connexion with the Merchant Taylors' Company and School that has remained of inestimable benefit to both institutions and incidentally to Oxford as a whole. Of Sir THOMAS WHITE, the Founder, it has been said 'if it be his crime to have accumulated riches, let it be remembered, that he consecrated a part of those riches, not amid the terrors of a death-bed, nor in the dreams of old age, but in the prime of life, and the vigour of understanding, to the public service of his country'. And many further gifts have been added by other generous Londoners.

By a supplementary Charter one of the Fellows of St. John's was expected to study medicine. Students might also receive instruction from a lecturer in Natural Philosophy who was to receive 2*s*. a week, half to be paid by the College, and half by his audience; munificence that brought rewards in due time. It took forty years before any scientifically-minded Fellow appeared whose fame has been deemed worthy of record, but several others, whom we mention, flourished within the same decade. The first, NICHOLAS HILL, was acquainted with the

Greek views of the constitution of matter, and has the honour of a mention by Ben Jonson.

> Those Atomi ridiculous
> Whereof old Democrite and Hill Nicholis
> One said, the other swore, the world consists.
>
> *Epigrams*, 134.

The commentator on Aristotelian writings, JOHN CASE, was elected to a scholarship in 1564 and in due course held a fellowship until he married the widow of a keeper of Bocardo prison. He made money by reading logic and philosophy to young papists and also by the practice of medicine, having become D.M. in 1589. He died in 1600 and was buried in the college chapel.

He had as contemporaries two doctors, one, MATTHEW GWINNE, a Welshman, who came up in 1574, and read lectures on music until 1583; then, taking up medicine, he became a barber-surgeon and qualified as a Doctor of Medicine in 1583, four years after Laud came into residence. He learnt Italian from Florio of Magdalen, to whose books he contributed verses. In 1604 he was admitted a Member of the College of Physicians, and in the following year physician to the Tower of London. During that year, James I with his Queen, Prince Henry, and their Courts came to Oxford, where they were entertained for three days with academical exercises of all kinds. Dr. Gwinne was especially prominent on the occasion and took part in the two debates: Whether the morals of nurses are imbibed by infants with their milk; and Whether tobacco smoking is wholesome or not. This gave His Majesty, who had written against the use of tobacco, an opportunity of expressing his own sentiments on the matter. Seven years before his death in 1620, Gwinne, with certain other Royal Commissioners, was appointed to draw up regulations for garbling (or sorting) tobacco before it was exposed for sale. Endowed with a lively fancy he wrote poetry with ease, e.g. *Vertumnus*, 1607, but his only medical work was a Latin treatise to prove that Francis Anthony's celebrated but secret remedy, called 'potable gold', contained no gold at all, and that even if it did, the virtues of gold as a medicine were much exaggerated.

St. John's has good cause to hold in grateful remembrance Sir WILLIAM PADDY, 1554–1634, of Merchant Taylors' School; M.D. of Leyden, 1589; Physician to James I, 1603; President of the College of Physicians, 1609–11 and 1618; the friend of Laud and great benefactor to the College. The greater part of his botanical and medical libraries reached the College in 1602, although a few volumes are inscribed with the date of his death, 1634. His care that Bodleian susceptibilities might not be provoked is very touching: 'Bibliothecam libris adeo instruxit, ut Bodleianam tantum non provocare posset.' His monument is in the College chapel and his portrait in his doctor's robes in the Hall. His colleagues in the College of Physicians, too, held him in the highest esteem, notably Sir Theodore de Mayerne, and with good cause, for it was largely due to his successful pleading that the Fellows, Candidates, and Licentiates were granted the privilege of immunity from the charge of service for men or armour.

Paddy's contemporary, WILLIAM CLARKSON, proceeded D.M. in 1590, and in the next year RICHARD ANDREWS was elected a Fellow, who having proceeded D.M. in 1608 and filled the office of Censor at the College of Physicians, was appointed to succeed Harvey as physician to St. Bartholomew's Hospital. He died before him in the same year as his brother Fellow Paddy.

Twenty years later came ROBERT FLUDD, 1574–1637, eminent as a Rosicrucian, and a most prolific writer, who moved on to Christ Church about 1605. Perhaps the most striking of his ideas is graphically illustrated by an engraving of a patient in bed in a 'castle of health', one bastion of which has been broken down by cold, and crowds of flying creatures are entering to attack the sick man. If we transmute his flies into microbes, we shall not be far removed from modern belief. He is said to have used 'a kind of sublime unintelligible cant to his patients, which, by inspiring them with greater faith in his skill, might in some cases contribute to their cure'.

The last and greatest of the group was William Laud, astrologer and one of the most influential of Oxford men, who, for mastery of astronomical methods, coupled with signal success as a Churchman, emulated the great mathematical ecclesiastics of the Merton School of two centuries earlier. His scientific instruments, seen by Evelyn in 1660, are now in the History of Science Museum. He became President of St. John's in 1611, and few Colleges have had a greater Head. Juxon, the friend who inherited his powers, succeeded him in the Presidency until 1633, when he became Bishop of London, afterwards following Laud in the Archbishopric. The mortal remains of both prelates now rest in the Chapel of the College.

One more word may be added about Laud. In his endeavour to make all churchmen 'high', by whipping or other inducement, he drove hundreds of godly men of all classes from their native land to Massachusetts. They, spreading over the New England colonies, the western citadels of Protestantism, have prepared a home for the most thriving centres of scientific culture in the western world. I have now in my custody the very astrolabe with which Laud consulted the stars when he felt curious as to their indications.

He possessed and presented to the College an interesting anatomical manuscript (*St. John's* MS. 22) with drawings of bones from an articulated skeleton:

Σκελετος πολυκινητος
Cujus artificio
Ossis Cujusque Articulatio perficitur
et motus quo natura vivum instruxerat.
Nunc primum non infeliciter elaboratur.

Reverendissimo in Christo Patri et Domino Honoratissimo D. Gulielmo Archiepiscopo Cantuarensi totius Angliae Primati et Metropolitano Sacrae Caroli Majestati a Consiliis sanctioribus prudentissimo Academiae Oxoniensis Cancellario.

Σκελετον utriusque sexus πολυκινητον
D. D.
Amplitudini vestrae devotissimus Joannes Speed.

The dedication is flanked by drawings of two articulated skeletons. The frontispiece was evidently copied in pencil and inked over from the well-known view of a professor demonstrating a dissection to a class in the Leyden Anatomy Theatre.

Among the treasures in the keeping of the President is a stony object piously preserved in a gold reliquary; it is the gall-stone from John King, Bishop of London, 1621.

Both the son and grandson of JOHN SPEED, the eminent Elizabethan cartographer, 1552?–1629, came up to St. John's; their dates were 1595–1640 and 1628–1711 respectively; both were named John, both were doctors of medicine; both had topography in their blood; the elder wrote on Stonehenge, the younger on Southampton, of which he was Mayor in 1681 and 1694.

To a rather later period belong EDMUND GAYTON, 1608–66, the adopted son of Ben Jonson, and WILLIAM HOW, 1619–56, a young Botanist distinguished for having been the first to compile a flora of Britain, *Phytologia Britannica*, 1650, in which the localities are mentioned for the first time. It comprised 1,220 plants, including many rarities communicated by his correspondents Johnson, Goodyer, Stonehouse, and others. His own copy of his *Phytologia Britannica*, with additional notes,[1] is in the Magdalen Library. John Ward noted that How had two apothecaries to help him. Crosse may have been one of them, and Hunnibon the other. How practised as a physician in London. He had doubtless derived pleasure from the gardens of the College and we honour his name for his British Flora. Endowed with different interests were JOHN EDWARDS, who held the Chair of Natural Philosophy from 1636 until he was deprived in 1648, and EDWARD BERNARD, 1638–96, also an Old Merchant Taylor Fellow 1658, famed for researches into the archaeology of science. In 1673 he was elected into the Royal Society and became Savilian Professor of Astronomy. His chief works were *De mensuris et ponderibus antiquis*, 1688, and *Chronologiae Samaritanae Synopsis*, 1691. A very learned

[1] Gunther, *Early British Botanists*, p. 279.

man for his time, he had acted in Paris as tutor to the sons of Charles II by the Duchess of Cleveland, 1676.

A fine example of Oughtred's Double Horizontal Dial 'whereby not only the hour of the day is shown, but also the meridian line is found', was presented in 1638 by GEORGE BARKHAM, the son of John Barkham, S.T.P. The dial, combined with the Circles of Proportion, the oldest known slide-rule, is a beautiful piece of the inspired work of that excellent instrument maker, Elias Allen. In this connexion it may be noted that a Dr. Barckham, writing from Lambeth, corresponded with Digby about a case in which a learned astrologer was able to prove that a certain V. Nabod 'killed himself with his owne sword'. The manuscript was presented by Digby to Laud, and it is not unlikely that the instrument arrived by the same hand. The physicians of the mid-17th century were WILLIAM CONYERS, D.M. 1653, who died of the plague while attending to others; THOMAS BROWNE, D.M. Padua 1654; JOHN GRIFFITH, Extra-Licentiate 1670; HUMPHREY BROOKE, B.M. 1659, '*A Conservatory of Health comprised in a plain and practical Discourse upon the six Particulars necessary for Man's Life*, 1650; RICHARD TORLENE, D.M. 1666, Physician to St. Thomas's; WILLIAM WARNER, 1640, D.M. 1676.

WILLIAM GIBBONS was a loyal member of the Merchant Taylors' School who proceeded B.A. in 1672 and D.M. on 9 May 1683, on the day before the Old Ashmolean Museum was opened. As a Fellow of the College of Physicians he opposed the establishment of the Dispensary, and was accordingly castigated by Garth under the sobriquet of Mirmillo:

> 'While others meanly ask'd whole months to slay,
> I oft dispatch'd the patient in a day.
> With pen in hand, I pushed to that degree,
> I scarce had left a wretch to give a fee:
> Some fell by laudanum, and some by steel
> And death in ambush lay in every pill;
> For, save or slay, this privilege we claim,—
> Tho' credit suffers, the reward's the same.

Two matters have been associated with his name. Firstly, the water from a ferruginous mineral spring at Hampstead, which was sold at threepence a bottle in 1700, a time when many people used to drive out from London on Mondays, Thursdays, and Saturdays, being attracted by the pleasing prospect, dancing, and the mineral spring. Gibbons's other achievement was the introduction of mahogany to the cabinet-maker's trade. His brother, a West India merchant, had brought over some of this wood, and from this a candle-box and two bureaux were made.

'Literarum et literatorum et suorum Oxoniensium amantissimus' he bequeathed £1,000 to St. John's in 1728, and soon after his widow presented his portrait.

THOMAS HOY came up from Merchant Taylors' School in 1675, proceeded D.M. 1689, and practised at Warwick, but was recalled to Oxford to fill the Regius Professorship in 1698. Wood says that he died in Jamaica about 1718.

Dr. WILLIAM SHERARD, 1658–1728, was, next to Magdalen College, the greatest patron that Oxford botanical studies have ever had. He was also a good ornithologist. When acting as consul at Smyrna from 1702 to 1718 he described about forty species of birds not mentioned in literature. Living as he did in contact with the foreign fauna, his scholarly instincts caused him to examine the great book of nature for himself, and to obtain first-hand evidence with his own eyes instead of continuing to trust the Natural History written by Aristotle in 326 B.C. and based on the discoveries of Alexander the Great during his Eastern campaigns. The aims of Sherard were set forth by his brother James in a letter to Richardson.

'We buryed him last Monday at Eltham. . . . He has left his books and plants, etc. and £3000 to be laid out in land for the maintenance of a Botany-Professor in Oxford; upon condition that the University shall, within six months after his decease, settle a sufficient and perpetual fund for ever for the fitting-up and maintaining the garden at Oxon., to the satisfaction and good liking of his executors; but in case of neglect or refusal of such settlements, he has left power in his executors, to fix the said library, and the said Professorship, in some other place. . . . He has nominated Dr. Dillenius to be the first Professor for life.' He did not quite trust the University to maintain and keep up the garden in a reputable state. 'My brother', wrote James, 'grew uneasy with the University, and repented himself of what he had done; but there had been so much said about it that he was willing to give them the preference and the refusal of it.' He had good cause to distrust the powers that were, for the Margaret Professor of Divinity 'wheedled him out of a hundred pounds'. To lose such a sum 'vexed him heartily, and gave him a taste of what usage he was to expect if he left anything in the absolute power of the University'. (*Letter* of James Sherard of August 20, 1728.)

John James Dillenius, 1687–1747, then became the first Professor of Botany on the Sherardian foundation, and, as he received the Oxford medical doctorate as a member of St. John's College in 1735, he may appropriately be mentioned here. He was an accomplished German botanist, who had listed the flora of Giessen, where he had studied, and had been invited over to England by Sherard, who had been much impressed by his undoubted ability. As a reward for a description of the plants in the Eltham garden, entitled *Hortus Elthamensis*, 1732, and in the hope of the completion of his *Pinax*, Sherard nominated him as Professor. His other works included a fine *Historia Muscorum*. The visit of Linnaeus to Dillenius in the Physick Garden, and their conversation, which lasted for a whole month, is one of the more notable episodes in the history of Botany.

Among the Fellows of the College there have been good sportsmen in all generations, but George Markland, *b.* 1678, was the only one to publish a poem about the elusive flight of the woodcock and other game birds. On the title-page of his *Pteryplegia: Or, the Art of Shooting Flying*, he described himself as 'A.B. late Fellow of St. John's' in 1735.

Thomas Hoy, appointed the Regius Professor of Medicine in 1698, was followed in 1718 by another member of the College, Joshua Lasker, D.M. The latter practised medicine in Oxford for half a century, dying in 1729 'vir a multis desideratissimus' according to his memorial in St. Aldate's Church. The principal medical practitioners of the period were Francis Lee, 1661–1719, who studied at Leyden 1692 and was elected L.R.C.P. in 1708; John Radcliffe, D.M. 1721, physician to St. Bartholomew's Hospital; John Monro, 1715–91, who came up in 1733, became a Fellow and Radcliffe Traveller in 1741, but took his B.M. from University College; and Edmund Crynes.

Robert James, 1705–76, was an authority on fevers, which he treated with a patent antimonial powder of his own compounding that was manufactured for him and sold by Francis Newbery of Reading, a well-known publisher, who also sold Martin's microscopes. An unopened packet of this powder, together with Newbery's account book of its sales, has been presented to the Lewis Evans Collection by E. Heron Allen, F.R.S. The powder is of tragic interest, as it is reputed to have caused the death of Oliver Goldsmith, who was addicted to its use. James had moved much in literary circles, having been a contemporary of Dr. Johnson at Lichfield Grammar School. He was the author of *A Medical Dictionary, with a History of Drugs*, 1743; *Treatise on the Gout and Rheumatism*, 1745; *Presages of Life and Death in Diseases*, trans. from the Latin of Prosper Alpinus, 1746; *Dissertation on Fevers*, 1748; *Treatise on Canine Madness*, 1760.

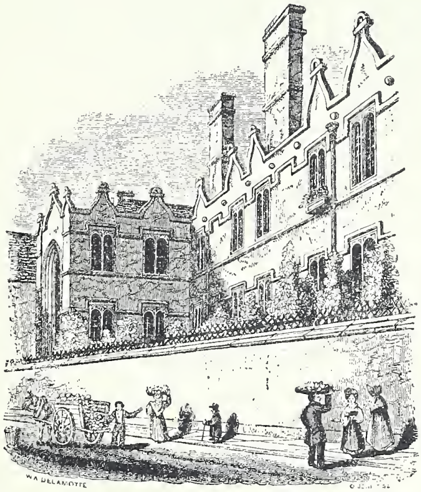
John Green, M.D. 1752. Harveian Orator, 1771. Died 1778.

By the second half of the eighteenth century Halley and Bradley by their Herculean labours had directed public attention to the needs of astronomy. About 1772 St. John's, intending to benefit astronomical studies in Oxford, permitted the Radcliffe Trustees to acquire for a low price some nine acres of their valuable estate by the Woodstock Road for an observatory. It was particularly desired to benefit the then Savilian Professor of Astronomy. It may be here noted that in this same year, 1772, the Chancellor of the University, George Henry Lee, 3rd Earl of Lichfield, who had come up to St. John's in 1735–6, died. He left a remarkable sun-dial with movable gnomon to his successors, one of whom, Viscount Dillon, presented it to the Lewis Evans collection in 1930.

Dr. Paggen William Mayo (1766–1836) was elected to a Fellowship about 1788. He proceeded D.M. in 1795 and delivered the Gulstonian lectures three years later. He spent many years to professional advantage at Buxton. Another Gulston lecturer was Richard Harrison, D.M. 1813.

Dr. Francis Hawkins served for many years as Registrar of the College of Physicians and of the General Medical Council.

Although not a professional teacher of science none of the present generation can forget the personality of Henry Bidder, to whom the cultivation of rock plants became a scientific hobby. Through his enthusiasm St. John's garden has been, and still is, a joy and inspiration to thousands. Perhaps the spirit of Dillenius, How, and other botanical fellows was working within him.



VIEW OF JESUS COLLEGE FROM MARKET LANE.

16. JESUS COLLEGE, 1571

QUEEN ELIZABETH and Dr. Ap Rice shared in the foundation of Jesus College for Welshmen: that is, the Queen took the credit, and Ap Rice supplied the money. It was the first post-Reformation College in Oxford. But for the first fifty years endowments proved insufficient, living was hard and there were relatively few Welshmen. Not till Griffith Powell became Principal in 1613 did the College become passably 'decent, fittinge and habitable', but at his death the healthy independence of the Society was assured and his good work was continued as successfully by Principal Thelwall. In the long roll of Jesus men, scientific worthies of Cambrian ancestry are by no means easy to pick out, but it is interesting to note that the majority of the few who were, were interested in Biology. Scientific studies were materially aided by a part of a donation of 900 volumes from the library of Lord Herbert of Cherbury, and by the even larger Meyricke Library given in 1713.

We owe the first news about Oxford as an intellectual centre to the eminent Welshman GIRALDUS CAMBRENSIS. After a holiday of travel in Ireland which inspired him to write a work on the topography of that Island, and being desirous, as he said, 'not to hide his candle under a bushel, but rather to place it in the candle-stick so that it might give light', he resolved to read his essay right through before a vast audience at Oxford in 1187; here he pretends to have entertained doctors of the various faculties and the most distinguished scholars. Had he not had this assurance, that Oxford was then the centre of intellectual life, he would doubtless have displayed his light elsewhere.

The distinguished littérateur JAMES HOWELL, 1594–1666, has left an attractive account of the incidents of his tours on the Continent in a series of *Familiar Letters*, 'partly philosophical', written on emergent occasions to a number of imaginary personages. Of scientific interest are his descriptions of crystal glass furnaces, and of the many cases of leprosy which he saw in Holland and which he attributed to a diet of over-much fresh-water fish. He also wrote *Instructions for Foreine Travell, shewing by what cours, and in what compasse of time, one may take an exact Survey of the Kingdomes and States of Christendome, and arrive to the Practicall Knowledge of the Languages to good purpose*, 1642. Another worthy, JOHN JONES, Fellow, Ll.B., constructed a Pneumatic Clock, the working of which is fully described in Plot's *Natural History of Oxfordshire*, p. 226. He wrote *The Mysteries of Opium revealed*, 1700, but they were said to be 'perfectly unintelligible'. He practised at Windsor. JOHN POWELL became extra L.R.C.P. in 1690.

The mystical philosophy of alchemy was ably treated by THOMAS VAUGHAN, on whose shoulders the mantle of Robert Fludd may be said to have fallen. Master of an appropriate literary style, he knew well how to cloak the secrets of his occult science, even as he concealed his identity under the pseudonym of Eugenius Philalethes. He gives 1622 as the year of his birth, and 1638 for his entry to Jesus College.

His first work, *Anthroposophia Theomagica, or a Discourse of the Nature of Man and his State after Death* was dedicated by him from Oxford to the Rosicrucian brotherhood in 1648. This work and the *Anima Magica Abscondita* brought a criticism from Henry More, *Observations upon Anthroposophia Theomagica* and *Anima Magica Abscondita*, by Alazonomastix Philalethes, 1650, to which Vaughan replied acrimoniously with *The Man-Mouse*. More retorted with *The Second Lash of Alazonomastix* [1651], and Vaughan again replied with *The Second Wash* to 'answer a fool according to his folly': all polemical, seasoned to the coarse taste of the period. Vaughan's later works included *Magia Adamica*, *Coelum Terrae* and the *Lumen de Lumine*, 1651, which last is dedicated 'To my Dear Mother, The Most Famous University of Oxford', to whose bosom he had returned when 'the unsetledness of the time hindered him a quiet possession of a country rectory of St. Bridget', and in a sedate repose he prosecuted his medicinal geny (in a manner natural to him), and at length 'became eminent in the chymical part thereof at Oxon and afterwards at London under the protection and patronage of that noted chymist Sir Rob. Moray, knight, secretary of state for the kingdom of Scotland. . . . He was a great chymist, a noted son of fire, an experimental philosopher' who was knighted at Oxford by Charles I in 1643. Sir Isaac Newton owned an autographed copy of Vaughan's *Fame and Confession of the Fraternity of R: C: commonly called the Rosie Cross*, 1652, recently noted in Marks's catalogue.

We have perhaps dwelt over long on what many moderns will condemn as the unhealthy vapourings of a charlatan, but it must be remembered that Elias Ashmole was deeply impressed by such writings as those of Vaughan, and that he in consequence became the founder of the first Professorship of Chemistry in England.

In the Epistle Dedicatory to his *Lumen* Vaughan, addressing his alma mater, observed with some truth that in most of her sons there is 'a complexion of fame and ingratitude. Learning indeed they have, but they forget the breasts that gave it. Thy good works meet not with one Samaritan; but many hast thou cured of the leprosy of ignorance.' Perhaps Vaughan's 'mustard-seed' [of Alchemy] has grown to be 'the greatest amongst herbs' [Chemistry].

Sad to think that Vaughan himself should have died from inhaling fumes of mercury during a chemical experiment.

The subject of the particular variety of Marble that was used for making lime in Pembrokeshire was a matter of special interest to Principal JOHN LLOYD, 1638–87, when he was Vice-chancellor in 1683, as was also the cubical form of pyrites that he had obtained at St. David's. He became Bishop of St. David's in 1686.

The most eminent man of science in the College before the nineteenth century was undoubtedly EDWARD LHWYD, who owed his career to the opportunities and incentives for study presented by the scientific collections in the Old Ashmolean Museum.

He was born in South Wales about 1670, and died in the Museum in 1709. In 1684 Plot employed him as his Under-Keeper at the Museum, and on his retirement recommended him for the Keepership, an office which he held until his death. In the summer of 1691, soon after his appointment, he was much distressed owing to a robbery having taken place in which Murat was suspected of being implicated. After five years' service he found his Keepership to be 'a mean place, seeing there is no salary', and all along he had to depend for his subsistence on fees paid by visitors for seeing the curiosities. He therefore determined to go off to Wales on a five years' antiquarian and scientific tour, of which several publications were the outcome.

Some account of a fiery exhalation in Merionethshire. Note concerning extraordinary hail in Monmouthshire. 1697.
Concerning some regularly figured stones recently found; and observations on ancient languages. 1698.
On a figured stone found in Wales. 1699.
Account of some fossils. 1704.
Account of very large stones voided by the urethra.
Observations in natural history, made in travels through Wales.
Observations on the natural history of Ireland. 1704.

Account of some uncommon plants growing about Penzance and St. Ives in Cornwall. 1704.

On the natural history and antiquities of Wales and Scotland. On an undescribed plant Tubularia indivisa, Linn. 1713.

His larger works included his *Lithophylacii*, 1699, reissued in 1760; his *Archaeologia Britannica*, 1707; and *Adversaria de fluviorum, montium, urbium in Britanniae nominibus*, 1719.

He was the first writer on Fossil Plants in England. Until recently it was believed that all Lhwyd's type specimens, upon which the *Lithophylacii Britannici Ichnographia*, the pioneer work on British Palaeontology, was based, had been lost, but by one of those rare turns of fortune a number of his type fossils enclosed in their original paper wrappings inscribed with name, locality, and serial number have been discovered by the present writer in the library of Oriel College: they are of the highest historic interest.

Lhwyd had suffered from asthma for several years before his death of pleurisy in the Museum between 10 and 11 on the evening of 30 June 1709. He left no will and was buried in St. Michael's Church. His property went to Lewis Price of Cardigan.

Nathaniel Alcock, 1707–79, D.M. Leyden and Oxford, F.R.S. 1750, seems to have arranged an unauthorized course of lectures on Chemistry about 1756 which were fully reported by an undergraduate of the College and seem to have aroused considerable ill feeling at the time. The episode is described in *Some Memoirs of the Life of Dr. A., lately deceased*, Anno 1780. He retired to his native town, Runcorn, where he died.

Dr. Henry Owen, 1716–95, presents the curious case of a man who after obtaining the fullest medical qualifications, saw fit to undertake the duties of Rector of St. Olave in London and of Vicar of Edmonton during the last twenty years of his life.

The British Association owes a deep debt of gratitude to George Griffith, who was placed in the first class in Natural Science in 1856 and three years later acted as Local Secretary for the Oxford Meeting in company with Professors Henry

Smith and Rolleston. From then onwards for thirty years he rendered most useful services to the Secretariat, aided by his wide range of knowledge, accurate memory, and unfailing courtesy. He died in 1902.

When the new Natural Science School was started W. Boyd Dawkins was one of the first to be awarded a first class in 1860. As a young man he had found inspiration in the geological collections of Buckland, which at that time (1857) were conserved in the Old Clarendon Building, and in early field excursions in 1862 with James Parker in search of palaeoliths and hyaena bones in Wookey Hole in Somersetshire. His work on *Cave hunting*, published in 1874, has long been a standard work on the subject. In 1870 he was appointed to the Curatorship of the Manchester Museum, and in 1872 became Professor of Geology and Palaeontology in the Victoria University. He was an enthusiastic advocate of a Channel Tunnel; and it was largely due to his inferences that a search for coal in the concealed coal-field under Kent was undertaken. He frequently acted as 'expert adviser' in matters of water supply, and of great engineering works, such as those for the Manchester Ship Canal and the Humber Tunnel. His *Early Man in Britain* is a good example of his extremely felicitous and clear exposition of the facts, and is an eminently readable book. He was elected into the Royal Society in 1867 at the age of forty.

Sir Edward Poulton took his degree in 1876, and after several years of tutorial work at Keble College was appointed Hope Professor in succession to Professor Obadiah Westwood. His work on the Mimicry of Insects and on the classification of the causes of coloration in that group have been recognized by the award of the Darwin Medal of the Royal Society. On the death of Weismann it was said that his mantle had fallen on Poulton's shoulders. Now it may as truly be said that he is carrying by far the larger portion of the mantle of Darwin.

In 1908 the revered name of Leoline Jenkins was revived by being attached to the newly founded Chemical Laboratory. A plan for the building was drawn out by Arthur Henry

A. H. CHURCH

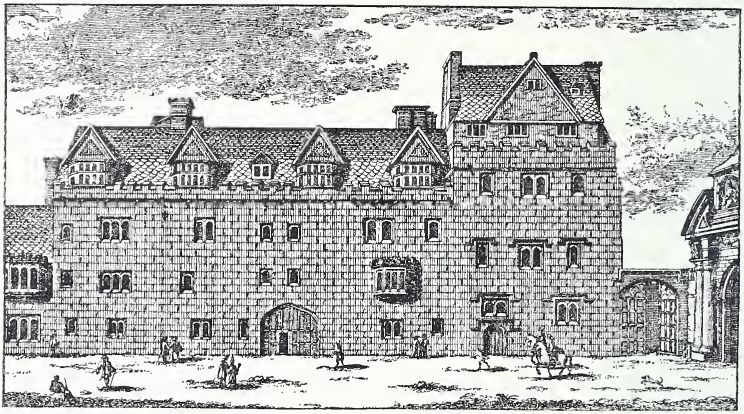
Church, 1865–1937, the most learned and accomplished teacher of botany, who has remained in Oxford all his life in spite of very meagre financial inducement. Election to a research fellowship at Jesus College for four short years was his only College endowment after taking his degree, but by dogged determination to advance his science he made the botanic garden, library, and laboratory the tools of his success.

Certainly the encouragement that his work received from the professors under whom he had the misfortune to serve was of the slenderest. It has proved a real loss to botany that he was not elected to the Sherardian chair in 1920.

In a recent appreciation of his great qualities the writer regretted that Church 'avoided scientific meetings and social occasions'. The reason was not far to seek. As a young employee of the botanical department his stipend was too small for him to indulge in the necessary visits to learned societies in London which his scientific colleagues know to be an indispensable part of the higher training of young men of science.

When during his later years his stipend improved, he became able to pay for the printing of a series of 'Oxford Memoirs'. His *Plant Life of the Oxford District* served as an admirable introduction to the study of oecology, just as his superb drawings of *Types of Floral Mechanism*, perhaps the finest accurate delineations of twelve early spring flowers, have set the highest standard to students of botany. It was a real calamity that the delegates of the Oxford Press should not have taken advantage of his supreme craftsmanship by continuing and completing this work as originally planned, and so to provide teachers of botany with a masterly description of a hundred typical plants.

Thalassiophyta stated his views concerning life in the sea, and in various works on *Phyllotaxis* he propounded a theory of growth based on the properties of logarithmic spirals. Of his powers as a teacher it was said that he covered ground that elsewhere required the services of three lecturers. All that he did, he did thoroughly, and thanks to his special gift of imagination combined with meticulous accuracy of observation his contributions to science will live.



17. MAGDALEN HALL, 1602–1874

THE original Magdalen Hall stood on the west side of Magdalen College, adjacent to the beautiful little house known as the Grammar Hall. Its Principals paid rent to the College, but though, like John Stokesley in the time of Henry VIII, they may have been members of the College, they were not nominated by it, nor were they under its jurisdiction. Two of the Principals became Presidents of Magdalen College. Although small in size, the Hall was great in attainment, at least as far as its scientific members were concerned: indeed, in the seventeenth century few Colleges can boast a more imposing list of medical graduates.

Neither its heir, Hertford College, nor its foster mother, Magdalen, seem, however, to feel the responsibilities of their relationship very urgently, and so for the time memories of the old Hall have fallen between two stools.

One of the earliest of the medical graduates of whom we have some account is HENRY FOWLER, who entered the Hall in 1583, enrolled as 'plebs' to which he added a merchant's mark, 'This is my Father's Cloth-mark. Scorn not the merchant or clothier; *sunt reipublicae nervi*, and without sinews the body can have no strength.' His tutor was Thomas Allen of Gloucester

Hall, his 'profounde and mathematicall friend', who in 1626 obtained a recipe for him from Mr. Fenton 'the King's Master Chyrurgian of England and Master of the Hospital by Smithfield'. This note is taken from Fowler's own book of medical receipts, full of personal notes, now in the Hunterian Library.

THOMAS HOBBES, mathematical tutor to Charles II and intimate with the great men of his day, entered the Hall in 1603. He is said to have preferred the snaring of jackdaws to the educational methods of his day. Two years later came Principal JOHN WILKINSON, who made the Hall the headquarters of the Puritan party. Other celebrities were JONATHAN GODDARD, *c.* 1612–75, D.M. 1643, who became Warden of Merton, and the still more famous JOHN WILKINS, 1614–72, who matriculated at New Inn Hall in 1627, but took his B.A. and M.A. from Magdalen Hall. He was the son of an Oxford goldsmith who became Warden of Wadham and Bishop of Chester, otherwise he would surely have been the first President of the Royal Society, the foundation of which was his chief work. And like NARCISSUS MARSH, at the Hall in 1658, all these became heads of Colleges.

EDWARD LEIGH began as a commoner at Magdalen in 1616, but moved to the Hall two years later. Author of *Three Diatribes or Discourses. First of Travel, a Guide for Travellers into Foreign Parts. Secondly of Money or Coins. Thirdly of Measuring of the Distance betwixt Place and Place*, 1671. It was reprinted as *The Gentle-Guide in three Discourses*, 1680, and dedicated to Francis Willughby.

WILLIAM PEMBLE, author of *Brief Introduction to Geography*, a text-book much used and often reprinted, assured his readers that the 'earth resteth immovable in the midst of the whole world', showing that the writer was still holding firmly to the Ptolemaic theory in 1630.

The physicians of the period included WILLIAM DENTON, 1605–91, D.M. 1634, physician to Charles I and II, whose principal secretary, Sir Edward Nicholas, his daughter Anne married; SAMUEL THOMSON, Extra-Licentiate of the College of Physicians in 1640, who seems to have practised in Rochester:

he was created D.M. in 1648; John Skinner, D.M. 1647; Samuel Morris, D.M. Leyden, 1668.

Walter Charleton, 1619–1707, at the early age of twenty-two years attained the double distinction of D.M. and of being appointed Physician-in-ordinary to the King. He was a prolific writer. As a young doctor he translated, illustrated, and 'ampliated' the *Ternary of Paradoxes* of von Helmont, comprising the 'Magnetick Cure of Wounds, the Nativity of Tartar in Wine, and the Image of God in Man', 1650. He believed that calculi were formed by a definite stone-forming spirit or *Spiritus Gorgonicus*, 1650. His *Oeconomia animalis*, 1659, was a general physiology and was succeeded two years later by the *Exercitationes pathologicae*, London, 1661.

In 1664 he was given a post in London 'to have the care of dissecting bodies for one year'. His *Onomasticon Zoicon*, 1668, was a systematic list of all the animals in Charles II's menagerie in St. James's Park. Whilst writing this and the *Exercitationes de Differentiis et Nominibus Animalium*, 1677, including a few fossil genera, he came to realize the importance of names and nomenclature and made extensive use of binomials. His *Three Anatomie Lectures*, 1683, dealt with the physiology of the heart and the circulation.

The greatest of Oxford physicians, Thomas Sydenham, aged 18, matriculated on May 20, 1642 as a member of the Hall, which had then become one of the most successful societies in Oxford chiefly owing to the serious attitude of its Puritan members and to the high reputation of the Principal, John Wilkinson, Fellow and afterwards President of Magdalen College. The Civil War soon led to his leaving Royalist Oxford and to his taking arms for the Parliament, in the service of which he became a Captain. However, in 1647 he returned and as a Fellow Commoner of Wadham began to read medicine, becoming a Bachelor of Physic in 1648, and gaining in the following October a Fellowship at All Souls, under which College his great medical achievements receive further mention. Indeed, the story of Thomas Sydenham might have been selected to enrich the history either of Wadham or of All Souls

THOMAS SYDENHAM

From the portrait in the Royal College of Physicians

College, where for a time he acted as bursar to the detriment of his health, for it was there that he began to suffer from the gout about which he composed the classic treatise.

Another member of the Hall whose work can never be forgotten in Oxford was ROBERT PLOT, 1640–96, the descendant of an old Kentish family. Having matriculated at Magdalen Hall in 1658 he became a D.C.L. in 1671, and about 1676 left the Hall to enter University College as a commoner. He paid for placing a statue of King Alfred over the portal in the High Street.

He had all the instincts of a good traveller, and the ambition to compile a Natural History of Britain from observations that he might make. So he issued a schedule of 'Enquiries to be propounded in my travels through England & Wales—all in an Itinerary', but finding the scheme too large he restricted his inquiry to Oxfordshire, and in the same year, 1677, he obtained his F.R.S. The publication of the *Natural History of Oxfordshire* undoubtedly convinced Ashmole that Plot was just the man to have custody of the collections, which he accordingly offered to Oxford. When Ashmole's conditions had been accepted by the University, Plot very naturally was nominated Keeper of the Ashmolean Museum and Ashmole's first Professor of Chemistry.

Plot edited the *Philosophical Transactions* during a part of his secretaryship to the Royal Society, and contributed the following memoirs: *A paper on the Formation of Salt and Sand from Brine of the Pits in Staffordshire*; *On Perpetual Lamps, in imitation of the Sepulchral Lamps of the Ancients*; *On the incombustible Cloth made of the Asbestos*; *A History and Register of the Weather at Oxford during the year 1684*; *On the Black Lead of Cumberland*; *On the best time for felling Timber*, which, with the ancients, he advises to be performed in the autumn; *On an Irish Giant, nineteen years of age, and measuring seven feet six inches in height*; *A Catalogue of Electrical Bodies*, *Phil. Trans.* No. 245. The subscription for his *Natural History of Staffordshire* was a penny a sheet, a penny a plate, and sixpence the map. There is a portrait of him standing, the last of the right-hand group, in the *Oxford Almanack* 1749.

Unsuccessful as a candidate for the Wardenship of All Souls, he was rewarded in 1688 with the honorific title of Historiographer Royal. After seven years of unremitting work in Oxford for slender pay, he resigned in favour of his assistant, Edward Lhwyd. Plot died of the stone at Sutton Barne, and was buried in Borden Church, May 1696.

Richard Morton became a chaplain of New College, but having adopted the principles of the Nonconformists, probably at the Hall, he forsook theology for medicine after the restoration of Charles II, and took an M.D. in 1670. His treatise on consumption, *Phthisiologia, seu exercitationes de Phthisi*, appeared in the last year of the life of Sydenham, for whose methods he had the highest admiration. He also wrote *Exercitationes de morbis universalibus acutis*, and died in 1698. About this time the Hall could boast 115 undergraduates as against 15 at Magdalen College.

The importance of the intensive study of animals by dissection, already stressed by Wren, was shown by Edward Tyson, 1649–1708, in an admirable series of monographs illustrated by excellent engravings. He anatomized a series of animals, including the Chimpanzee, Muskhog, Porpoise, Virginian Opossum, Rattle-snake, embryo Shark, Lumpfish, Tapeworm, and Round Worm. In 1674 he discovered that Polecats were provided with scent bags, comparable to the follicular repositories of strongly scented humours in the beaver, whence Castoreum, or in the Gazella indica, whence Musk, as also in other strong scented animals, as the Hyaena and Civet Cat. He was also a student of finger prints. About 1679 he was elected into the Royal Society and appointed Lecturer in Anatomy to the Barber-Surgeons. He is believed to have been the Carus of Garth.

The success of the Hall may have been due to the scientific knowledge of its Principals. From 1681 to 1694 it was under the rule of William Levett, 1644–94, after whose death Magdalen College endeavoured to recover the Principalship by appointing D. Hammond, but he was succeeded by Dr. Richard Adams of St. John's and All Souls Colleges in 1694, whose achievement 'Unius etiam e quinque Commissionariis quibus Regnante Anna Nautarum Aegrotantium et Sauciorum cura fuit demandata' is recorded on his memorial in the church of St. Peter in the East. He held the Principalship until his death in 1716.

Other medical members of the Hall were Stephen Chase, B.M. 1703, who proceeded D.M. from Merton College ten years later, F.R.S. 1724; John Cartledge, L.R.C.P. 1713, died in 1752 aged 81; and Thomas Lewis, L.R.C.P. 1713, died in 1764.

Robert Turner was the author of several geographical text-books and a work on surveying entitled *The Young Gauger's best Instructor*, 1762. In 1765 he was teaching astronomy at Worcester and published *Plain trigonometry rendered easy and familiar by calculations in arithmetic only*, in which is also shown a curious trigonometrical method of discovering the places where bees hive in large woods, merely by observing the direction of their flights.

James Higginbotham, afterwards James Price, d. 1783, took a D.M. degree in 1782, but devoted himself to the pursuit of chemistry with so fruitful a result as to persuade himself that he had succeeded in transmuting a baser metal into gold sufficiently pure to pass the testing and weighing by Mr. Locke, goldsmith of Oxford. Unfortunately, the Royal Society took notice of his *Account of some experiments on Mercury made at Guildford in May 1782*, and asked him to repeat the experiment before a Committee. The experiment failed, and James Price committed suicide.

George Shaw, 1751–1813, was destined for the Church, but his love of science led him to study medicine. He qualified as D.M. 1787, took a London practice, helped to found the Linnean Society, and in 1791 was appointed Assistant Keeper to the Natural History Department of the British Museum, being promoted full Keeper in 1807. He was the author of the *Speculum Linneanum*, 1790, *Museum Leverianum*, 1792, the *Zoology of New Holland*, 1794, a *General Zoology*, 1800–12, *The Naturalist's Miscellany*, finely illustrated in 24 volumes, 1789–1813. He was emphatic on the need of illustrating works with coloured plates. His college contemporary, HENRY BEST, had remarked on his peculiar stilted manner in the use of language. If he meant to tell you that some one had offered to shake hands with him, he would say 'the animal protrudes his tentacula'. Showing a visitor some well-filled coal-cellars under the British Museum, 'This puts to shame the subfenestral carbonaria of your Alma Mater', referring to the College bunkers under window-seats.

Another physician of the Hall, JOHN NOBLE JOHNSON, D.M. 1814 and physician to Westminster Hospital, has remained in memory through the notes which he collected for a life of Thomas Linacre. His early death in 1823 robbed him of the reward of publication, until they were edited posthumously by R. Graves. MANUEL JOHN JOHNSON, 1805–59, matriculated at the advanced age of 30, and four years later was appointed Observer by the Radcliffe Trustees on the death of Stephen Rigaud in 1839. The name of T. W. WEBB, 1807–85, is still known to thousands of amateur astronomers by his admirable book on *Celestial Objects for Common Telescopes*.

In 1874 the Hall became merged in Hertford College, in the library of which a few of its old books may still be seen, including a set of the *Philosophical Transactions* and a few volumes of *Acta Eruditorum*, memorials to the work of its great members of the seventeenth century. Bradwardine's *de Causa Dei* given by Warden Wilkins to the Hall, and a presentation copy of Plot's *Natural History of Oxfordshire*, 1677, from the author, are in the collection. Among the surviving members of the Hall who became members of Hertford College was ARNULF MALLOCK, F.R.S., the successful engineer who devised measuring machines of the utmost delicacy. One for measuring the daily increment in the growth of a living tree-trunk has been presented to the Oxford Museum for the history of Science by his executors. His Ear-defenders were invented for use during the Great War.

c. 1836.

18. WADHAM COLLEGE, 1613

Wadham College will always remain *terra sancta* to students of Science on account of its early association with the remarkable group of men who founded the Royal Society, chief among whom was John Wilkins, Warden of Wadham in 1648. But long before that Wadham had attracted distinguished *alumni* to herself. The second name upon the list of the original fifteen Fellows admitted on April 20, 1613, was that of John Goodridge, a Master of Arts of Gloucester Hall, who was admitted to practise medicine in 1618. He died in 1654, bequeathing valuable medical books to the library.

One of the more successful scholars at the same election was Walter Stonehouse, 1597–1655, originally a Demy of Magdalen, a most cultured horticulturist, whose scientific interests and contacts have only recently been revealed, when the anagram *Theologus servus natus*, written on certain manuscripts in the Magdalen Library, was found to conceal his name. A friend of Tradescant, he was the first person known to have acclimatized a number of plants in England in his rectory garden at Darfield in Yorkshire.

A near contemporary, Robert Blake, took a B.A. degree in 1617, and became the greatest seaman of the age. But no other considerable name occurs in the Register for a decade, until the Chancellor armed Sir Richard Napier with a letter describing him as 'a kinsman of the Duchess of Richmond, . . . a person well deserving in all that is necessary in a gentleman and a scholar'. Not unnaturally he was soon annexed by All Souls, took his D.M. in 1642, and became one of the first members of the Royal Society.

An even greater celebrity, Thomas Sydenham, was at Wadham from 1647 to 1649 when he migrated to All Souls (p. 159). No other College can boast such a trio. And they were succeeded by Professor Walter Pope and John Wilkins, who both came up in the same year, 1648.

In 1625 the Plague drove the Parliament out of London into Oxford. Peremptory orders were given to clear the Colleges and Halls for the Members, but as they brought the disease with them, their stay was short and their *Parliamentum vanum*. On July 28th the members of Wadham were dispersed until next January. There was general misery in the town. The citizens went out to live in huts on Port Meadow, and a petition was addressed to the King to check the citizens from building cottages, to the increase of which the plague was attributed. In 1626, when the plague had ceased *in oppido ferocientem*, a Thomas Clarke was admitted, who is known to have become a 'Bachelor of Phisick' by 1664. He was followed in 1634 by Anthony Nourse, D.M. 1651; and in 1637 by George Joyliff of lymphatic fame, before he migrated to Pembroke College to take his B.A. in 1640, and by Lionel Pine, admitted to practise *in re medica* in 1647.

In 1642 Charles I entered Oxford after Edgehill, and students were set to dig trenches. Among the courtiers was William Brouncker, 1620–84. He was the son of Sir Wm. Brouncker, one of the privy chamber of Charles I, who became D.C.L. on November 1, 1642, and died in Wadham in the same month. Pepys says that he paid £1,200 to be made an Irish Lord and then hadn't 12 pence to pay for his dinner.

Young Brouncker became a good mathematician and in 1646–7 was created D.M. at Oxford. His mathematical mind showed itself in his new division of the diapason by 16 new proportionals into 17 equal semitones, the method of which was exhibited in an algebraical process, and also in logarithms, but Descartes declined to accept the scheme. In 1657–8 he corresponded with John Wallis and is credited with having been the first to introduce continued fractions and to give a series for the quadrature of a portion of the equilateral hyperbola. John Evelyn was his intimate friend, and the two discussed scientific questions with Charles II. In August 1662 Brouncker built a yacht for the King. Brouncker, Boyle, and Sir R. Moray, according to Evelyn in a letter addressed to Wotton, 'were the persons to whom the world stands obliged for the promoting of that generous and real knowledge which gave the ferment that has ever since obtained and surmounted all those many discouragements which it at first encountered'. He wrote on *Experiments on the Recoiling of Forces*, *Algebraical Paper on Squaring the Hyperbola*, *Finding a Straight Line equal to a Cycloid*, *Phil. Trans.* iii. 645, vii. 6 and 9. He was the first President of the Royal Society.

By 1647 those who by good fortune, or by superior genius, could rise superior to the troubles of the times were beginning to reap advantages from the new state of affairs. On May 1 the Ordinance for the Visitation and Reformation of the University became law, and one who, like THOMAS SYDENHAM, had 'retired from Oxford when it became a Royalist fortress, returned to it when it fell into the hands of the Parliament, and retired finally just before the Restoration', could not but succeed. He was admitted a Fellow Commoner in October 1647, and a Fellow of All Souls a year later, having been registered as M.A. of Magdalen Hall in the interval. On April 14 he took the degree of B.M.

On April 13, 1648, JOHN WILKINS of Magdalen Hall was intruded Warden of Wadham by the Visitors. He was the son of an Oxford goldsmith, who as a young man became Chaplain to the elder brother of Prince Rupert, and was a member of a little coterie of men of science who used to meet at the Bull's Head Tavern in Cheapside. Made Warden of

Wadham in 1648, he married in 1651 the youngest sister of Oliver Cromwell. In 1659 Richard Cromwell appointed him Master of Trinity College, Cambridge.

Already in 1638 he had written *The Discovery of a World in the Moone*, which was followed by *Mercury, or the Secret and Swift Messenger*, an ingenious work on Cryptography, 1641. In the year of his appointment to Wadham College he produced his *Mathematical Magick*. In 1668 appeared his *Essay towards a Real Character*, in which he was helped by John Ray. His last work on the Principles and Duties of Natural Religion, 1678, anticipated Butler's argument. His collected philosophical and mathematical works were published in 1708, and reprinted in 1802.

Evelyn has left an entertaining account of the instruments and scientific toys with which on July 13th, 1654, 'that most obliging and universally curious Dr. Wilkins at Wadham College' amused his dinner guests. They included a variety of shadow dials, perspectives, and many other artificial mathematical and magical curiosities, a way-wiser, a thermometer, a monstrous magnet, conic and other sections, a balance on a demi-circle: most of them belonging to himself and to Wren.

He also possessed a rare burning-glass and a great telescope which he left to Queen's when he went away to Cambridge in 1659.

In the garden he had transparent apiaries, built like castles and palaces, and so arranged that the honey could be taken without injury to the bees. They were adorned with a variety of dials, little statues, vases, &c. He had also a hollow statue which gave forth a voice and uttered words by a long concealed pipe, and in sunshine an artificial rainbow produced in a mist raised by a water-squirt. His way-wiser with 5 indexes for Perches, Furlongs, Miles, 10's of miles, 100's of miles to work on a coach. It lost 1 yard in 100 yards. It was long preserved in the Royal Society's Museum, also his wind-gun with two barrels, flying-machines, carriages, two burning-glasses and an otacousticon. Later, when Bishop of Chester, he owned one of the first watches with a balance spring made by Tompion according to Hooke's plan. While at Oxford Wilkins ruled over Wadham College most successfully for eleven years. A most fruitful period. In the year that he became Warden he brought up his half-brother Walter Pope as a scholar.

In his second year there arrived Christopher Wren; Francis Crosse, who studied medicine at Leyden and practised successfully at Bristol, having written *Disputatio medica inauguralis de febre intermittente*; William Turges, M.B. 1658; and Seth Ward of Cambridge: all admitted in 1649. Then came Lawrence Rooke in 1650 and Thomas Spratt in 1651. Lastly, Thomas Jeamson matric. 1654, D.M. 1668, referred to as 'Anatomicus Praelector' by Wood. Also Caspar Needham of Peterhouse, Cambridge, who seems to have come to tutor Sir Benjamin Maddox.

In fact under Wilkins Wadham became a place of resort for virtuous and learned men who relished the satisfaction of breathing a freer air there than was possible amid the civil commotions of London.

Best known of all, that miracle of a youth, Wren, who came up in 1649, was elected Fellow of All Souls in 1653, but continued to occupy the so-called Astronomy Chamber over the gate of Wadham. He was one of those rarely gifted persons endowed with a singular charm of address and a power of concentrated thought, that makes success a certainty. If chance had not called forth his architectural powers, he would have excelled as an astronomer or as an anatomist. Everything interested him: he had the gift of compelling the interest of others in anything.

Seth Ward from Cambridge, who entered Wadham as a Fellow Commoner, was elected Savilian Professor of Astronomy, and in 1659 President of Trinity.

After the Restoration Wilkins gathered together the men, and presided over the Committee which drew up the scheme for 'the founding of a College for the promotion of Physico-Mathematicall-Experimentall Learning'—the Neosophy for which the Royal Society of London was incorporated in 1662.

Lawrence Rooke left Oxford, and was one of the Committee of twelve which on November 28th, 1660 appointed Wilkins their Chairman for considering the foundation of the Society. Pope, who had been appointed Gresham Professor of Astronomy in succession to Wren, and graduated D.M. in the following year, was one of the early Fellows of the same Society. In October 1664 he visited Venice with his friend Sir A. Balfour.

Another member of the College, Thomas Spratt, afterwards Bishop of Rochester, composed the early history of the Royal Society, and with a literary skill that makes it as pleasant to read now as it was two and a half centuries ago. He made it clear that their object was 'to separate the knowledge of Nature from the colours of Rhetorick, the devices of Fancy, and the delightful deceit of Fables'.

By 1662 most of the Royal Society had moved with the Court to London, but of those men of science who remained in Oxford several members of Wadham did useful work, and after a couple of decades took part in the foundation of the Oxford Philosophical Society.

We gather that the physicians of the period had no lack of cases on which to practise, for on May 10, 1660, during a terrible thunderstorm, Samuel Mashborne was killed by lightning, Ahasuerus Rigemoter was struck speechless, and William Harman was injured. And again, in little over five weeks in Michaelmas 1672, six members of the College died of a malignant fever that raged in the town.

During the Wardenship of Ironside, 1666–89, several members of the College displayed interest in natural phenomena and proceeded to the study of medicine. Thomas Jameson, D.M. 1668, was the author of *Artificial Embellishments, orArt's best Directions how to preserve Beauty or procure it.*

Robert Pitt, F.R.S., after holding various College offices, proceeded D.M. in 1681, went to practise in London, and became Deputy Professor of Anatomy 1684. In 1687 he was admitted F.R.C.P., and ten years later was elected physician to St. Bartholomew's Hospital, a post that he held until

1707. He published *Observationes ponderis 'Testudinis terrestris' cum in auctumno terram subiret cum ejusdem ex terra verno tempore exeuntis pondere comparato per plures annos repetitae*, 1691. He did useful work as an exposer of quacks and their remedies, and protested against the excessive use of drugs in *The Crafts and Frauds of Physick exposed*, 1702. Also in *The Antidote; or the Preservative of Health and Life, and the Restorative of Physick to its Sincerity and Perfection*, 1704; *The Frauds and Villanies of the Common Practice of Physic demonstrated to be curable by the College Dispensary*, 1705.

Pitt's contributions to the Philosophical Society included discourses on experiments on digestion, on the boiling of oil; on the peristaltic motion of the stomach of a dog; and on lacteals arising from the stomach.

An unusual case of a prodigious polypus found in the heart of an epileptic citizen of Oxford was described in the *Philosophical Transactions* for 1683–4 by W. GOULD, who made a reputation by his demonstration of the non-acid character of the liquid in the thoracic duct.[1] He also wrote on *The Increase of Weight of Oil of Vitriol, exposed to the Air*. Gould, who was the Umbra of Garth's *Dispensatory* and holder of many college offices, proceeded D.M. (1687), as did his contemporaries JOHN OSMOND, D.M. 1689, and ARTHUR PARSONS, D.M. 1693.

An Earthquake which happened at Oxford in 1683 naturally claimed the attention of THOMAS PIGGOTT, who was acting as Librarian in that year. He was also interested in musical notes and scales, and had been associated with John Ballard of New College in his magnetic experiments in 1683.

The last of this group of 'naturalists' who were matriculated between 1669 and 1675, was WILLIAM COWARD, who proceeded D.M. in 1687 as a Fellow of Merton College. He practised medicine at Northampton and later (1693–4) in Lombard Street, London. His metaphysical writings made a considerable stir at the time, and in 1704 were commended to the common hangman for incineration. He wrote *De Fermento Volatili Nutritio Conjectura Rationalis*, 1695; *Alcali*

[1] *Early Science in Oxford*, iv, p. 10.

Vindicatum; or an Enquiry into the fallacious reasons of a late Essay touching Alcali and Acid, 1698; *Remediorum Medicinalium Tabula*, 1704; *Ophthalmiatria, qua accurata et integra oculorum male Affectorum instituitur Medela*, 1706. But Coward was never admitted to the Fellowship of the College of Physicians.

One great name still remains to be mentioned. In the last year of Ironside's Wardenship RICHARD BENTLEY of St. John's, Cambridge, came to Wadham as tutor to James Stillingfleet, the son of the Bishop of Worcester. He became Master of Trinity, in succession to John Wilkins, in 1700.

The Savilian Chair of Astronomy was filled by JOHN CASWELL from 1709 to 1712. His sole publication, *A brief but full Account of the Doctrine of Trigonometry both Plain and Spherical*, 1689, showed his bent to have been mathematical rather than astronomical, and it is a good example of Oxford humour that his colleague, the great astronomer, Edmund Halley, should have been relegated to the Geometry chair. Caswell also officiated as Vice-Principal of Hart Hall. He took advantage of the warm summer of 1686 to ascertain how much alteration in temperature affected a Baroscope devised by him. He was probably one of those members of the Philosophical Society who saw Venus by daylight about noon on July 6, 1686.

Matters of pure science appear to have been less studied.

THOMAS COX and HENRY COSTARD both took B.M. degrees in 1720; JOHN SADLER and EDWARD HARINGTON followed two years later; and Sir ROBERT PYE, Bart., attained to the honour of F.R.S. Otherwise the Wadham men admitted under Warden Dunster do not appear to have very actively advanced science or the art of medicine. And when in due course Robert Thistlethwayt became Warden he had to be given leave of absence, 'small-pox being still rife in Oxford'. He died abroad.

Oxford can boast several JOHN WARNERS of distinction. One, Warden of All Souls in 1536, became Henry VIII's first Professor of Physic. A second became Bishop of Rochester and a great benefactor to Magdalen College. A third about 1720 grew and ripened Burgundy grapes against a wall better than had been done before: he also grew pine-apples in stove-houses, and died in 1760. The Wadham representative of the family, RICHARD WARNER, 1713–75, came up in 1730. He was 'bred to the law' in Lincoln's Inn, but his means enabled him to live at Woodford Green, where he maintained a Botanic Garden and was especially successful in the cultivation of rare exotics. He was also in his youth, as is related of the great Linnaeus, 'remarkably fond of dancing; nor, till his passion for that diversion subsided, did he convert the largest room in his house into a Library'. He was visited by Kalm. He received from the Cape of Good Hope the so-called Cape Jasmine, which flowered for the first time in his hot-house in the summer of 1749. The captain of an East Indiaman when on shore at the Cape had been 'most wonderfull surprised by a fine smell, and looking round, spied a large double white flower which it came from; the next day he went with two sailors and a box, took it up and planted it, and brought it to his friend Mr. Warner, who is the only one has it'. It was figured by Miller and when it was proposed to call it *Warneria* the grower objected, and it was named *Gardenia*.

The *Plantae Woodfordienses*, 1771, was based on herborizations of the Apothecaries Company of London. Warner left his botanical and natural history books to Wadham and £300 for an exhibition in Botany tenable for seven years.

Of the physicians of Wadham, JOHN BARKER, D.M. 1743, F.R.C.P., served as physician to the army in the Low Countries in 1747. WILLIAM AUSTIN, 1754–93, was a remarkable man. He matriculated at Wadham College in 1773, and after taking the B.M. and D.M. in 1781 went to St. Bartholomew's Hospital and studied under Percival Pott. On returning to Oxford in 1781 to practise as a physician he found time to put his hand to many other activities. He gave lectures for the Savilian Professor of Geometry, and before going to London had given lectures for the Laudian Professor of Arabic. He also wrote sermons for his clerical friends, and appears to have had an insatiable desire for learning. He was elected to the Infirmary in 1783, and in 1785 as Professor of Chemistry in the University gave courses of lectures. He ultimately migrated to London and was elected a Physician of St. Bartholomew's in 1786, where both by his learning and manners he became a very popular physician. He wrote a *Treatise on the Stone,* 1791. His Gulstonian Lectures have been printed. Dr. Charles Price, 1776–1853, Fellow, proceeded M.D. in 1804 and held the physicianship to the Middlesex Hospital until he removed to Brighton about 1815. John Bright, M.D., 1783–1870, B.A. 1801, M.D. 1808, after a brief term of service as physician to the General Hospital at Birmingham, became attached to the Westminster Hospital from 1822 to 1843, and was appointed a Metropolitan Commissioner in Lunacy.

A second endowment for science came from John Wills, Warden 1783–1806, who provided for a Fellowship and Exhibition in Medicine, but either the value was insufficient or it was merged in a prize for lawyers, and it did not produce the results anticipated. The Wills Medical Exhibition certainly brought fame to one of the first beneficiaries, Robert Patch, 1788–1840, who later received the Wills allowance for superannuated fellows: 'he lived in the Tower Chamber for many years, but quite cut off from society'.

Less of a recluse, Thomas Mosley Crowder, 1831–92, became a great traveller, whose tour on foot along the frontier of Roman Germany has been printed. Geology and meteorology were studied by Richard W. Greaves, B.A. 1840, and Philip H. Newnham respectively.

A more illustrious scholar was Mervin Herbert Nevil Storey, 1823–1911. Taking the name Storey-Maskelyne in 1849, he became the most distinguished English mineralogist of his day. In 1851, as Professor of Mineralogy, he occupied quarters in the Old Ashmolean Building until 1857, when he left Oxford to take up the Keepership of the National Collections of Minerals in the British Museum. A pupil writing in 1852 records that he 'liked talking to us, and encouraged us to spend long hours in the laboratory discussing the first principles of chemistry, and now and again took us through an instructive course of analysis'. Until 1895 he con-

Nevil Story Maskelyne

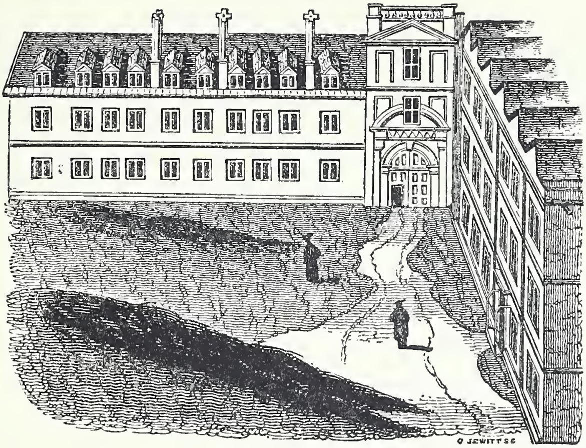
tinued to come up to lecture in Oxford, where his pupils and grand-pupils have kept bright the crystal lamps of learning. He was elected F.R.S. in 1870 and M.P. 1880–92. His work on *The Morphology of Crystals* appeared in 1895.

The Wadham Botanists seem not to have been sufficiently encouraged to merit a history; indeed, the only name that occurs to me is that of James Hewetson Wilson, admitted 1846, who died at the early age of twenty-four just after he had translated Jussieu's *Elements of Botany*. A few years later came Sir Thomas Graham Jackson, 1835–1924, to whom Oxford owes much of her modern architecture including the new Radcliffe Science Library.

The connexion of Wadham with Physics began in 1865 with the election of Robert Bellamy Clifton, 1836–1921, Fellow of St. John's College, Cambridge, to the Professorship of Experimental Philosophy. He had already been Professor of Natural Philosophy in Owen's College, 1860–6. Elected F.R.S. 1868, F.R.A.S. and President of the Physical Society 1882–4, he designed and organized the Clarendon Physical Laboratory wherein he taught from 1865 to 1915. He was noted for the high standard of accuracy with which he conducted his physical experiments and for the care that he took of his instruments. But little actual research was done in the Clarendon Laboratory in his time—one of the most important being the determination of the weight of the earth by C. Vernon Boys. One of Clifton's early pupils was Robert Edward Baynes, matric. 1868, who became a senior student of Christ Church in 1874 and Lee Reader of Physics in 1886.

Two of the moderns merit special notice. Even as Warden Wilkins took a most important part in the foundation of the Royal Society, so his successor Joseph Wells, originally of the Queen's College, helped in the initial stages of the foundation of the Oxford Museum of the History of Science, by recognizing the unique historic value of the scientific collections in Oxford to the University. Until his death in 1929 he served as a most efficient Chairman of the Committee of Management of the Lewis Evans Collection.

Not less active was Frederick A. Dixey, D.M., F.R.S., eminent as a histologist and entomologist. His work on the phylogeny of Pierine butterflies was followed by a masterly study of Mimicry produced by natural selection, and of those scales on insect wings which are specialized for producing scent. He presided over the Zoological section of the British Association in 1919 and over the meetings of the Friends of the Old Ashmolean, whose object it is to secure the restoration of this venerable scientific institution in Britain as a museum for the History of Science, a restoration which has now been promised by the University for 1942 or earlier.



PEMBROKE COLLEGE BEFORE 1829.

19. PEMBROKE COLLEGE, 1624

BROADGATES HALL has been honoured with many famous sons, chiefly lawyers and a poet or two, but in medicine THOMAS HALL, D.M. 1581, and WILLIAM CLARKSON, D.M. 1590, were the only scientists whose names come to our mind in the first three hundred years of this foundation; so that, scientifically speaking, we may argue that it was never more flourishing than at the time of its metamorphosis into Pembroke College.

On August 5th, 1624, Dr. THOMAS CLAYTON, the Regius Professor of Medicine, THOMAS BROWNE, and JOHN PYM, the Founder of Parliamentary Government in England, took part in a ceremony by which the ancient Hall of Broadgates, of which they were members, entered into a new life and became the youngest college in Oxford for over a century. Thomas Browne in his speech compared it to a Phoenix rising from ruins. King James I graciously accepted the honourable sinecure of Founder, while Chancellor Pembroke looked benignly on.

Dr. Thomas Clayton, the last Principal of the Hall, and the first Master of the new College, took his D.M. in 1611, being appointed Regius Professor in that same year. Later he was nominated first Tomlyns Reader in Anatomy and gave instruction in the Anatomy School. His students were helped by a small reprint of Bartholin's *Institutions of Anatomy*, printed in Oxford in 1633 for their special benefit. He greatly helped the young College by raising a building fund. In the Regius Professorship he was succeeded in 1647 by his son, Dr. Thomas Clayton, also of Pembroke College, but the son was not of the same character as his father. He was 'possest of a timorous and effeminate humour, [which] could never endure the sight of a mangled or bloody body', a fact that got well known amongst his pupils and was the cause of much fun in a poem entitled 'Sr. Thomas Clayton or a fearfull Anotamie Lecture'.

Sir THOMAS BROWNE, 1605–82, the favourite author of Sir William Osler, had been a Wykehamist who took an M.A. degree in 1629, and after studying at Montpellier and Padua, graduated D.M. at Leyden in 1633, and again at Oxford in 1637. He settled in Norwich, where he practised physic and wrote his celebrated books: *Religio Medici*, 1642; *Pseudodoxia Epidemica* or *Enquiries into Vulgar Errors*, 1646; *Hydriotaphia* or *Urn Burial and Garden of Cyrus*, 1658. He was knighted in 1671 on the occasion of a Royal visit to Norwich. It is reasonable to assume that he received such preliminary training as was customary for a medical student while he was in residence at Broadgates Hall, 1623–4. His wider fame rests on his power of getting outside himself and the narrow sphere of professional experience. An innate fondness for animals made him a scholar-naturalist in the highest sense of the word, singularly gifted with a poetic instinct, yet a sceptical unveiler of fallacies. He was equipped as few had been for his pastime of philosophic research into the fairy realm of animal and vegetable life.

Sir Thomas was followed by several scientific worthies, the most eminent being Dr. GEORGE JOYLIFFE, 1639–43, a most excellent anatomist, to whom is attributed the first discovery of the Lymphatics, which he demonstrated to his contemporary, Dr. ROBERT STAPLEY. In this he anticipated the discovery that has been claimed for Rudbeck eight years later and for Bartholinus later still. As early as 1657 John Evelyn found Joyliffe experimenting with the venom of a rattle-snake that he had obtained from Virginia, to find the rate at which it killed rats and mice.

Other Pembroke men of eminence were the following: ELISHA COYSH, matric. 1650; D.M. 1657; F.R.C.P. 1673; died 1685. WILLIAM QUARTERMAN, 1618–67; D.M. 1657, Physician to Charles II; F.R.S.; M.P. for New Shoreham.

Of those who engaged in general medical practice, ELISHA COYSH was 'vir integerrimus et medicus expertissimus' 'very famed for his advice in cases of that dreadful malady [plague], and was much resorted to at his copyhold residence at Highgate'. NICHOLAS LAMY was a Frenchman who proceeded B.M. in 1631.

JOHN WYBERD came up as a commoner in 1638, but went abroad when the troubles began. He qualified D.M. at Franeker, and incorporated at Oxford. Author of *Tactometria, or Tetagmenometria, or the Geometry of Regulars practically exposed.* JOHN MARTYN, L.R.C.P. April 1683.

It was not, however, every medical student who could stay a full course. RICHARD GRAVES, 1715–1804, had been at school at Abingdon until the age of sixteen, when he came up to Pembroke. Evidently the terror of examinations did not weigh very heavily in those days, and he and Shenstone found time to anticipate the work of the modern English school and to read plays and poetry, and other 'works of easy digestion', washed down with Florence wine. The result was pecuniarily satisfactory, for in 1736 he was elected a Fellow of All Souls. There he exchanged his projected theological studies for two courses of anatomy under Dr. Nichols. At the end of the second course he got ill of a fever. The doctor prescribed bed and sweat for six weeks, which Graves obediently did, taking assafoetida volus 'and all the cordial medicines of the shops'. If another physician had not ordered him a glass of sack every day and a toast he would not have survived the experiment. Determining that he had not the strength for further study, he took orders and a chaplaincy in 1740.

NATHANIEL BLISS, 1700–64, entered the church and became Rector of St. Ebbe's in Oxford in 1736. With a natural taste for mathematics and astronomy he attended Bradley's lectures in the Old Ashmolean and was appointed to the Savilian chair of Geometry in 1742. The observations made during his Oxford period were on Jupiter's satellites (1742) and on the Comet of 1745. He assisted Bradley at the Royal Observatory, and from 1762 to 1764 held the appointment of Astronomer

Nathl. Bliss A.M. Professor of Astronomy at Oxford F.R.S
Obit 1764 ætat 64.

Royal himself. But, curiously enough, when he died the records of his Greenwich observations were regarded as the property of his widow and were not published until long after his death, as a supplement to Bradley's observations issued in 1805. George, Earl of Macclesfield, used frequently to ask Bliss to stay at Shirburn Castle to discuss astronomical matters.

Under the will of Lord Leigh a trust fund was provided for the illustration of experimental lectures with suitable apparatus. They are to resemble those delivered by Professors Bradley (see p. 359) and Bliss, and in the first year after the latter's decease his energetic widow seems to have seen to it that his successor should duly deliver such lectures, as is shown by the following amusing, if unacademic, notice.[1]

[1] Discovered by Mr. H. Minn among Bodleian papers.

Oxford May 20 1765

Mrs. Bliss begs leave to acquaint her Friends, that the Professor of Astronomy proposes to repeat the Electrical Experiments for the Entertainment of Ladies and others, on Tuesday the 21st in the Schools Tower at 3 o'clock in the Afternoon, when Tickets already delivered for the 17th will be accepted.

Tickets for Admission at half a Crown each may be had of

Mrs. Bliss
Mr. Hornsby } in New Coll Lane

Mr. Stratford in the Butcher-Row.

N.B. For the Convenience of Ladies, Admittance will be given through the Picture Gallery.

John Lightfoot, 1735–88, entered Holy Orders, and being recommended by his taste for Botany and Conchology to the Dowager Duchess of Portland, an 'intelligent admirer and patron of Natural History in General', became her chaplain. In 1772 he accompanied Pennant on his second tour through Scotland, with the result that he compiled a *Flora Scotica*, 1778, which was based partly on his own observations, and partly on the Dillenian Cryptogamic herbarium at Oxford. He was an early Fellow of the Linnean Society.

During the second half of the eighteenth century the scientific sympathies of the Master, William Adams, 1706–89, the lifelong friend of Dr. Johnson, seem to have attracted several men who afterwards became famous as chemists. Among physicians we note the names of Devereux Mytton, D.M. 1781, who farmed in Wales, and J. Littlehales, D.M. 1782.

Thomas Beddoes, 1760–1808, acted as Reader in Chemistry from 1788 to 1793, devoting his attention more particularly to the indispensability of a knowledge of that science to the medical student. The close association of medicine and chemistry had been realized at Glasgow by Black and also at Edinburgh. Dr. Beddoes became one of the chief apostles of pneumatic chemistry and endeavoured to show that every newly isolated gas had valuable physiological actions of its own. For this study he founded a Pneumatic Institution in 1798 at Clifton for the treatment of diseases by the inhalation of gases, perhaps in the hope that he might receive some satisfactory financial return from the venture. He placed Humphry Davy in charge of the laboratory, with the result that he made the discovery of the valuable anaesthetic effect of nitrous oxide or laughing gas. Maria Edgeworth, sister-in-law to Dr. Beddoes, has recorded the circumstances as follows: 'A young man, a Mr. Davy, at Dr. Beddoes', who has applied himself much to Chemistry, has made some discoveries of importance, and enthusiastically expects wonders will be performed by the use of certain gases, which inebriate in the most delightful manner, having the obvious effects of Lethe, and at the same time giving the rapturous sensations of the Nectar of the Gods! Pleasure even to madness is the consequence of this draught. But faith, great faith is, I believe, necessary to produce any effect upon the drinkers, and I have seen some of the adventurous philosophers who sought in vain for satisfaction in the bag of "Gaseous Oxyd", and found nothing but a sick stomach and a giddy head.'

Dr. Beddoes's other service to the history of science, his rediscovery of the long-forgotten work of Mayow, has been referred to in the chapter on All Souls. His son, Thomas Lovell Beddoes, 1803–49, is remembered rather as a poet than as an erstwhile physiological pupil of Blumenbach of Göttingen, who took an M.A. at Oxford in 1828, and lived abroad.

James Macie, or James Smithson, 1765–1829, was the illegitimate son of Sir Hugh Smithson or Percy, Duke of Northumberland. Matriculating in 1782 he obtained distinction as a mineralogist and chemist by 1786, when he was made an F.R.S. He lived abroad, but contributed valuable papers to the *Philosophical Transactions* and to Thomson's *Annals*. By his will £100,000 was left to the United States of America to found at Washington an institution for the increase and diffusion of knowledge. The foundation took effect in 1846, and the Smithsonian Institution has become world famous.

Smithson died in Genoa and was buried in the old British cemetery marked by a clump of cypresses on the ridge running out to the lighthouse. The latest news of him comes from an American tourist who was spending the last fortnight of 1903 in Genoa. Having heard that the Italian Government required his grave for the extension of barracks, he told an hotel acquaintance that it was 'a disgrace to America to allow Smithson's bones to be sent to a bone-factory. Something should be done, and done at once, to save us from the reproach of such ingratitude': it was surely incumbent upon the United States to transfer these saintly relics.

'Yes, it is,' replied his acquaintance, 'and I have been sent here to take them away. They were exhumed this morning and to-morrow will be on board ship—a North German Lloyd liner—and I shall of course go with them.' The ship was probably the *Princess Irene*, which sailed on Thursday, January 7, for New York. The acquaintance was Mr. Graham Bell.

A request had been made to the English chaplain to go up to the cemetery and 'say a prayer' upon the occasion, but he apparently did not receive the message. He said, however, that he should have refused to go, for the reason that if he went once he could not refuse to go upon every occasion when a body was taken up—and 'the cemetery is choked with bodies, all being rapidly removed'. The fact was that he knew nothing about Smithson, and had probably never heard of the Smithsonian Institution.

William Higgins was concerned with one of the greatest achievements of the human brain—the Atomic Theory. After a preliminary training in chemistry in the laboratory of his uncle Bryan in Greek Street, Soho, William came up to Oxford about 1785, being apparently attracted by the Master of Pembroke, Adams, who was 'considerable deep in Chemistry'. As contemporaries he would have had Gilbert Davies, who succeeded Humphry Davy as President of the Royal Society, and Richard Edwards, Lecturer in Chemistry at St. Bartholomew's Hospital, and James Smithson. Higgins acted as operator to Beddoes in the Old Ashmolean Laboratory in 1787, and after leaving Oxford became chemist to the Apothecaries'

Hall of Ireland and the Royal Dublin Society. In the Atomic Theory he went farther than his uncle. He was the first to write against the phlogiston theory of Stahl, but his principal claim to our notice was his discovery of that great law of chemical combination known as the Law of Multiple Proportions. The idea that there is a law regulating proportions when the same chemical constituents unite in different proportions to form a series of compounds, so that knowing the first proportion, we may infer that of the whole series, was first set forth by Higgins in his *Comparative View of the Phlogistic and Antiphlogistic Theory*, printed in 1788. This work contains many remarkable anticipations and discoveries to which later writers have laid claim, besides some additional facts decisively hostile to the hypothesis of phlogiston.

Nineteen years later John Dalton advanced as his own discovery the law of multiple proportions, whereupon Higgins published a second book entitled *Experiments and Observations on the Atomic Theory and Electrical Phenomena*, in which he abundantly established his claim of priority to the discovery of the fundamental Law.

Robert Hooper, 1773–1835, began life as apothecary to the Marylebone workhouse infirmary. He went up to Pembroke College in 1796, graduating M.B. in 1804, M.D. St. Andrews and L.R.C.P. 1805. He became a successful lecturer on the practice of medicine in Savile Row, and formed a large collection of pathological specimens. He was a voluminous author of works on anatomy.

1. *Observations on the Structure & Economy of Plants; to which is added the Analogy between the Animal and Vegetable Kingdoms*, Oxford 1797.
2. *The Hygrology; or Chemico-Physiological Doctrine of the Fluids of the Human Body*. From the Latin of J. J. Plenck, London 1797.
3. *A Compendious Medical Dictionary*, London 1798, 6th edit. 1831, eventually, after further editions, becoming the *Lexicon Medicum*.
4. *The Anatomist's Vade Mecum*.

5. *Anatomical Plates of the Bones and Muscles, reduced from Albinus.* 1802. 3rd edit. 1807.
6. *Observations on the Epidemical Diseases now prevailing in London*, 1803.
7. *The London Dissector*, London 1804.
8. *Examinations in Anatomy, Physiology and Pharmacy*, 1807.
9. *The Physician's Vade Mecum*, 1809, 1833.
10. *Anatomical Plates of the Thoracic and Abdominal Viscera*, 3rd edit. 1809.
11. *Morbid Anatomy of the Human Brain*, 1826.
12. *Morbid Anatomy of the Human Uterus and its Appendages*, 1832.

Several eminent physicians received their early training here towards the close of the eighteenth century. WILLIAM MOORE (1766–1832), the eldest son of the well-to-do London apothecary of the same name, came up from Campden School and qualified as D.M. in 1791. He served as an army surgeon during the campaign in the Low Countries, ending up with the duty of chief medical officer to the army depot in the Isle of Wight, where he died at the age of sixty-six. RICHARD POWELL, D.M. 1795, Harveian Orator 1808, who helped in the revision of the *Pharmacopoeia Londinensis*, 1809, also started his academic career in Pembroke but soon passed on to Merton.

RICHARD EDWARDS, son of the manager of a Cornish copper company, was a lawyer turned physician who proceeded D.M. in 1802. He excelled as a practical mechanic and in Chemistry, on which science he lectured at St. Bartholomew's Hospital. He died at Falmouth in 1827. Sir ARTHUR BROOKE FAULKNER, an Irishman, came to Pembroke via Catharine Hall, Cambridge, graduating B.M. and D.M. in 1806. As an army physician he served in Spain, Holland, Sicily, and Malta. After receiving a knighthood, he retired to Cheltenham, where he died, aged sixty-six, in 1845. He was the author of *A Treatise on the Plague*, 1820; *Rambling Notes and Reflections suggested during a Visit to Paris*, 1827; *A Visit to Germany and the Low Countries in 1829–30–31 and 1833.*

Clement Hue, a Jersey man, Fellow of Pembroke, D.M. 1807, followed Edwards as Lecturer on Chemistry at St. Bartholomew's, where in 1823 he was elected physician. Joseph Ager, 1780–1857, D.M., son of a London apothecary, lectured on Materia Medica at the College of Physicians in 1827–8 and helped Dr. Hooper to form his pathological museum. He enjoyed a reputation for taciturnity.

George Poulett Scrope, 1797–1876, travelled in Italy, Sicily, and Germany to carry on those studies on Volcanoes for which he was awarded the Wollaston Medal of the Geological Society in 1867. He became Secretary to the Geological Society in 1825, and sat as M.P. for Stroud in 1833–68.

George Rolleston, 1829–81, placed in the First Class in

Literae Humaniores in 1850, and having held several important medical appointments in London, became Linacre Professor of Anatomy and Physiology ten years later. For many years his *Forms of Animal Life* served as a model zoological text-book in which the 'type' system was adopted with conspicuous success. He was truly a great biologist and

ROLLESTON

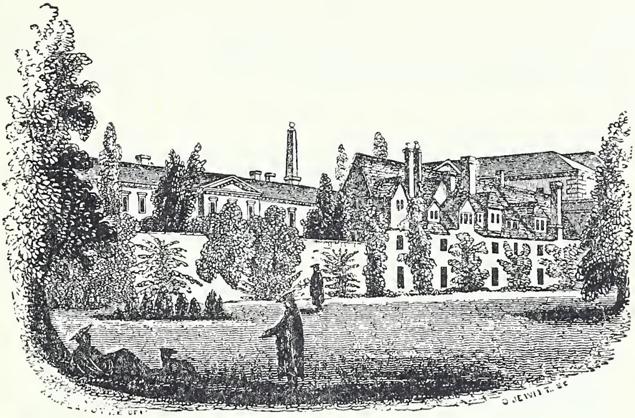
a student of all sorts of knowledge from Homer to Tennyson, from Aristotle to George Eliot.

The eminent mathematician the Rev. BARTHOLOMEW PRICE, F.R.S., 1818–98, was appointed to the Mastership in 1891 as the wise choice of Lord Salisbury. Having produced a volume on the *Infinitesimal Calculus* in 1852, he was elected to the Sedleian chair of Natural Philosophy. The value of his ser-

vices to the University, first as a Delegate and then as Secretary of the University Press, have been unsurpassed, for by his wise statesmanship he led that commercial business to a high pitch of prosperity and usefulness.

Bishop J. MITCHINSON, a good geologist who was the third Oxford graduate to obtain a First Class in Natural Science at a time when the examiner (Dr. Daubeny) was unable on three occasions to award any class to any other candidate at all. Bishop Mitchinson succeeded to the Mastership in 1899.

THE REV. RICHARD GRAVES.
Of Pembroke and All Souls Colleges. c. 1800



View from the Garden.

20. WORCESTER COLLEGE, 1714

Worcester College is the outcome of Gloucester Hall, whose ancient monastic buildings are still standing, one of the most picturesque things in Oxford. The Hall was founded in 1283 by John Giffard, in a meadow beside a stream well outside the town, so that Benedictine students might carry on their intellectual work in quiet near the University. One of them, John Feckenham, who died as last Abbot of Westminster in 1585, had a good working knowledge of sovereign medicines helpful in cases of ague, plague, and gout, which he wrote down in a book now in the Hunterian Library at Glasgow. In 1560 Sir Thomas White refounded the Hall as a retreat for good Catholics, their lodgers, knights, and ladies. In the course of time the buildings served not only as a retreat for Catholics, but also as a safe repository for scientific books. This came about through the visitation of Edward VI, when priceless books on all subjects were taken from Merton College Library and burned or sold as waste paper. Not less than a cartload of valuable manuscripts would have been destroyed had not some been rescued by Thomas Allen of Trinity College, who moved into Gloucester Hall in 1572, dying there, after sixty years of residence, aged 96, in 1632. He was the most learned astrologer of his time: Dudley, Earl of Leicester consulted him for casting nativities, as did Queen Elizabeth when a new star appeared in Cassiopoeia. 'The vulgar did verily

Thomas Allen M.A.

believe him to be a conjurer. He has a great many mathematical instruments and glasses in his chamber, which did also confirm the ignorant in their opinion; and his servitor, to impose on freshmen and simple people, would tell them that sometimes he would meet the spirits coming up the stairs like bees.' To him, more than to any other person, we owe the preservation of the works of the astronomer-physicians of Merton. Later, their manuscripts were acquired by Sir Kenelm Digby, and with his manuscripts went to the Bodleian in 1632. In a funeral oration Burton described Allen as 'the very soul and sum of all the mathematicians of his time'.

The geographical situation of Gloucester Hall caused it to be selected as the last resting-place of the body of Amy Robsart before her funeral in St. Mary's Church.

Sir Kenelm Digby, 1603–65, compounded a marvellous 'powder of sympathy' for the healing of wounds out of vitriol, which was applied to the bandage and not to the wound. But as he had the reputation of being 'the very Pliny of our age for lying' (Stubbes), and 'an arrant mountebank' (Evelyn) his assertions were not taken very seriously. His pretensions as a beauty specialist were also open to criticism. In order to preserve the beauty of his wife, Dame Venetia Stanley, a lady of a perfectly healthy constitution, he fed her on capons fattened with the flesh of vipers. She died suddenly, and some suspected poison. 'When her head was opened, there was found but little braine', which her husband imputed to her drinking of viper-wine. He found it expedient, however, to retire to study chemistry in the seclusion of Gresham College, for 'spitefull woemen would say 'twas a viper husband'. A more serious contribution to learning was his *Discourse concerning the Vegetation of Plants*, 1660, in which he expounded the importance of vital air (i.e. oxygen) to plants. His views on physiology and reproduction were criticized by Nathaniel Highmore of Trinity, who wrote a short censure on them.

Other distinguished members of the Hall included Theodore Haak, 'a German of the Palatinate', born 1605, who entered the Hall in 1629 and died in London in 1690.

Christopher Merrett, 1614–95, who took a D.M. degree from the Hall in 1642, but then, as we have seen, passed on to Oriel (p. 111). In the course of his thirty years' not unsuccessful practice in London he tells us that he had had 'some experience of what the groundless anger (of London Apothecaries) can do, when they some years since proclaimed me in their publick Hall their Enemy, for acting in the College of Physicians' interest, and of late . . . dispensing *gratis* my medicines'. He retorted by writing in 1670 a very exhaustive report upon all possible malpractices of Apothecaries, entitled *A Short View of the Frauds and Abuses committed by Apothecaries As well in Relation to Patients as Physicians: and of the only Remedy thereof by Physicians making their own Medicines*. This he published with the full knowledge that 'hereby a whole Company of men will become my implacable adversaries, and by their private whispers of untrue tales, will endeavour to their utmost either to keep me from any new, or shuffle me out of my fixt imployment'.

The report shows that there were in common use

'pitiful, dangerous, nay sometimes mortal medicines, whereby great sums of money have been gained in a short time. I shall instance first in Lockyers Pills made of Antimony, discovered to be so by some of my colleagues and myself at the first selling of them: A medicine as ill made as any of that Mineral, and no physician though meanly versed in Chymistry but could have excelled it. Yet so great a vogue this pill had for some time that infinite people resorted to him, and purchased them for their lives, both for themselves, and families, and (as I have heard) for posterities too. . . . Experience brought these pills into a disuse, if not a total oblivion, even amongst the vulgar.'

Four other cried-up medicines that he castigated were Matthews's pills made of opium, white hellebore roots, oil of turpentine and salt of tartar; Hughes's powder made of gold and quicksilver and sold at 10*s*. the grain and £3 10*s*. the dose; Delaun's Pill and Dr. Goddard's Drops. The composition of the last-named was exposed when some one wagered that the doctor would not be able to distinguish a sample of his Drops from a sample of spirit of hartshorn, and the doctor refused the wager.

William Cole, 1635–1716, M.D. of Gloucester Hall in 1666, practised in Worcester and was held in high esteem by

THE
Craft and Frauds
OF
PHYSICK
EXPOS'D.

The very low Prices of the beſt Medicines Diſcover'd.

The Coſtly Medicines, now in greateſt Eſteem, ſuch as. *Bezoar*, *Pearl*, &c. As alſo the *Diſtill'd Waters*, Cenſur'd.

And the too frequent Uſe of Phyſick prov'd Deſtructive to Health.

WITH

Inſtructions to Prevent being Cheated and Deſtroy'd by the prevailing Practice.

Diſcite Juſtitiam Moniti. Virgil.
Arte Medicâ nulla fructuoſior eſt. Plin.

The Second Edition, *improv'd. And Augmented with an Alphabetical Index of all the Simples and Compounds now in uſe, referring to the Page where their Virtues and Prices are ſet down.*

LONDON:

Printed for Tim. Childe, at the *White-Hart* in St. *Paul*'s Church-yard, 1703.

Sydenham, whom he followed to London in 1692. He was 'learned without ostentation, and polite without affectation'. His *De Secretione animali cogitata*, 1674, is a conjectural explanation of secretion on mechanical principles, but without any experimental basis. Apoplexies he attributed to the effect of cold, and dated an increase in the number of such attacks from the severe winter of 1683. He contributed several papers to the Oxford Philosophical Society in 1684–5 and was the author of the following works: *Physico-medical essay concerning the late Frequency of Apoplexies; with a general Method of Prevention and Cure*, 1689; *Novae Hypotheseos Febrium Intermittentium Symptomata explicandi Hypotyposis*, 1694; *De Mechanicâ Ratione Peristaltici Intestinorum Motus*, 1693; *Consilium Aetiologicum de Casu quodam Epileptico, annexa Disquisitione de Perspirationis insensibilis Materia et peragendae Ratione*, 1702. Also medical cases described in *Phil. Trans.* 1685.

James Pound, F.R.S., 1669–1734, proceeded M.A. from Gloucester Hall in 1694, and B.M. in 1697. Two years later he went to Madras as Chaplain to the merchants at Fort St. George. On returning to England he furnished an observatory at Wanstead, where he devoted himself to studying the movements of the satellites of Jupiter and Saturn. His skill in the use of astronomical instruments was remarkable, but he will probably be best remembered as the trainer of his greater nephew, James Bradley of Balliol.

Two Principals in succession, Tobias Garbrand, d. 1689, and J. Maplet were D.M.s of Oxford. The Oxford distiller, John French, dedicated his *Arte of distillation* to Garbrand.

During the second half of the seventeenth century the buildings of Gloucester Hall fell into disrepair. It was in 1692 that Dr. Benjamin Woodroffe, F.R.S., Canon of Christ Church, became Principal of the Hall, and elaborated plans for the foundation of Worcester College. The young foundation was helped by a gift of £10,000 from Sir Thomas Cookes of Worcestershire and by Dr. Clark of All Souls.

The first member of the new College to achieve considerable fame was JOHN WALL, 1708–76. He graduated D.M. in 1739, and when a consultant at Worcester interested himself in the purity and salubrity of the Malvern waters, planned walks on the hills, and became the founder of the present prosperity of Malvern Wells. His other great achievement was the establishment of the Royal Porcelain Works at Worcester, an undertaking which was due to a political motive. As a student in the Ashmolean Chemical Laboratory he had learnt that china clay from which alone fine porcelain can be made is a Cornish product, so he founded a company to build works, to transport the raw materials, and to start the business. But all through those early days from 1751 onwards we can see the influence of his fine and cultivated taste to which Worcester china owed its superiority and world-wide success.

The use of mineral springs for medicinal purposes had been revived in Italy in the sixteenth century and had become of great interest to English travellers to Naples and other favoured localities from that time onwards. The waters of Bath and these southern springs had encouraged the discovery of others in England. Plot had even described those near Oxford, but of all the new spas that made their appearance during the second half of the seventeenth century, Malvern, 1654, was one of the first. The wells of Astrop, 1664, it will be remembered were exploited by John Locke of Christ Church, and Hooke was interested in the 'late-found Balsamic Wells at Hoxdon (1687), but none rose so high in popular favour as those of Malvern when advocated by John Wall. His son Dr. Martin Wall became a Fellow of New College.

John Wall's pupil, James Wall of Worcester town, may be mentioned here, although he did not come up to the University. He practised in Leicester for nearly forty years and was the father of Sir Henry Halford of Christ Church.

Of medical interest we have ROBERT BOURNE, 1761–1829, D.M. 1787, F.R.C.P. 1790, Physician to the Radcliffe Infirmary and Reader in Chemistry. He published some *Cases of Pulmonary Consumption treated with Uva ursi*, 1805. SAMUEL HOLLAND was one of the few Oxford men who held the post of

Physician to the Middlesex Hospital, 1801–6, but resigned to take orders in the Church of England. THOMAS DE QUINCEY, 1785–1859, studied Hebrew and German and began the practice of eating opium here.

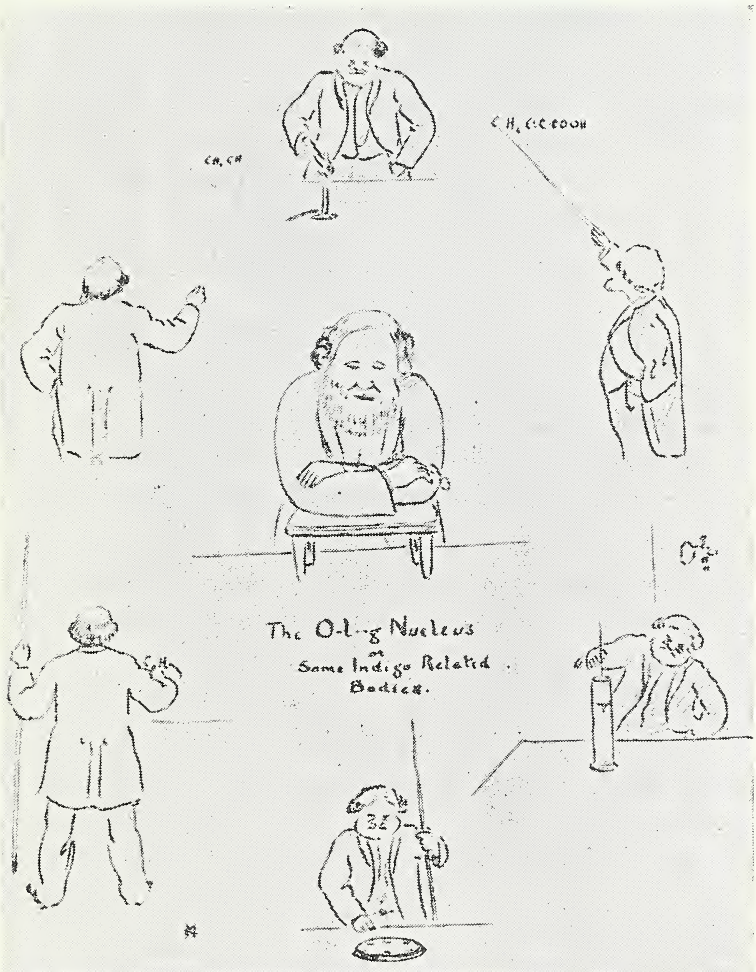
The beautiful lake was dry in 1817, and the College was rendered accessible three years later by the opening of Beaumont Street, which at one time bid fair to become the Harley Street of Oxford.

T. L. BEDDOES, 1803–49, the eldest son of Thomas Beddoes (see p. 277), combined poetry and medicine. As a pupil of Blumenbach of Göttingen he nearly became Professor of Physiology at Zürich at the age of thirty-two. He died after the amputation of a leg rendered necessary through a self-inflicted wound.

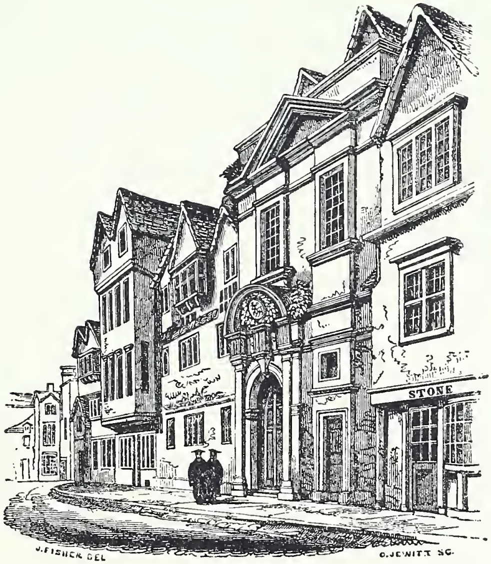
WILLIAM ODLING, 1829–1921, most eloquent of chemical lecturers, through whose pioneer labours with Williamson the accepted atomic weight of oxygen was doubled, being changed from 8 to 16, remained a Fellow of Worcester though his office as Waynflete Professor of Chemistry attached him also to Magdalen. His earlier appointments included a demonstratorship of Chemistry at Guy's Hospital, a Lectureship at St. Bartholomew's, and the Fullerian Professorship at the Royal Institution. He was elected Waynflete Professor of Chemistry in June 1872 and a Fellow of Worcester College on the following day. His published works included a *Manual of Chemistry*, 1861, and other educational works.

He was one of the analysts employed to test the purity of the water-supply of London.

THOMAS ROSCOE REID STEBBING, 1835–1926, was until his marriage in 1867 to the daughter of W. W. Saunders, F.R.S., a Fellow of Worcester. Settling at Torquay he began to take an interest in Natural History under the inspiration of William Pengelly. He was not originally a zoologist, but 'having become much interested in Natural Science, and having also been trained in the strictest school of evangelical theology, I had conceived it a duty to confute the vagaries of Darwin. But, on reading the *Origin of Species* as a preliminary, it has to


The O-l-g Nucleus
or
Some Indigo Related
Bodies.

be confessed that instead of confuting, I became his ardent disciple.' From then onwards he published *Essays on Darwinism* which drew upon him a good deal of ecclesiastical hostility. In 1888, after six years of work, he produced a fine report on the Amphipod Crustacea collected by the Challenger Expedition.



HERTFORD COLLEGE, 1819.

21. HERTFORD COLLEGE, 1740 and 1874

ALTHOUGH the continuity of the corporate life of Hertford College has been interrupted on several occasions and the last foundation dates only from 1874, yet its constituent parts, the original Hertford Hall or Hart Hall of 1284 and Magdalen Hall of 1602, can claim a much greater antiquity. Of the scientific alumni of Magdalen Hall mention has been already made: the first of those who belonged to Hart Hall appear to have belonged to the faculty of medicine.

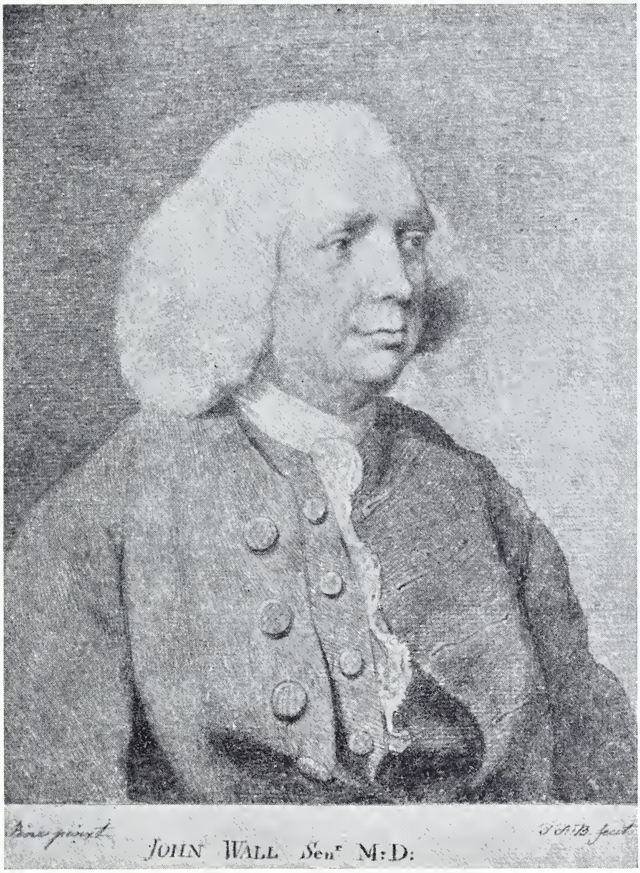
The distinguished physician GILBERT KYMER, who became Principal of Hart Hall in 1411, must be remembered for his share in superintending the completion of the Divinity School, a task which would have been to him, as the friend of Humphrey, Duke of Gloucester, a labour of love.

One of the more learned of our early physicians was EDWARD JORDAN, M.D. 1569–1632, believed to have been educated at Hart Hall, D.M. Padua 1591, and author of *A Briefe Discourse . . . of the Suffocation of the Mother. . . . Passions of the Body which in the common opinion are imputed to the Divell have their true natural causes*, 1603; *A Discourse of Natural Baths and Mineral Waters*, 1631.

Two Vice-Principals of Hart Hall, John Caswell, for a time Savilian Professor of Astronomy, and Philip Stevens, the botanist, have been mentioned on pages 268 and 138 respectively.

The great educationist John Theophilus Desaguliers, 1683–1744, of Christ Church, was appointed lecturer on experimental philosophy in Hart Hall, but removing to London in 1712 he continued his courses there, illustrating them with very numerous experiments, 70 on mechanics, 25 on hydrostatics, 25 on pneumatics, and 30 on optics. Even mathematicians 'may be diverted in seeing those machines used and physical operations performed, concerning which they have read'. The lectures were published in 1717 and again in 1734. They were attended by King George I, and by King George II and his queen, to whom a defence of constitutional monarchy in an allegorical poem *The Newtonian system of the World the best model of Government* doubtless appealed. Desaguliers was assisted by William Vream, who with Richard Bridges made the instruments for the lectures. In 1719 Desaguliers was elected Grand Master of the Freemasons. By 1722 his method of teaching physics was being continued at the Academy in Little Tower Street by B. Worster, who complained of the opposition of the Universities and the clergy to scientific lectures. In *The Principles of Natural Philosophy* he wrote:

'The great objection against all enquiries into nature is, that they are dangerous, and many times prejudicial to religion. I take notice of this objection the rather, because it is industriously propagated by many persons who ought to know better; and indeed I am inclined to think, that the chief design of keeping up this clamour, is to put a good face upon their own ignorance. However it is no new thing for men to despise and vilify what they do not understand, whatever be the reason of it.'



DR. JOHN WALL

From a drawing in the collection of Mr. Dyson Perrins

DESAGULIERS

But fortunately the methods of Desaguliers prevailed, and by 1727 the publication of *A Course of Mechanical and Experimental Philosophy* shows that the experimental lectures were being extended by JAMES STIRLING, F.R.S., of Balliol College, Peter Brown, William Watts, and William Vream,[1] both at the Academy and over the Bedford Coffee House, Covent Garden, where Desaguliers came to reside in 1739.

The eminent diplomatist and politician JOHN COXE HIPPISLEY, 1748–1825, also devoted much of his spare time to the encouragement of science, more particularly chemistry and mineralogy, in which interests his second wife shared. He matriculated in 1764, and studying law with success was created D.C.L. in 1776. Ten years later he entered the service of the East India Company. On returning to Europe he was employed in delicate political negotiations in Italy from 1792 to 1796. In London he became attached to the Royal Institution as one of its first managers in 1800, the year after the death of his first wife. His portrait appears in Gilray's picture of the administration of Laughing Gas during one of Davy's lectures at the Royal Institution. His scientific interests are well illustrated by the following letter from Charles Hatchett, one of the first Fellows of the Linnean Society.

Addressed to: Sir J. C. Hippisley, Bar^{t}. M.P.
Stone Easton House
near Bath.

Hammersmith
Lower mall Dec. 26th, 1805.

My Dear Sir,

I beg you to have the goodness to tell Lady Hippisley that Flos Ferri has nothing to do with iron, but is only a *Calcareous Stalactite.* The name 'Flos Ferri' has very improperly been given to it, in consequence of its having been most commonly found in the cavities of veins formed by the Sparry Iron Ore, especially in the Mines of Styria. In Lady Hippisley's Catalogue the following authorities may be quoted. [*Here omitted.*]

[1] W. Vream, author of *A description of the Air pump with the manner of making fifty of the most curious experiments upon it.*

This I hope will be sufficient to prove that Flos ferri is nothing more than a Calcareous Stalactite, and I think you will say that the authorities are quoted chapter and verse.

I have just seen a friend whose family (which is highly respectable) resides in Hanover. Many houses have had eight or more Prussian soldiers quartered upon them, which has caused great distress, but the universal exclamation is '*anybody but the French*'.

Give me leave to congratulate you on the success of your Motion respecting the Laboratory for the W of E Society [*sic*].[1] It will I am sure be attended with real and essential benefit, and the Society is much indebted to you for such a valuable addition to its establishment. I perfectly agree with you in your remarks upon another establishment, but it does not rest with me. I can only say, I would if I could.

Believe me Dear Sir John,

most faithfully yours CHARLES HATCHETT.

Pray say everything for us to Lady H., Col. and Mrs. Horner, Miss Hippisley, etc. etc.

P.S. If any of the specimens of the Flos Ferri have some portion of Spongy Iron ore, or any other adhering to them, they may be arranged accordingly and the Flos Ferri is then only to be considered as an *accompanyment*.

The second Lady Hippisley, daughter of Thomas Horner of Mells Park, married Sir John in February 1801 and brought him Stone Easton House. She had a chemical laboratory there and used to seek the advice of Charles Hatchett when her experiments did not succeed. Her large collection of minerals seems to have gone to the Museum of the Literary and Scientific Institution which was founded at Frome in 1847.[2] Sir John is buried at Stone Easton.

GRANT DAVID YEATS, 1773–1836, who matriculated here in 1790, was the son of Dr. David Yeats of Florida. An early introduction secured him the post of body physician to the Duke of Bedford when Lord Lieutenant of Ireland in 1806–7.

[1] Hippisley was Vice-President of the West of England Agricultural Society.

[2] I am indebted to Mr. Wightman for the opportunity of discovering Hatchett's letters in the rarely visited Museum at Frome. Hatchett was an acknowledged authority on minerals: he valued the Davy collection when it was offered to the Royal Institution in 1805 at over 100 guineas.

He graduated D.M. in 1814 as a member of Trinity College, and removed to London, becoming F.R.S. in 1819. His chief writings were *Observations on the Claims of the Moderns to some Discoveries in Chemistry and Physiology*, 1798; *An Address on the Nature and Efficacy of the Cow Pox in preventing the Small Pox*, 1803; *A Statement of the Early Symptoms which lead to Water in the Brain*, 1815.

Stephen Pellet, B.A. 1773, wrote a dissertation on *Miasmata*, printed in Edinburgh in 1779.

THE WOMEN'S COLLEGES

'I wish heartily that that sexe, which is thus advantaged by Nature with a choyce structure of body, and thereby gives cause to conclude, that the guest thereof must be more than ordinary, would not suffer themselves to be diverted from those nobler improvements they are, to speak the truth, as capable of as men; nor be contented to have their innate capacity in their education stifled or debased to the needle or the making of sweet meats.'

These words were uttered in 1660 by one of the first secretaries of the Royal Society, Henry Oldenburg of Bremen, perhaps the first of Oxford men to advocate the higher education of women.

The Societies of Women Students date from just before 1880. Lady Margaret Hall was opened in 1879, Somerville College was incorporated in 1881, St. Hugh's College was opened in 1886, and St. Hilda's College dates from 1893.

Many of their members hold important teaching appointments at Universities and Hospitals. A rough survey indicates that the greater number of women who have chosen to adopt a scientific career have taken medical qualifications. Out of a list of 32 graduates, 14 are licensed to practise medicine, the others who have done notable work seem to be divided among the various sciences as follows: Botany 5, Zoology 5, Anthropology 2, Chemistry 2, Crystallography 2, Mathematics 2.

The Colleges are too young as foundations to have as yet many distinguished daughters, but they have made a better beginning in the Natural Sciences than did many of the men's Colleges. Miss J. W. Kirkaldy of Somerville College was placed in the First Class in the Final Honour School of Zoology about forty-four years ago. Among her other contributions to the advancement of science we may mention her continuation of the work of Professor Weldon on primitive vertebrates, which included a reinvestigation of the kidney of Myxine published in the *Quarterly Journal of Microscopical Science* in 1894, and her *Revision of the Genera and Species of Branchiostomidae*, the family to which Amphioxus belongs, read at the Oxford Meeting of the British Association in the same year. An excellent translation of the widely read *Text-book of Zoology* by Professor Boas was prepared by Miss Kirkaldy in conjunction with her contemporary Miss E. C. Pollard.

OTHER OXFORD MEN OF SCIENCE

A BRIEF list of some of the more or less distinguished men of science who have worked in or for Oxford, but either were not members of the University, or whose names do not occur on the rolls of any of the Colleges, has been appended to the lists of Alumni printed in *Early Science in Oxford*, iii, p. 548.

There have always been physicians and surgeons engaged in medical practice in the County and City of Oxford who have not been attached to any of the Colleges of the University, or whose membership cannot now be identified. Among others JOHN GEYNES, D.M. 1535, attained to some notoriety through being cited before the College of Physicians in 1559 for impugning the infallibility of Galen. Four years later he died of the plague. Dr. RICHARD SMITH flourished about 1550–60. ALEXANDER READE of Aberdeen was created D.M. in May 1620 by Convocation by virtue of letters from King James I. He was distinguished as an anatomist and surgeon. JOHN BANISTER, non. coll., a great surgeon who in 1573 obtained the Oxford licence to practise, and settled at Nottingham, was the author of works on surgery; STEPHEN BREDWELL, a native of Oxford, wrote *Helps for Suddain Accidents endangering Life*, 1633, and *Physick for the Sicknesse commonly called the Plague*, 1636.

The list can be very greatly extended in many directions; indeed, such a subject as Oxford Botany has had more votaries among those who were not matriculated members of any of the Colleges.

The first notice of an Oxfordshire plant appears in a small work on *The Names of Herbes* published in 1548 by William Turner, a Fellow of Pembroke College, Cambridge, who received the D.M. degree at Oxford. His successor, Thomas Johnson, received the D.M. Oxon. 1643, ten years after he had re-edited, enlarged, and corrected Gerarde's *Herbal* 1633. Again, Henry Danvers, 1573–1644, the founder of the Oxford Physick Garden in 1622, was not a member of the University. Nor was Jacob Bobart, the first Keeper of the Garden and author of the *Catalogus plantarum Horti Medici Oxoniensis*, 1648. Oxford never had a more devoted servant. He was buried in St. Peter's in the East, where is a monument *To the pious Memory of* Jacob Bobart, *A native German, A man of Great Integrity, Chosen by the Founder to be Keeper of the Physic Garden. He died Feb. the 4th* 1679 *in the* 81*st Year of his Age.*

His son, Jacob Bobart, succeeded to the botanical chair on the death of Morison in 1683; and his successor John Jacob Dillenius, 1687–1747, has been mentioned on p. 244.

The teaching of Mathematics was practised most successfully by John Kersey, 1616–95?, of Banbury, who wrote a large book on *The Elements of Mathematical Art, commonly called Algebra*, 1673–4, the standard work of its day, and forerunner of Cocker's *Arithmetic* of 1703. Kersey held classes in Charles St., near Covent Garden, and later in Chandos Street, St. Martin's Lane. But even long before his time a certain Augustinian Friar of the name of Whitehead is said to have trained in Oxford the eminent mathematician of Cambridge, Sir Henry Billingsley.

Chemical studies were greatly advanced by the lectures and demonstrations of Peter Sthael, who received much early encouragement from the Father of Chemistry Robert Boyle.

It was a great day for Oxford when Boyle accepted the invitation of Wilkins, Warden of Wadham, to reside in our City. He took lodgings in Crosse's house on the west side of University College, known by the name of Deep Hall. It was there that Peter Sthael gave his first lectures on Chemistry;

H. COLEY

Adopted son of William Lilly, b. Oxford 1633

there Boyle seems to have discovered that spirits of wine was a good preservative for anatomical preparations; and there Robert Hooke constructed the first English Air Pump. By their experiments Boyle and Hooke made those measurements on which Boyle's Law of the expansion of gases is based. They produced evidence to show that the processes of respiration and combustion are essentially similar in nature, depending upon air, for when that is withdrawn the mice, sparrows, and lighted candles died or went out. Boyle's Air Pump became the progenitor of the Newcomen Atmospheric Engine, and therefore of the industrial age in Britain. With his pneumatic engine Boyle also investigated the phenomena of phosphorescence and came to the conclusion that air had a great deal to do with it.

The story of our knowledge of respiration was continued by Hooke and Lower of Westminster and Christ Church, and Mayow of All Souls.

Elsewhere the view has been expressed that Boyle would not have progressed so successfully with his pneumatic researches if he had not had the advantage of the assistance of Robert Hooke, for Boyle does not appear to have been a mechanical or a manipulative genius, and this view has received confirmation from a note[1] written by Thornhill to Charlett, the Master of University College, presumably about 1698: 'Gentlemen who knew Mr. Boil when living say that he had framed a rough draft of this engine and for the same purposes, but could never bring it to any perfection.' The engine was Captain Savery's invention for the raising of water by the force of fire, designed for the draining of mines. Boyle died in 1691, when Savery was about forty years of age.

It is interesting to read the estimation of the work of Boyle contained in the writings of his immediate successors. Bradley, for instance, when lecturing on 'the more known properties of the Air establish'd by ye Air Pump', feared that he should be thought to have injured someone by ascribing the invention to a foreigner, but he explained that 'the Air Pump indeed

[1] MS. *Ballard* 11, fol. 124, to which Mr. Minn has recently drawn attention.

is so generally known by the name of Machina Boyleana, and the void space produced by it is so commonly called Vacuum Boyleanum, that many are thereby persuaded to it. They do very justly bear the name of Mr. Boyle, since whoever might happen to be the inventor of them, his certainly was the more excellent part to have first applyed them to such admirable and useful purposes; . . . the glory of the English experiments has in a manner totally eclipsed that of ye Magdeburgick.'

Henry Oldenburg of Bremen, born *c.* 1615, matriculated as 'nobilis Saxo', which means nothing at all, in 1656. He acted as tutor both in Oxford and on the Continent to Richard Jones, a nephew of Robert Boyle, with whom he was on intimate terms. From Saumur he wrote to John Milton and to Boyle concerning the 'existence and working of Animal poison', and later on, from Paris, he sent news of a wonderful oil that would heal 'migrane, palsies, lameness, crookedness and all ricketing diseases'. About November 28, 1660, at a meeting for considering the constitution of the Royal Society, Oldenburg was named as co-secretary with Wilkins. It was but an empty honour, for the Society was not in a position to pay any salary, but as it was realized that its Secretary must live, he was permitted in 1664 to publish *Transactions* and to 'make what he could', which seldom amounted to more than £40 a year. The Secretary's life was not a happy one, for his foreign correspondence raised suspicions against him and in 1667 he was imprisoned in the Tower. He died at Charlton in Kent in September 1677.

His advocacy of the higher education of women is printed on page 301.

What should have been a considerable endowment in Oxford for higher zoological studies was provided by Martin Lister, 1638?–1712, who though not an Oxford man himself, was the father of Alexander Lister of Balliol, and had been educated by his uncle Sir Matthew Lister of Oriel (p. 109). Becoming an F.R.S. in 1671, he practised medicine in York until the year of the opening of the Old Ashmolean for

Science. Next year, 1684, he took the Oxford D.M. degree; but although he was settled in London, he presented to the Ashmolean all the drawings of shells that had been made by his two sisters for his great *Historia sive Synopsis Methodica Conchylia*, 1685–92. Later he gave his scientific library also. It was a most appropriate gift, for the Ashmolean was a scientific institution in those days, and it stimulated George Huddesford to produce a second edition in 1770. Since the Lister library has been removed to the Bodleian, the Lister collections have been lost, and the whole intention of his benefaction as a departmental library has been frustrated. Lyell considered that the publication of Lister's essay on Maps in 1683 marked the beginning of the era of Geological Maps.

In 1695 Oxford was visited by Dr. BERNARD O'CONNOR, a most remarkable man, an Irishman, who had travelled extensively on the Continent, and had taken a degree in medicine at Rheims in 1691. Beginning as travelling-tutor to the sons of the High Chancellor of Poland, whom he met in Paris, he passed on into Italy. In Venice he was called to attend William Legge, Earl of Dartmouth, who had contracted a fever; and, having recovered his patient, accompanied him to Padua. Later he spent some time at the courts of the Emperor Leopold at Vienna, and of John Sobieski at Warsaw, who appointed him physician to his Polish Majesty.

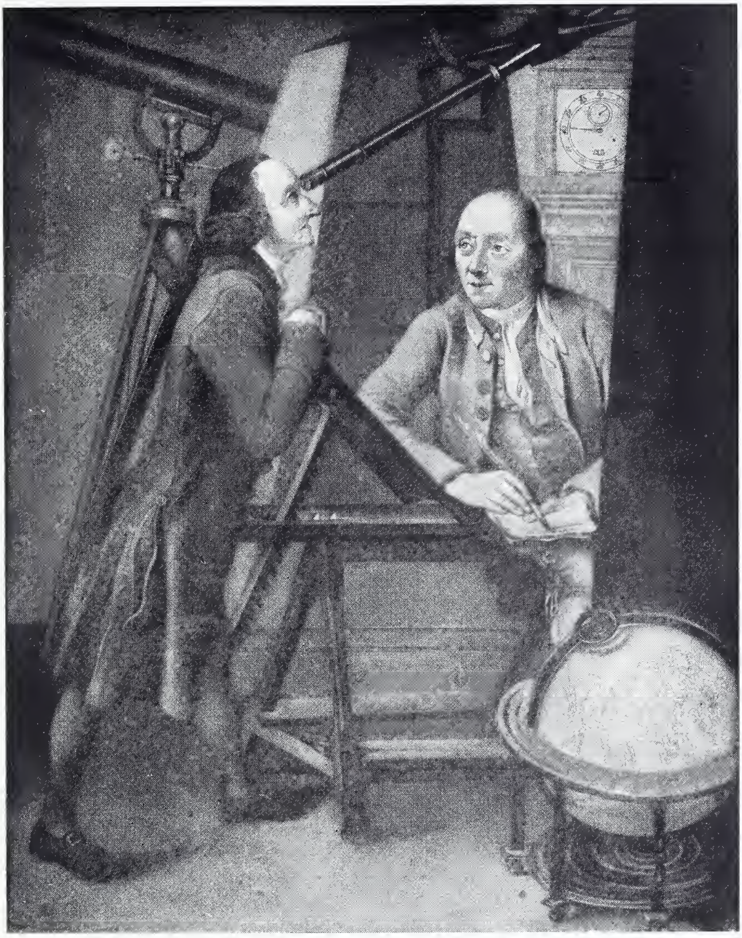
There his reputation was still further enhanced by his successful diagnosis of a case of abscess of the liver in the king's sister. His position was thereby secured, but O'Connor was too much of a roving spirit to remain long in one employment. Being appointed physician to Princess Teresa Cunigunda he travelled with her as far as Brussels, where he left her, to return to England in February 1695. During his long tour he had become acquainted with Malpighi, Bellini, Redi, and other men of science, and had studied their discoveries in anatomy, chemistry, and physic to such good effect that he was able to lecture learnedly upon them in London and

Oxford. During his sojourn here he published *Dissertationes Medico-Physicae de Antris Lethiferis; de Montis Vesuvii Incendio; de Stupendo Ossium coalitu; de Immani Hypogastrii Sarcomate.* He was elected into the Royal Society and the College of Physicians, but died soon after at the early age of thirty-two.

Scientific studies were so well to the fore during the second half of the seventeenth century that Oxford could boast a local maker of instruments, JOHN PRUJEAN, who had a shop in New College Lane, presumably near the corner of what is now know as Hell Passage, where he sold astrolabes and quadrants printed on paper. Two examples of his work on brass are still extant. The Manciple of Wadham College, BROOKES, also had the reputation of being a skilful mechanic, a craft in which he was most successfully followed by that eminent clock-maker JOHN KNIBB, fl. 1670–90, who with JOHN HAWTING must share the honour of having produced the most valuable clocks made by Oxford men.

GEORGE PARKER, second EARL OF MACCLESFIELD, 1697–1764, learnt mathematics from de Moivre and William Jones. Becoming a Fellow of the Royal Society in 1722 he, helped by Bradley, erected an astronomical observatory at Shirburn in 1739. Its equipment, reputed to have been the best then obtainable, included a 5-foot transit and quadrant by Sisson, a 14-foot refractor and a $3\frac{1}{2}$-foot achromatic both by Dollond, and clocks by Tompion and Graham. He observed the great comet of December 1743, and his observing-books extend from 1740 to 1787 for the Transit, and from 1743 to 1793 for the Quadrant. He trained his stable-boy, THOMAS PHELPS, 1694–*c.* 1780 to take observations. There exists a rare mezzotint engraving showing Phelps in the act of observing with the 5-foot transit at Shirburn in 1776 when he was 82 years of age. The other figure, the recorder, was JOHN BARTLETT, originally a shepherd.

The Natural Sciences have been cultivated as well as the Arts at Blenheim, but necessarily with less continuity, for whereas a work of art may always be present for appreciation, a



THE EARL OF MACCLESFIELD'S ASTRONOMERS
AT SHIRBURN CASTLE

physical experiment or observation is a thing of the moment. GEORGE SPENCER, 1739–1817, the 4th DUKE OF MARLBOROUGH, is remembered for his great interest in astronomy. He worked hard as a pupil of Hornsby's, he helped the Radcliffe Trustees to equip their Observatory in Oxford with the gift of the fine reflecting telescope now in the Old Ashmolean Museum, and he became an F.R.S. in 1786. The scientific tradition still held on at Blenheim, and in the time of JOHN WINSTON, 1822–83, the 7th Duke, who is better remembered for having sold the Marlborough Gems and the Sunderland Library, and in that of GEORGE CHARLES SPENCER-CHURCHILL, 1844–92, the 8th Duke, there was much important physical apparatus in the house. The latter was described by Lord Redesdale as having come 'within measurable distance of reaching conspicuous success in science, mathematics and mechanics'. In London he acted as Chairman of the City of London Electric Light Company and of the Telephone Company. The Blenheim apparatus was probably the best of its kind in any large country house in England, and we still have in the Oxford History of Science Museum a large Air-Pump, a Gramme Electric Machine by Breguet, a Sprengel Pump, and a superb Spectroscope—all the gift of Lily, Duchess of Marlborough in 1892.

Oxford's principal Medical Institution, the Radcliffe Infirmary, has become a centre of science and research, and has brought many eminent surgeons and physicians to reside in our city.

Though JOHN RADCLIFFE was a Fellow of Lincoln College from 1669 to 1677 and practised in Oxford as a physician until he went to London in 1684, there appears to have been no thought in his mind of founding a hospital in Oxford. His will, after mentioning his desires for a foundation of a library, bequeaths certain money to St. Bartholomew's Hospital, London, 'towards mending their diet and for buying linen'. The founding of the Radcliffe Infirmary was part of a great charitable movement that spread throughout Great Britain in the middle of the eighteenth century. Previously medical practice at least for much of the poor had been in the hands of very illiterate and ignorant practitioners, though men in good practice had often given an hour or so of their services in the day for people unable to pay.

The decision to found an Infirmary at Oxford was taken by the Radcliffe Trustees in 1758 and appears to have been the special care of George Henry Lee, third Earl of Lichfield, Chairman of the Trustees, and Thomas Rowney, M.P. for the City of Oxford, who generously gave the site. The Infirmary was built and equipped entirely by the Radcliffe Trustees, and was opened for the admission of patients in October 1770. It was then handed over to the University as a public institution, and the University with the general public was made responsible for its maintenance. The hospital, therefore, from its inception until the year 1885, when it obtained a Royal Charter, was a University institution, governed by University officers and staffed, as regards its physicians especially, by Fellows of colleges or teachers in the University. On the initial staff of the Infirmary the four physicians all held University appointments: William Lewis was a Student of Christ Church and a practising physician; William Vivian, Fellow of Corpus Christi College and later in 1772 Regius Professor of Physic; John Smith, Vice-Principal of St. Mary's Hall, a practising physician; and Dr. Foulkes.

The site comprised five and a quarter acres between Woodstock Road and what is now Walton Street. The original building consisted of four wards on the first and second floors, respectively, and accommodated seventeen patients in each ward, and in addition to the patients there were an apothecary, matron, four nurses—one for each ward—an assistant nurse and a night nurse, three household servants, and a porter.

Dr. A. G. Gibson, from whose account of the Infirmary this brief sketch has been taken, has compiled an admirable series of brief biographies of the following members of the Medical and Surgical Staff in his book *The Radcliffe Infirmary*, 1926; and although many of these persons have already been mentioned under the Colleges to which they belong, there are many others who would find a more appropriate place in the present chapter.

R. Frewin	S. B. Watson	W. Stephens
W. Lewis	W. A. Greenhill	J. Swift
W. Vivian	R. Jackson	E. M. Wardle
J. Smith	H. W. D. Acland	W. Tuckwell
J. Parsons	G. Rolleston	G. Hichings
M. Wall	G. W. Child	W. Dobson
W. Austin	E. B. Gray	W. Cleoburey
J. Latham	H. M. Tuckwell	C. Wingfield
W. Thomson	S. D. Darbishire	C. L. Parker
R. Bourne	J. Ritchie	W. P. Ormerod
J. Sibthorp	W. Osler	J. T. Hester
G. Williams		E. L. Hussey
Chr. Pegge		R. J. Hansard
J. Kidd	H. Towsey	F. Symonds
J. A. Ogle	J. Grosvenor	A. Winkfield
C. G. B. Daubeny	Ch. Nourse	W. L. Morgan
C. J. Bishop	J. Langford	H. P. Symonds
J. Wootten	R. Burford	E. A. Bevers

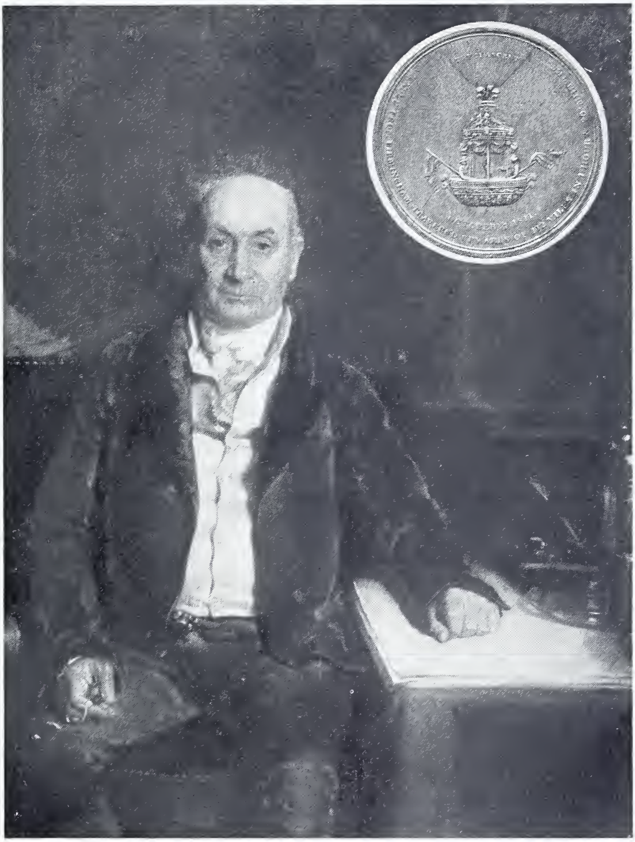
A number of local fossils were selected in 1772 by JOSHUA PLATT, a curiosity-monger of Oxford, for Christopher Sykes, the eminent agriculturist of Brasenose College. The list was printed by C. Davis Sherborn in *The Naturalist* for May 1934.

The first English Aeronaut, JAMES SADLER, was born in Oxford in 1753. His father was a confectioner in the High Street. As an assistant in the chemical laboratory in the Old Ashmolean he undoubtedly learnt the preparation and properties of 'inflammable air', with which in February 1784 'before a great concourse of people' he inflated an 'air balloon' measuring 36 feet in circumference. Other balloons that he made were exhibited first in the Town Hall and then released from the Physic Garden or from Christ Church Meadows. His record-making flight was made on October 4, 1784, when he travelled six miles in the direction of Islip. His second attempt on November 12 took him to near Aylesbury, 14 miles off, in 20 minutes. Further flights with passengers followed, but were discontinued after June 1785 owing, it was said, to the jealousy of the dons 'of his superior science'. Four years later we find him lecturing on 'philosophic fire-works', and in the early nineties he was acting as Assistant to the 'Professor' of Chemistry, Dr. Thomas Beddoes. Cox recollected that he was 'a clever, practical and experimental manipulator in chemistry, and as such was patronised by the University, or rather by the few scientific men then in the University'. In 1796 he obtained the important post of technical adviser to the Admiralty, or as it was described, Member of the Board of Naval Works and Inspector of Chemistry to the Admiralty. He was handicapped by the failure of the authorities to provide him with any 'manufactory, workshop or laboratory' in which to carry out his duties, so he was obliged to turn his own dwelling into a Manufactory for Gun-carriages, a Brewhouse, or a Chemical Laboratory, as his object might require.

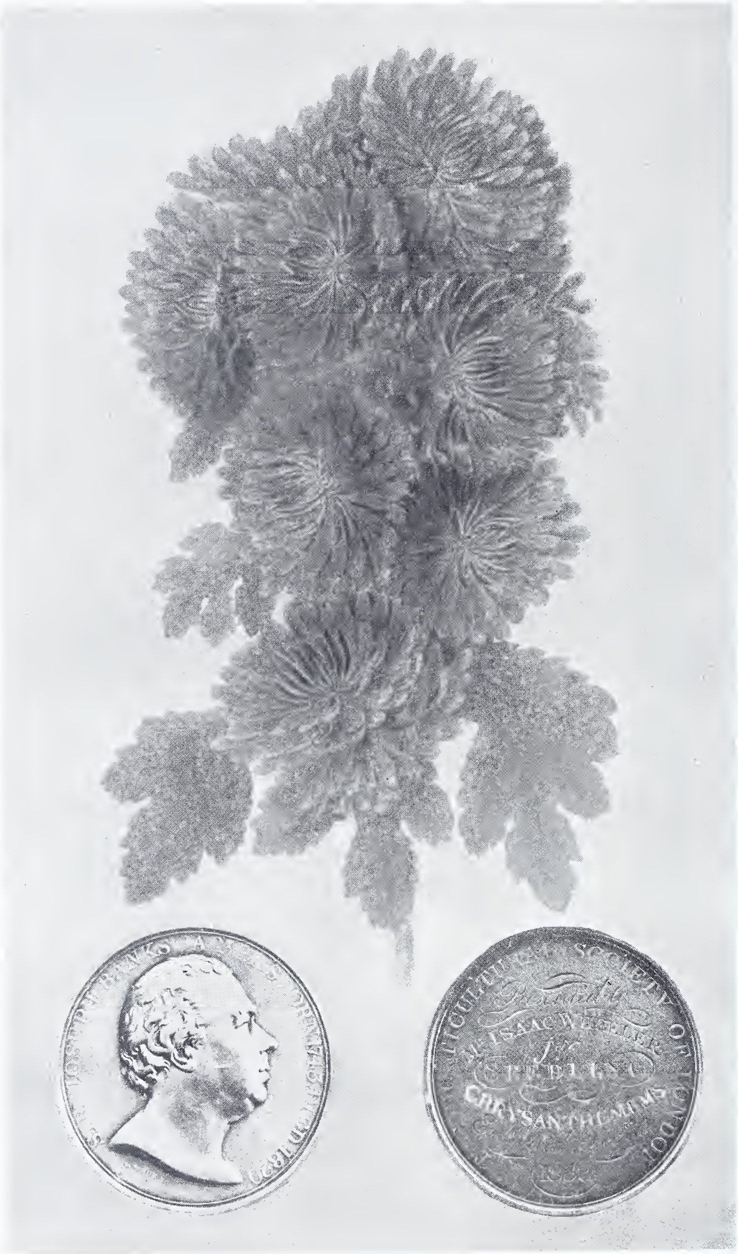
His chief researches during the next decade related to the qualities of Copper-sheathing; the Distillation of Sea-water; Analysis of Dockyard Spring-water; improvements in Brewing on shipboard; the Seasoning of Timber for shipbuilding; Combustion of Gunpowder for Fire-ships; construction of Signal-lights; improvements in Air-pumps; an impurity in Nitrate of Ammonia, etc. However, an ungrateful body of Lords Commissioners dismissed him from their service in 1810, without compensating him for the laboratory and expensive machinery which he had erected out of his own money for their service. His friends, who included John Lockhart, M.P. for Oxford, started a subscription to meet his immediate necessities.

During this period he designed several steam-engines. Beginning with the first steam-engine he erected at Coalbrookdale in 1792, he made others in 1793 and following years. In 1796 a Sadler engine was working on Garlick Hill, London, for Sutton, Keen & Co., the mustard-makers, and finally there was a successful engine in Portsmouth Dockyard which was in use until 1805. Mr. Hodgson considers that Sadler took 'a big step in the direction of making the steam-engine direct-acting and self-contained, that is in freeing it from the trammels of the engine-house'.

He then turned his attention to the improvement of artillery,



JAMES SADLER



CHRYSANTHEMUM RAISED BY ISAAC WHEELER AND HIS BANKSIAN MEDAL, 1832 with such success that in 1799 four sloops in the Navy were armed with Sadler's patent carronades. The accuracy and quickness of firing gave satisfaction to the officers concerned. Nelson, too, remarked that he 'would take on board the Victory as many guns as Mr. Sadler could send alongside'. Unfortunately Sadler was in poor health and could not execute the order.

The Rifling in small arms appears to have been due to his suggestion, as well as the idea of a cradle for the recoil of guns. The open-neck balloon may also be attributed to him. In 1808 we find him writing to Lord Mulgrave about a project for conveying dispatches without difficulty or danger into France and other parts of the Continent. From 1810 onwards he became a professional aeronaut, and died in 1828. His son, Windham Sadler, became manager of the Liverpool Gas Company.

The time was evidently favourable to the production of engineers, for Sadler's contemporary, William Weston, 1753–1833, was a civil engineer who made a great name for himself as the constructor of the first canals in America. He was born in or near Oxford, and was trained under James Brindley. In 1787–91 he built the three-span bridge over the Trent at Gainsborough. He was the engineer of the Oxford Canal and lived in the Canal House.

When the Americans turned their thoughts to canals, it was found that they had no competent engineers who could deal with their special problems. Of land-surveyors like George Washington, bred to the use of compasses and circumferentors, there were plenty. Early in 1792 the Pennsylvania group of canal prospectors, hearing that Weston was one of the most experienced in England, offered him a handsome salary to 'manage, superintend and direct an inland navigation in the State of Pennsylvania'. A copy of the contract in 2,000 words is in the possession of the Reading Company. He certainly would have taken his engineer's level with him, the first that had ever been used in America. Between 1792 and 1800, when he returned to England, he worked at six canals, a turnpike road, the Potomac River locks, Schuylkill Perruant Bridge, and the public water-supply of New York. His lineal descendant of the sixth generation, Mr. W. T. Coxhill, is working in Brasenose College bursary to-day.

Two horticultural achievements are well worthy of record. George Kempster, who resided at Old Woodstock, on the west side of the road near the Mill, and there died 15th September, 1773, was the first grower of the Blenheim orange apple.

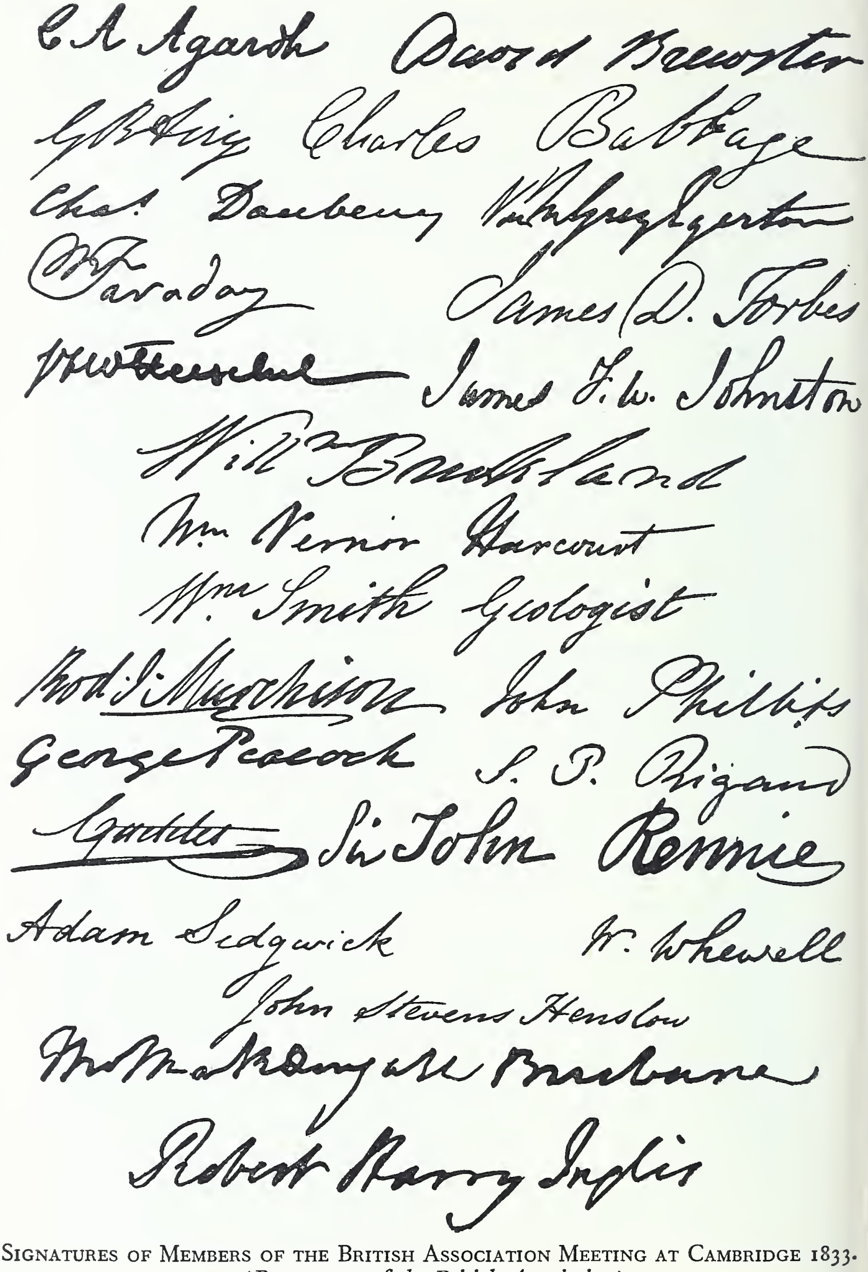
'When a young man he observed a plant growing close to the wall of the house; it was so young that he could not ascertain what it was, but liking its appearance, he removed it into a flower pot, where it became so large that he transplanted it into his garden. In due time it produced two apples, which proved remarkably fine. The tree continued to thrive, and regularly every year bore fruit. One year its produce amounted to twenty-one bushels. No person could state how it came there, for nothing like it was to be found around that country; every one was desirous of possessing a Kempster pippin, as it was at first called, and such was the eagerness to obtain grafts that large branches were repeatedly torn off in the night-time. The general size of the fruit is that of a large orange. In shape it resembles a handsome golden pippin, as it does also in flavour. Its colour is a bright yellow tinged with red. Its culinary properties cannot be exceeded by any apple hitherto known, and it will with proper attention keep sound and fit for the table until March. Plants and grafts of this tree have been sent into every part of the kingdom. In 1811 Mr. Whitman, the Duke of Marlborough's gardener, prevailed on his Grace to allow them a place on his table, and the Duke highly approving of them, they have since obtained the name of the Blenheim orange. In 1820 Mr. Cook, fruiterer in Covent-garden Market, sold a bushel of them for 14s., they being before this period unknown in the Market. The original tree was standing in 1826. On the 21st of September, 1822, five of these apples gathered in the garden of Mr. Fardon, of Woodstock, weighed as follows:—No. 1, 1 lb. ½ oz., its circumference being 13 inches; No. 2, 1 lb. 5¼ ozs., 14½ inches; No. 3, 15 ozs., 12¾ inches and ⅛ inch; No. 4, 1 lb., 12¼ inches and ⅛ inch; No. 5, 1 lb., 12½ inches; total, 5 lbs. 4¾ ozs., or 84¾ ounces. When first gathered their total weight was 88¼ ozs. They were exhibited at the October meeting of the Horticultural Society in that year, where the Banksian silver medal was awarded for them. In the same year Mr. Griffin, surgeon, of Deddington, gathered one of these apples weighing 24 ounces.'

Of the largest of these specimens a model in wax was made, which was (1822) in the possession of Professor Westwood, of Oxford, and is now in the Museum of the History of Science.

Another local horticulturist whose name was well known at the time was WILLIAM WHEELER of Oxford, who is said to have been the first in England to raise chrysanthemums from seed, an achievement which was recognized by the award of a Banksian medal in 1832, on the occasion of a flower-show held where No. 4 Beaumont Buildings now stands, at the back of St. John's Street. The red chrysanthemum named Miss Wheeler was figured in the *Gardener's Magazine* for 1890.

The little village of Churchill in north Oxfordshire has the distinction of being the native place of the Father of Geology, WILLIAM SMITH, 1769–1839. At the age of eighteen he became assistant to a surveyor living at Stow-on-the-Wold, and in course of this employ acquired such a good knowledge of the soils and underlying rocks of the county that in 1793 he was entrusted with the survey of a canal in the Somersetshire coal-field. In 1795 he removed to Bath and in the next ten years he accumulated the geological collections, fossils, maps, and sections of strata from which his great Geological Map was evolved.

In 1831 the Council of the Geological Society passed a resolution 'That the first Wollaston medal be given to Mr. William Smith, in consideration of his being a great original discoverer in English geology; and especially for his having been the first, in this country, to discover and teach the identification of strata, and to determine their succession by means of their imbedded fossils'. And, appropriately enough, it was in Oxford in June 1832, on the occasion of the second meeting of the British Association, that the Wollaston Medal was handed to Smith together with the announcement of a civil list pension of £100 a year. His signature appears among those of members attending the Cambridge Meeting of 1833. *Memoirs of William Smith, LL.D., author of the 'Map of*



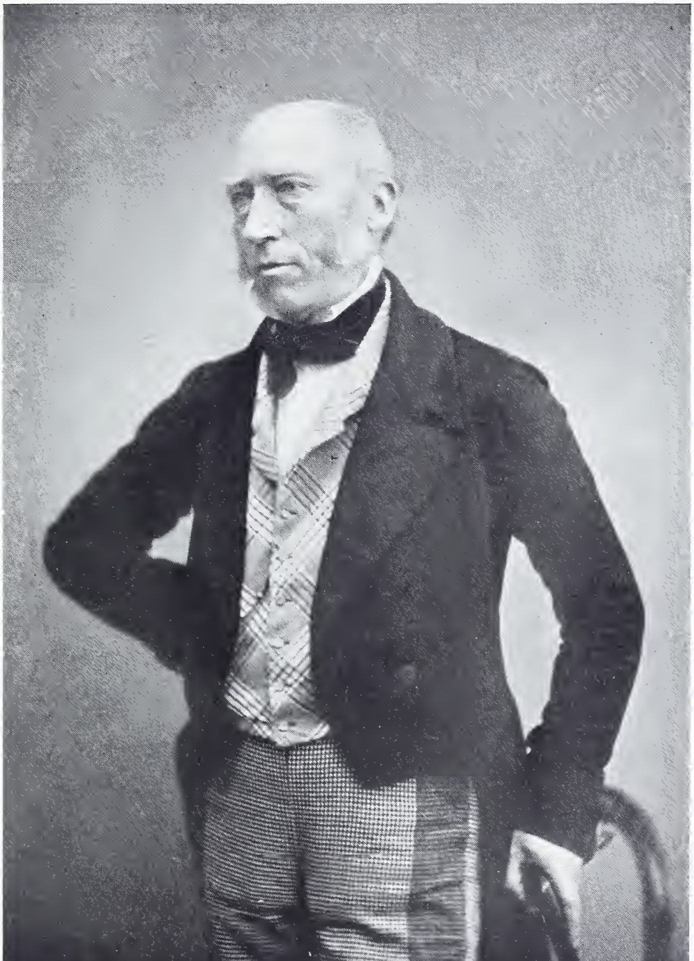
Signatures of Members of the British Association Meeting at Cambridge 1833.
(By courtesy of the British Association.)

the Strata of England and Wales' were compiled by his nephew and pupil John Phillips in 1844.

JOHN PHILLIPS, 1800–74, had every professional advantage that birth can give, for his mother was the sister of William Smith of Churchill, 'the father of geology'. She died when John was but seven years of age and left him to be brought up by his uncle William. His natural tastes were still further fostered by a prolonged visit to the Rev. Benjamin Richardson of Farley Castle near Bath, who had been at Christ Church and was one of the best naturalists in the West of England. Between 1815 and 1821 he resided with his uncle at the east end of Buckingham Street, Strand, and accompanied him on many geological excursions and sketching tours, for the purposes of his geological surveys. 'Innumerable rambles led us up every glen and across every hill, now sketching waterfalls, anon tracing the boundaries of rocks, or marking the direction of "diluvial" detritus. . . . For two or three months we were incessantly occupied by investigations of the lead and copper mines.' In 1825 Phillips was appointed Keeper of the Yorkshire Museum and with industry unremitting for a quarter of a century he compiled his *Illustrations of the Geology of Yorkshire* and his *Rivers, Mountains and Sea-coasts of Yorkshire*, in which his aim was 'to plead with the residents of Yorkshire for a better knowledge of its natural beauties and the memorials of its old inhabitants'. On September 27, 1831, he communicated a statement to a meeting of influential persons, and as a result was founded the British Association for the Advancement of Science—'to give a stronger impulse and a more systematic direction to scientific inquiry; to promote the intercourse of those who cultivate science in different parts of the British empire with one another, and with foreign philosophers; to obtain . . . a removal of any disadvantages of a public kind which impede its progress'. The second meeting was held at Oxford, and Phillips was chosen Assistant General Secretary, which office he held until 1863. In the meantime he had done much work for the Geological Survey. He served on a Commission of inquiry into the system of ventilation of coal-mines, and recommended inspection by H.M. inspector of collieries. And having held professorships of Geology at King's College and in Dublin, he finally accepted a Readership in Geology in Oxford in 1853. The *Geology of the Thames Valley*, of *Vesuvius* and of the *Phlegraean Fields* were all treated by him in turn, and he also investigated the contour of the mountains of the moon. Last, but not least, he became the first Keeper of the New Science Museum at Oxford. He died in 1874 in consequence of a fall down a flight of steps in All Souls College.

The cause of Rain, Storms, the Aurora, and all the allied meteorological phenomena were subjects of all-absorbing interest to George A. Rowell, 1803–*c.* 1890, who proudly described himself as Underkeeper of the Ashmolean Museum, meaning the Old Ashmolean. He was the last living official connected with that institution who did his best according to his lights to preserve the original tradition of scientific teaching and research. Unfortunately he suffered from a deficiency of early education which might have saved him from tediously reiterating his views and grievances in his old age. Briefly, he lost no opportunity of observing and recording unusual meteorological phenomena—'from my childhood one of my greatest delights was to watch the lightning and listen to the thunder'. The chance loan of a copy of Lovett's *Philosophical Essays* focused his attention on accounts of electric experiments and of atmospheric electricity. By 1840 he put into writing his views on the cause of rain, and finding that they were favourably received by Professor Baden Powell and others, he communicated them to the Ashmolean Society and eventually printed them in the *Edinburgh New Philosophical Journal*, 1842–53.

His theory was that 'particles of water are buoyed up in the air by the coatings of electricity which they take up in accordance with their temperature, and they rise in the air to a height in accordance with their electric coatings. That on the reduction of their temperature, their capacity for electricity being thus reduced, they become surcharged with electricity and are still buoyed up by it, till—from the effects of hills, trees, or



PHILLIPS

the conducting condition of the atmosphere—the surcharge escapes, and the buoyancy and the mutual repulsion of the particles being thus reduced they unite and form rain, or sink to a lower level.'

He published his evidence in several papers in the expectation that the Royal Society would finance an investigation of the phenomena. In this he was not successful, largely owing to the loss of his early patrons, Rolleston, Walker, Phillips, and Baden Powell, who would have doubtless advised him to have adopted a less personal tone in his essays. But one cannot help feeling sorry for the old man who wrote 'Can such treatment tell to the honour of Oxford, or does it not rather tend to the disgrace of the kingdom at large or, at least, to the professors of science connected with it?' What he could not understand is that in his day neither he nor the professors knew what electricity was.

A more satisfactory work was his *Essay on the Beneficent Distribution of the Sense of Pain*, 1857, the object of which was to show that sensibility to pain is bestowed only just so far and in such a direction as is necessary for the preservation and well-being of each particular species. It is therefore one of the great conservative agents of the animal world. *The Cause of Rain and its allied Phenomena*, 1859, was sold by the author at 3 Alfred St., St. Giles'. Many *Letters on Meteorological Phenomena* appeared in the *Oxford Times* in 1877–8, and *Electric Meteorology* in 1887.

Like Professor Phillips, whom he succeeded in 1874, Sir Joseph Prestwich, 1812–96, had had a long and learned geological past before he came to lecture in Oxford, for there was scarcely a stratum of any period that he had not fruitfully studied. One of his more important publications, *A Geological Inquiry respecting the Water-bearing Strata of the Country around London*, 1851, led to his being recognized as the leading geological authority on water-supply. His large text-book on *Geology* appeared in 1886 and 1888. In his day the duties of a geological professor were not very onerous, but Prestwich filled the office with dignity and advantage. 'Phillips, who excelled in eloquence, had at times no more than three students, as geology received no encouragement from the University authorities. Few geologists of note have, therefore, hailed from Oxford as compared with Cambridge, and we call to mind only Edgworth David and F. A. Bather who, trained under Prestwich, have since gained distinction' (H. B. Woodward).

William Baxter, curator of the Physick Garden from 1813 to 1851, who is said to have given the undergraduates more practical instruction in Botany than the professor, made notable contributions to our knowledge of the Cryptogams, Mosses, and Fungi of Oxfordshire, and published a valuable volume of *British Phaenogamous Botany*, 1834.

Henry Boswell, 1837–97, was an excellent example of a successful business man with a scientific hobby, by trade a trunk-maker who made many additions to the Flora of Oxfordshire and became one of the leading authorities on British Mosses.

Coupled with Boswell we think of George Claridge Druce, whose trade as a chemist and druggist naturally led him to develop his interest in herbs.

Maxwell Tylden Masters, 1833–1907, D.M. of St. Andrews, was for a time sub-curator of the Fielding Herbarium in the Botanic Garden (1854). In 1865 he succeeded Dr. John Lindley as joint-editor of the *Gardeners' Chronicle*, becoming sole editor from 1882 until his death, and in which much of his literary work was published. Always interested in abnormalities, he published *Vegetable Teratology* in the Ray Society's series in 1869. His name is commemorated by the leguminous genus *Mastersia*, so named by Bentham.

Edward James Stone, 1831–97, F.R.S., had graduated as fifth wrangler at Cambridge in 1859 and after ten years' work as Airy's chief assistant at Greenwich, served as H.M. Astronomer Royal at the Cape from 1870 to 1879, when he became Radcliffe Observer. While at the Cape he produced the *Cape Catalogue*, giving the positions of 12,500 stars. To this he added a *Radcliffe Catalogue* for 6,424 stars. It was issued in 1894.

Oxford was indeed to be congratulated when GEORGE JOHN ROMANES, 1848–94, determined to end his days in St. Aldate's. He was a graduate of Caius College who had enjoyed the friendship of Charles Darwin, whose ardent disciple he became. He began with an extended research on the locomotor system of Medusae which he collected at the entrance of Cromarty Firth. His works on *Animal Intelligence* and on *Mental Evolution in Animals* and *in Man*, and finally his *Darwin and after Darwin* introduced him to a very wide public. In Oxford the annually recurring Romanes Lecture is an enduring memorial.

Born on Jan. 14, 1855, HENRY MICHAEL JOHN UNDERHILL came of an old Oxford family whose name had numbered many representatives on the roll of Freemen of the city. From his early school-days he showed a most rare combination of qualities. A deep appreciation of the beauty and science of Nature combined with a most unusual skill for recording it in black-and-white and in water-colour. That his work is not as well known as it deserves to be is due to the fact that he was the most modest and retiring of men.

His artistic talent for painting was developed by Adrian Rivière, the father of the famous Briton Rivière, who taught young Underhill to paint both in oils and water-colours. For a time he was regarded as an infant prodigy: at the age of twelve he painted a very creditable copy of Leonardo's 'Last Supper'. Between the ages of fourteen and eighteen he executed a series of studies of unusual flies, and of magnified drawings of parts of insects seen under the microscope. The minute forms of animal and plant life collected from the streams and ditches around Oxford were a never-failing source of delight to him. The weaving apparatus of spiders, the structure of the wings and compound sizes of insects, were all faithfully delineated by him and with a beauty that has seldom been equalled.

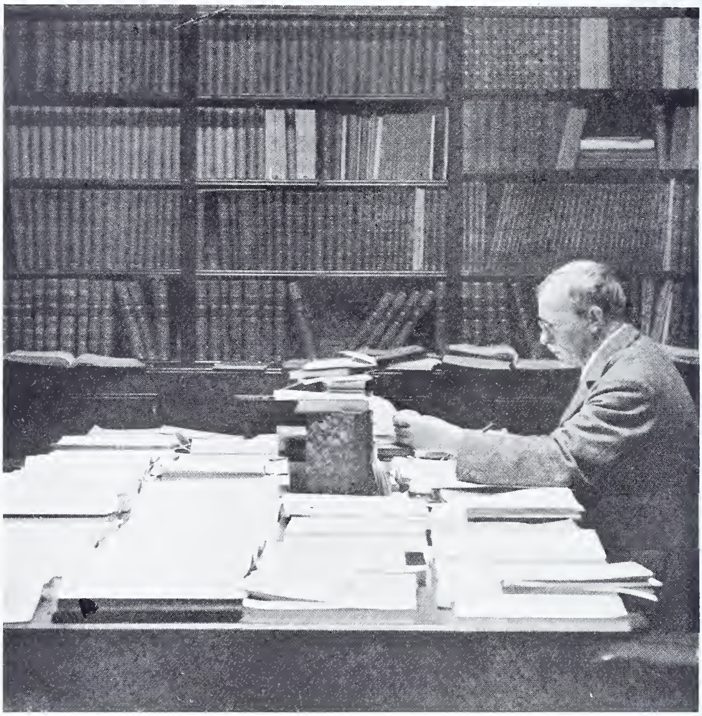
Some ten years later he made a special study of clouds and sunsets, which resulted in a long series of charming pictures. He was also a past-master in the art of painting lantern-slides, which he used to illustrate the delightful lectures which he gave to the Oxford Natural History Society, in which he held the offices of treasurer, secretary, and president, as well as to juvenile audiences of that generation. The best, perhaps, were a series of hand-painted slides to illustrate Professor Poulton's lecture on 'Colour Protection' before the British Association.

Many in the City of Oxford mourned his death in October 1920, but as a Body Corporate no city in England is more neglectful of the duty of conserving the works of its most distinguished members.

The office of Prosector in the department of Human and Comparative Anatomy was filled for many years by CHARLES ROBERTSON, who catalogued and curated the anatomical preparations. His best-known work was a series of dissections made in 1872 in illustration of the types described by Professor Rolleston in his *Forms of Animal Life*.

The early traditions of the Astronomers of Merton College have been upheld in the nineteenth century by several Oxford men of note. The last discovery of important additions to our planetary system was made by NORMAN ROBERT POGSON, 1829–91, assistant at the Radcliffe Observatory from 1852 to 1858. During this period he discovered the four planets Amphitrite, Ariadne, Hestia, and Isis, for the last of which he was awarded the Lalande Medal of the French Academy. It is said that in the use of the equatorial and meridian circle he had few equals. Later on in the Madras Observatory he catalogued the positions of some 60,000 stars, including the variable stars, which brought up the number discovered by him to 21. In the History of Science Museum we still treasure the original diaphragms which he used for his photometric work on the relative brightness of stars.

WILLIAM EDWARD PLUMMER, 1857–1928, began his astronomical work in 1868 under Hind in Mr. George Bishop's private observatory at Twickenham, where he recomputed Flamsteed's observations *On the Orbit of the Comet of 1683*. After 1874 he transferred his services to Prof. Charles Pritchard and was responsible for much of the wedge photometry which



F. A. BELLAMY

was published as the *Uranometria Nova Oxoniensis*. From 1892 to the end of his life he was Director of the Liverpool Observatory. He was an honorary M.A. of Oxford, and his son, H. C. Plummer, became Astronomer Royal of Ireland.

Frank Arthur Bellamy, 1864–1936, educated at Magdalen College School, had been an assistant at the University Observatory for forty-six years, and worked at the Radcliffe Observatory with his brother for nine years before that (1881–90). His period of service thus coincided with the last two years of Professor Pritchard's, and the whole of Professor Turner's occupation of the Savilian Chair. The preparation of that part of the Astrographic Catalogue which Professor Pritchard had accepted, and which was known as the Oxford Zone, was very largely the work of Bellamy in the photography and in the measurements and final reductions. His were the photographs upon which the New Star of 1903 appeared for the first time. Capable as he was of minute, accurate, and unremitting labour, he then went on with the reduction of the measures on the Vatican Zone, and on a part of the Potsdam Zone, a gigantic work in which he was helped by his niece. His other interests included the study of certain groups of Postage Stamps. He formed a superb collection of the Oxford and Cambridge College Messenger Stamps, 1871–86, which he offered to the University, together with his philatelic library, probably one of the best in private hands, and comprising more than 200,000 separate items, all relating to the world's postal history, and all catalogued by him. Doctors Cowley and Hogarth of the Bodleian Library refused to accept the offer, and the University is the poorer. Watching the behaviour of birds and the growth of plants was a perennial pleasure to him, and for fifty-two years he made observations for the Phenological Society. After holding the office of President of the Ashmolean Natural History Society he wrote its history. An obituary notice appeared in the *London Philatelist* for March 1936.

Dr. H. H. Thomas, F.R.S. of Sidney Sussex College, acted as assistant to Professor Sollas from 1898 to 1901. He became one of the most helpful authorities on igneous rocks in the Geological Survey offices in Jermyn Street.

He was able to solve conclusively the mystery of the provenance of the blue-stones of Stonehenge by showing that they had been derived from a small area surrounding Carn Meini in the Precelly range. The Tertiary volcanic history of north-west Britain was another of his special subjects.

In conclusion, a few words of the highest appreciation are due to the memory of generations of scientifically trained persons who were attached to the various scientific departments of the University. Certainly no member of my own generation can forget the willing help that was always rendered him by such assistants as those who figure in the photograph facing this page, which was taken of the Museum Staff of about 1884. The *esprit de corps* of the staff has been shown by the recent formation of an Oxford University Museum Club, which now makes a practice of holding an annual exhibition, representing nearly every scientific department of the University.

Fifty years ago classes of Honour Students were smaller than they are now. Let us hope for all parties that the appreciation of students of the ability and loyalty of their laboratory assistants may not vary inversely with the size of the classes.

William Hine *J. Walker* *J. Ford* *J. Barnett* *H. Lewenden*
H. Harris *T. Bowles* *A. Robinson* *W. Burdon* *H. Bowles*

THE STAFF OF MUSEUM ASSISTANTS *c.* 1884

APPENDIX A

OLD SCIENTIFIC BOOKS IN COLLEGE LIBRARIES

Books in College Libraries have one inestimable advantage over those in the Bodleian—they can be lent out. And, the college collections, being small, can also be readily rearranged, so as to bring them level with the needs of those who have the right to use them.

I have considered it helpful to pass in rapid review the resources of the College Libraries, in so far as I have had the privilege of ascertaining how far they may be helpful to students of the history of science. A preliminary survey of the names of former owners and donors written in the books, indicates that the greater part of these books were acquired by gift or bequest. Special attention has been paid to the sources whence these older scientific books may have been derived, for it will be generally conceded that those who collected and gave important books to the libraries of their colleges must have been among the most intelligent of their generation. These notes have been collected at odd times as opportunity offered, rapidly, and without co-ordination or idea of completeness. They are offered as suggestive of a new point of view: space will not permit the printing of the survey in extenso.

I desire here to add a word of appreciation of the high qualities of those Librarians who have refrained from the lust of destroying the history of the volumes in their care by extracting the end-papers and fragments of parchment inserted by the old binders as cover-linings, or guards to prevent the first and last leaves of the book from getting rucked up by the cover-boards. These end-papers, often scraps of manuscript, are generally worthless when divorced from their volumes and mounted in separate albums, but afford great assistance when in situ for settling questions of the provenance of the volumes to which they belong. In at least two Oxford Libraries (Magdalen and Corpus) wholesale mutilation of this part of the binding of the older books has been perpetrated within recent years. Where it has not been done the books retain a flavour of antiquity that is not only delightful, but essential to the history of the book.

UNIVERSITY COLLEGE seems not to have received any large collection by gift, but can boast several works of first-rate importance as well as several rarities. Those in a cellar certainly need protection from damp, mould, and a predatory clothes-moth.

A number of scientific books were acquired between 1670 and 1720 implying as at some other co eges collaboration in the scientific renaissance. Givers included Edward Gwynn; Dr. Wm. Musgrave; Wm. Pindar; J. Ledgard; R. Humfry; and also from Tim. Nourse, who had been expelled for having joined the Church of Rome, but died in 1699 forgivingly giving 'the small remainder of my books to University College of which I am an unworthy member'.

BALLIOL COLLEGE has a small but well-chosen collection of good books—useful for illustrating the history of the physical and mathematical sciences, with some interesting biological works. A considerable proportion were presented by former members of the College, for instance in 1694 John Barron, fellow, Sheldon Cole, and Tho. Guidott, M.D., combined to give books that were needed.

Gray (Bp. of Ely), 1449–54, gave 150 volumes in 1478.

By 1450 many young humanists were making literary pilgrimages to Italy. One John Free, having saved up for a sojourn at Padua, gave *Cosmographia Mundi*, a Natural History. In 1460 Stephen de Cornubia gave *Galen's Works*.

After 1670 the College made an attempt to attract Fellow Commoners when there were only 25 undergraduates in all in College. In 1673 Sir Th. Wendy bequeathed 1,100 volumes.

The following stray names occur in the books: Gul. Foster, Tho. Watson, Henricus Gocheus, John Evelyn, Th. Hupfer, S. Wesley Aed. Christi 1712, M. Marlow, Geo. Moberly, Wm. Goodday, Coll. Trin. Cant. 1720, J. Wall, Worcester Coll. 1730, M. Wall, M.B. New Coll. 1776, Edw. Feeld, E. Welbeck?, Joh. Lingfeild, and a more considerable gift of many volumes was received from George Coningesby of Wadham, 1711.

The Medical collection was notably enlarged by John Harris in 1666. A set of *Miscellanea Curiosa*, 8 vols. 1670–85, carefully indexed in the hand of the Librarian, and 75 volumes of *Medical Tracts* indicate great activity at this time.

A MS. Catalogue entitled 'Index ad Bibliothecam Schenckianam Medicam' indicates a possible source of many of the medical books. The same volume contains lists of books lent between 1650 and 1688. Both Plot and Musgrave were borrowers in 1684–5. Books were lent to Frater Chibnall in 1652–61

Lists of purchases include 87 books purchased of Mr. Gurn; 13 books purchased of Tho. Robinson and Richard Davies, stationers, in Oct. 1651, 8 in May 1652, 5 on July 23, 1653, 3 in June 1653, and 7 in 1655. Others came from Francis and Thomas Bowman in 1656.

A later benefactor was Magister Crynes in 1745, whose gift included the works of J. Caius, 1556, which had been presented to St. John's College.

Other stray names are franciscus Goldingham, Th. Allen, Jos. Godwin 1667, Henricus Savage, J. Horsman, Th. Watson, Th. Cole, W. Loggin, Matth. Baillie, Th. Hodges, Jo. Powell, Samuel Holding 1663, W. Weaver, Mart. Aysworth, W. Husbands e colle. Pmb. 1722, petrus Turner, P. Arnvill of Wadham, f. Hollier.

Merton College. The astronomical and other scientific works by the very early members of the Merton School have unfortunately been lost or dispersed. Several were saved by Allen of Gloucester Hall and are now among the Digby MSS. in the Bodleian Library, almost the sole evidences for the labours of the first fellows of the College. Still the College owns a fair number of standard astronomical treatises of the 16th and 17th centuries to which several important physical text-books were added during the first half of the 18th century, partly in recognition of the work of Newton, partly owing to the lectures on Experimental Philosophy given in the old Ashmolean building.

The College can also show a useful collection of the large medical folios of the 16th century, with a whole bay full of the 8^{vos} *et infra* of the 17th century. Some of the more valuable came as a gift from Helena, widow of Theodore Gulston, in 1635. Other owners of importance were Thomas Jhesope, Henry Neville, James Leeche, Roger Gyfford (who gave 12 vols. in 1597), Griffin Higgs, Edm. Wyndham in 1676 and Henry Sumner 1672, who with Robt. Whitehall 1672, Aemesius Cowley 1671, Norton Bold of C.C.C. 1675, Charles Willughby 1673, Thomas Cheston 1685, R. Huntington 1680, Ant. Dodsworth 1694, were evidently trying to repair the weaker places in the library by donations of wanted books.

Exeter College, although heavily ballasted with theological folios, has kept space for a good selection of useful old scientific works, to which Dr. G. W. Childe has added *Guido de Cauliaci* 1495, and the 1547 edition of *Medici antiqui*. Jo. Dotyn, M.B., in 1561 gave *Fuch's Historia stirpium* 1541. Sam. Cosens gave *Gerard's Herbal* 1633; J. Beere, 1715, gave *Grew's Anatomy of Plants* 1682; F. Randolph, C.C.C., gave *Dillenius' Musci* 1741. S. Conant, *Parey* 1582; Jacobus Jenkyns in 1647 gave *Spigelius' Anatomy* 1645 at a cost of £3 8*s*. 'loco Poculi argentei'. Other names are Edwardus Cooke, John Arden, T. Seale, Th. Poole, J. Freind, Sam. Adams, rector; Wm. Briggs, C.C.C., Fr. Loder 1719, Nic. Stoughton, Fr. Nicholls, physician to the King 1715, Rob. Spotswood.

The fine historical library of Stephen Rigaud of Exeter is at present in the Radcliffe Observatory.

Oriel is another of those colleges which can show a fine series of the early standard works on Medicine, thanks to the distinguished physicians who were fellows there and became benefactors to the library.

Best known of these was Thomas Cogan, the well-known author of the *Haven of Health* 1586, who practised medicine in Manchester. In 1595 he presented *Galen* in 5 vols., *Matthiolus*, and *Vesalius* to the college.

John Jackman, M.B., 1584, an Oxford practitioner, gave 38 books. Thomas Hill, fellow 1581–95, gave *Gesner* 1551.

Sir M. Lister, physician to Charles I; John Saunders, provost 1644–53 (29 books); Richard Dyer 'the excellent botanist' who left money for the garden and gave 8 cedars of Virginia for the Grove in 1685; Sam. Desmaistres, dying of small-pox 1686, left all his books; John Bosworth, fellow 1747–86, rector of Tortworth—were all considerable benefactors.

Lord Edward Leigh, matric. 1761, d. 1786, left his entire library, rich in fine folios on Art and on Natural History in its more beautiful aspects—all sumptuously bound. He also left £1,000 in trust for models and apparatus to illustrate the mathematical lectures and experiments explained in the Old Ashmolean Museum by Dr. Bradley and Mr. Bliss.

In Science, as in many other subjects, the Library of Queen's College is one of the most important in the University. The books are, moreover, very well arranged.

The Astronomical and Mathematical section is worthy of the College of Edmund Halley. It has been added to by Sir John Floyer, Th. Pile, Edmund Halley 1678, John Cropley, J. Drue, Alan Fisher, W. Rooke, J. Monkhouse, Bernard Robinson, St. Green, Dr. Wharton, Chr. Potter, provost 1634, Timothy Halton, provost, Gerard Langbain 1646, J. Waugh, Edm. Brig. . . ., Th. Gore 1653. A few items also came from Theophilus Metcalfe, and finally, as to every other department of the library, from the great R. Mason bequest, *c.* 1840–50.

The Biological section also contains a number of valuable works which are not usually found in College Libraries—such as Sibthorpe's *Flora Graeca*—the works of Bonnet, Agassiz, Cuvier, Reaumur, Erasmus Darwin, M. Lister, &c., an almost complete set of the English works of Boyle.

Rich medical collections were received from Dr. Theophilus Metcalfe and Sir John Floyer, which together include most of the 16th- and 17th-century writers and are deserving of special study. A few volumes came from Thomas Barlow's library, *c.* 1640.

Sets of the *Philosophical Transactions*, *Acta Eruditorum*, the publications of the *Berlin Academy*, and the great French *Encyclopaedia* all help to make this great library an ideal one for students of several aspects of the history of science.

New College owns a rich collection of Medical works of the 15th and 16th centuries, which differs from most of the other college collections in that the greater number of the books appear to have been purchased by the College itself, perhaps at the instigation of former Deans of Medical Studies of the College. Among the larger works are sets of the *Philosophical Transactions* and the *Acta Eruditorum*.

Early gifts include a *Dioscorides* and *Galen* 1516–17 from M. Latymer, and *Trallianus* 1548 from John Harmar.

Dr. Walter Bailey, who in 1566 disputed before his Sovereign in the Hall, gave in 1592 *Brasavolus* 1546, *Musa* 1541, *Gorraeus* 1564, *Matthiolus* 1565, to which Gulielmus Bailey consang. added *Paracelsus* 1573, *Antonii opera* 1565.

Thomas Hopper, a physician practising in Holywell, was another notable benefactor of works published between 1550 and 1620. He died in 1623.

T. Tanner 1656, Rich. Fleming 1615, John Estmond, Th. Wood, Th. Locke, Martin Colepeper, Robert Sharrock, Thomas Smith of B.N.C., Dr. John Smith, J. Goodwin.

Donors of mathematical and astronomical books were 'H.S.', Erasmus Williams 1608, John Cooth, late fellow 1621, Anthony Phelips 1636, John Gunter, John Estmond, John Jope 1773. Volumes of the astronomical tables of Regiomontanus 1550, Reinhold's Prutenic Tables and others indicate a special line of contemporary study.

All Souls in its earlier days was one of the strongholds of scientific studies in the University, as is indicated by a fair collection of the leading medical folios of the 16th century. At least two were given by John Warner, who was both Warden of the College and Regius Professor of Medicine. Other early donors being Nicholas Halswell 1486; Dr. Richard Bartlett; Richard Master, physician to Queen Elizabeth; Mat. King; Dr. John Hill; Peter Prideaux; Christopher Codrington; Dudley Digges; Dr. James Hawley; Wm. Matthews; Drs. Ralph Freman and Daniel Lysons, both of Magdalen College, and generous donors.

Botany is well represented by numerous fine and large folios of the 18th century of a kind only met with in the larger houses of the nobility and county families. These with a long set of the *Linnean Transactions* 1791–1866, and Zoological works from the time of Pennant to that of Van Voorst, show a contemporary country life cult of Natural History, as a shelf of select books on Husbandry, including Worlidge on Wines, dedicated to Ashmole 1678, also tells its own tale.

Elsewhere is a shelf of occult items, relating to Astrology, Magic, Chiromancy, Divination—the Palaeosophy of the 17th century—apparently purchased by the College.

MAGDALEN COLLEGE. There is a printed catalogue.

William Hasard, Waynflete praelector 1496–7, bequeathed two medical books, *Haly Abbas* 1492 and *Rhazes* 1497, which are still in the library.

Noteworthy special collections are those of Nicholas Gibbarde, an Oxford physician of 1576–93, and the Botanical Library of John Goodyer of Petersfield, both of which have been catalogued in the Daubeny Laboratory Register (p. 384) and in Gunther, *Early British Botanists*, 1922. Both were the working libraries of the men who collected them, and therefore, as a collection, of more interest than the books that are inscribed with the name of John Warner, Bishop of Rochester, for these were purchased out of moneys given by him, and he may never have heard of them.

Of more recent books and pamphlets of the nineteenth century the library of Chemical, Geological and Physical works, bequeathed by Dr. Daubeny to Magdalen College in 1867, is perhaps the most important, and of this a separate Catalogue has been printed.

BRASENOSE COLLEGE. Among the books given by William Smith, the founder, were a *Euclid* of 1482, and *Mesua* 1495 which started the medical collection. John Longlonde about 1541 added *Avicenna* of 1476, *Abuchare*, *Duns Scotus* 1477, *Euclid* 1491, *Rei rusticae scriptores* 1496, *Firmicis Astronomicon* 1497, *Alb. Magnus* 1507.

Th. Allen of Eton 1636 gave *Aldrovandus* 1623; Edmund Leigh *Aquilonius Optics*, 1613.

A shelf full of the works of Kircher was helped on by the pleasant college custom by which Determining Bachelors combined to give presents of books to the library. Thus in 1660 4 gave Kircher's *Obeliscus*, *Magnes* and *Musurgia* 1650; Th. Marsden in 1661 added the *Ars Magna* 1646; and in 1675 John Sefton gave *Mundus Subterraneus* 1665.

In	1700	13	det. bachelors	gave	Renaldinus 1684.
,,	1703	19	,,	,,	Euclid 1703.
,,	1705	14	,,	,,	Bullialdus 1682. Scarburg, Euclid 1705.
,,	1716	17	,,	,,	Newton, Optics 1706.
,,	1723	21	,,	,,	Albin, Hist. Insects 1720. Riccioli, Almagest.
,,	1749	6	,,	,,	Smith's, Optics 1738.

Other benefactors were W. Earnshaw 1642, John Delves, Th. Cooper 1701–2, Francis Yarborough, Dr. Th. King, Th. Caverley (adm. 1719), J. Holmes †1795, Shelley Pilkington Pennell, H. F. Pelham.

Corpus Christi College has an admirable collection of medical books, accumulated very largely through the beneficence of former members of the College. Chief among them were John Claymond, the first president (1517), who gave *Paulus Aegineta* 1532. Wm. Nicolson 1578 gave *Vesalius* with marginal notes. Wm. Orson 1594 gave *Ruellius de Nat. Stirp.* 1543. Jo. Rainoldus, Pres., d. 21 May 1607, gave *Aldrovandus* 1599 and *Rouillius* 1587. J. Chennell, M.D., 1612 gave *Matthioli* 1598 and *Fernelius* 1610. Hieronym. Rainoldus gave *Galen* 1556 in 4 vols., and *Brasavolus index* thereto.

Brian Twyne, first Keeper of Archives 1634–44, son of Thomas Twyne, physician, who died at Lewes 1613 (*Munk's Roll*), was also a notable donor of 16th-century folios—a series that was greatly extended by the 17th—medical library of William Creed, who died in 1711. The Creed collection includes important botanical works as well.

Other benefactors were Dr. John Osmond, John Rosewell, Samuel Byfield, Th. Turner 1714, Cuth. Ellison 1719.

There is a strange absence of the ordinary mathematical books that appear in most of the other libraries, but this absence is amply atoned for by a superb copy of the *De Arte Supputandi* 1522 given by the author, 'Cuthertus Londoniensis Ep̄s Collegii Corporis Christi dono dedit.'

The wealth of Christ Church in scientific literature of the 16th and 17th centuries transcends the possibility of adequate record in this limited space, owing principally to the benefaction of Charles Boyle, 4th Earl of Orrery, who collected all available literature between 1690 and 1730. His library is to be found in thirteen 'bays' in the Library: 6 of medical books and 7 of books on Mathematics, Astronomy and Physics.

The larger folios are grouped in another part of the library.

Other special items of great interest are the small library of Robert Burton assembled around his portrait by Sir William Osler, and the large number of books sent away at Dean Aldrich's death, which have now returned to Oxford marked with the book plates of the Henley Library.

St. John's College has been particularly fortunate in having received the gift of a biological and medical library from Dr. William Paddy within the first fifty years from its foundation in 1555. To this early gift later benefactors kept adding single volumes throughout the 17th century, with the result that the College owns an important collection of works on early medicine and the medical sciences.

Although the greater number of Paddy's books reached St. John's in 1602, a few are inscribed with the date of his death in 1634.

Archbishop Laud, who is well known to have been interested in astrology, gave in 1634 a copy of *Bayer's Uranometria* 1603, which Sir W. Paddy had received in 1627 from a grateful patient, Sir Edmond Skores. Also a finely coloured copy of Apian *Astronomicon Caesareum*, and the trigonometry of *Pitiscus* 1612.

Dr. Rich. Slythurst gave *Hippocrates* 1526; Milo Callowhill 1636 gave *Caesius Mineral.*, 1636; W. Clowes, surgeon to Charles I in 1646, gave *Parkinson's Theatrum* 1640; W. Brewster *Agricola* 1621; J. Hartop; C. May; Edw. Hervey in 1652 gave

Harvey's Exercitationes 1651; W. Clowes, surgeon to Charles 1646; W. Radclyf; Ed. Lapworth; Sir T. Ducket; Edw. Chamberlayne 1671; Hen. Newton 1681; Geo. Fothergill of Queen's; T. Rutter; John Smith; Nath. Crynes 1745; Ch. Perrot 1686 (several works). Some 50 volumes are inscribed with the name of John Merrick.

Among those who gave large and costly volumes of anatomical plates were Alex. Woodson, John Thorne, Archibald Clinkard, W. Gully, J. Blagrave, Dr. J. Speed, and W. Sheppard.

The Physical and Chemical sections contain a few useful books but cannot compare in value with the great botanical and medical works given by Sir W. Paddy. W. Juxon, W. Brewster, Ben. Thornburgh, Hen. Price, and J. Merrick are among the contributors.

In Jesus College may be consulted the notable collection of books of all kinds given by Edward Herbert of Cherbury—a 'great and Universall Heritage', rich in productions of foreign presses. Another great benefaction was received from George Davies of medical books collected *c.* 1690–4, supplemented by a smaller gift from Henry Fisher which suggest that the donor, who was Registrar of the University, was a Bon vivant. A few came from Leoline Jenkins, principal 1661–73, who built the Library 1676–9 and fitted it in a style which so closely resembles those of the Old Ashmolean as to suggest the employment of the same artisans.

Benefactors: Griffith Powell, principal 1613–20; Dr. Joseph Hoare, principal 1768–1802; Dr. John Wither (Lincoln); T. Ellis, fellow; W. Salusbury 1656; Wm. Ravenscroft; Th. Smyth; Henry East; Rich. Lloide 1665; Eliz. Burghers.

A series of the more important works of R. Boyle mostly given by Davies are a special feature of interest, and to these some useful early chemical works have been added.

Magdalen Hall, 1602–1874. Some early volumes of the *Philosophical Transactions* and of the *Acta Eruditorum* are a pathetic memorial to the departed greatness of the Hall and of the sacrifice made by its numerous patriotic members and others who subscribed the funds and gave the books for its early Library.

According to the Benefactor's Book, gifts came from Booksellers, and from Rich. Day, the 'tonsor'; Anonymous, 2 *Sphaerae*; Swanton, *Ortus Sanitatis*; R. Jenner, *Bartholin's Anat.*; J. Cave, *Theophrastus*; J. Wallis, his works; Ch. Willughby of Merton, *Van Helmont*; R. Plot, *Josephus*, Hen. Yerbury (Magd.), *Mesua opera*.

Sam. Turner, M.B., gave medical folios by Spigelius, Lacuna, Parkinson, Theatrum and Paradise, Sennertus, Ambr. Parey, Crooke's Anatomy, Joubertus, Galen, Villanova, Morton, Wirtzung, Bullein's Bulwark, Wiseman Chirurgie, Bannister, with 27 Quartos, and 40 others, many being on science.

Hen. Levett, A.M., Fellow of Exeter, gave 90 vols. including works on Physics.

John Brodrick presented the works of Wallis, Ray, Malpighi, and Hooke.

But of these few, if any, now remain. I was buying books that once belonged to the Hall when I was an undergraduate in 1890.

We are glad to see in the Hertford Library a Herbal of 1517; Bradwardine *de Causa Dei* given by J. Wilkins, Warden of Wadham; Plot's presentation copy of his *Nat. Hist. of Oxfordshire* 1677 (Map missing); Willughby *Ornithology*, *Hortus Elthamensis*, Blackwell *Herbal*, Moxon *Mechanics*; New Celestial Globe 20″, ed. by Neville Maskelyne, D.D., F.R.S., by W. and S. Jones, London.

WADHAM COLLEGE will always be *terra sancta* to students of science on account of its association with some of the founders of the Royal Society, chief among whom was Warden Wilkins. A set of the Philosophical Transactions is a memorial to his work.

Among early donors were John Everie, who gave the 1542 edition of Galen and works of Vallesius and Vega; Edw. Browne; Rob. Petraeus 1614; and Dr. Philip Bisse who gave *Pliny* 1587 and *Aldrovandus* 1599 doubtless as part of his foundation gift. A more extensive bequest was the entire medical library of John Goodrich, who took his M.B. in

1618 and died soon after in 1624. The books bear the date '1651'. They range from 1530 to 1617.

A second medical library of rather later date came from Alexander Thistlethwayte, covering the period 1580–1700. To these Samuel Bush added a set of the smaller medical books of 1720–50. He died in 1783.

A valuable series of botanical books was included in the general library of Richard Warner, who matriculated at Wadham in 1730, and which he continued to collect until about 1770. He died in 1775.

The College also owns an important collection of mathematical, physical, and astronomical works which was brought 'up to date' by a valuable gift of 18th-century monographs presented by Robert Bayer Patch. (Matric. 1804, d. 1840.)

Other benefactors are William and Charles Godolphin; Dr. Puleston, Samuel Lee 1651, Th. Hodges 1661, Dr. Clayton, Robert Knollys 1666, Hugh Wyndham 1674, Th. Bridges, Wm. Gould, Marie Dymock, W. Power 1617, Isaac Smyth, J. Eyans, proctor 1703, and last, but not least, John Wilkins, to whom the College owes a copy, possibly a presentation copy, of the first edition of Harvey's *Exercitationes de Generatione*, published in 1651, during Dr. Wilkins's Wardenship.

APPENDIX B

THE EARLIEST KNOWN REFERENCE TO A CHEMIST IN BUSINESS

Reprinted from 'The Chemist and Druggist', June 30, 1928.

Extract from a letter, dated March 23, 1596, from John De la Bere of Christ Church to Thomas Edmondes, Ely House, Holborn, London.

'Sr, Havinge byn from Oxforde this week and more I retourned not till yesterdaie: otherwise I would have answered your letters by the last carier. I am sorrie that you feele your bodie so indysposed, but am glad that now you have tyme and mynde to seeke redresse before your indisposytions be tourned into habytts: for confirmatus habitus est altera natura etc, by that meanes hardly to be remooved. Those Specifica medicamenta, wh were promysed to be p'pared for me, by your London Chymyst, I could never obtayne. Wherefore wantinge them much & some other there lyke in my practice, I am forced now to bylde a Laboratorie or Styllhouse of myne owne, and am at this present settinge upp of my furnasses, to work them my selfe: whereby I shalbe assured of their treue preparation. You shall have the first frutes of my poore laboures, for your medicines I will prepare first. Informe me in these and the lyke: and instante me no more, to have care of youre health, the which I desire as much as the neererness of our bloude, your mutuell love dothe in nature and vertu bynde me. I have no leasure now to write more, as I desyred: much lesse of my sute to Mr. Wentworth, but I thanke you for the offer of your healthe, as also for your greate courtesies towards me heretofore. God blysse you & prosper you as my harte desyereth
Christchurch in Oxfourde this xxiiird of March 1596

Your most lovinge uncle

John Dela Bere.'

'John Delabere sometimes of Ch. Ch. and batch. of phys. of this university, afterwards doct. of the same faculty at Basil in Germany, was then incorporated doct. of phys.—He was afterwards principal of Gloc. hall.'

Anthony Wood, under Nov. 1577.

APPENDIX C

ASHMOLE'S FIRST PUBLICATION

THE *Fasciculus Chemicus* is a small and rare work of no scientific importance. Its chief interest consists in the light that it sheds upon the character of its author, Elias Ashmole, whose name has acquired a posthumous fame that even his achievement in having founded the first public chemical laboratory has hardly merited. To some extent he was the dupe of a somewhat shady circle of charlatans among whom he lived, a circle of impostors who shrank from the light of day.

But let the title-page speak for itself. Firstly, the name of the author, Elias Ashmole, is concealed in the anagram 'James Hasolle', a *nom de plume* which is twice repeated later in the book. Further enlightenment is conveyed by the engraved frontispiece, the centre of which is filled by a portrait bust of Ashmole with his pet title *Mercuriophilus* inscribed on the base, but with the head blotted out by a horoscope, probably his own, but hardly worth further investigation. Down in the left-hand corner is the most remarkable signature of all, which seems to have hitherto escaped notice. It represents a tree with a faintly engraved hole at its base, near which is a dark, creeping thing. The last I interpret as a Mole, the figure certainly signifying Ash-mole.

The collation of the book is as follows:

Engraved Frontispiece.

Title-page: *Fasciculus Chemicus:* | OR | Chymical Collections. | EXPRESSING | The Ingress, Progress, and Egress, | of the Secret Hermetick Science, | out of the choisest and most | Famous AUTHORS. | Collected and digested in such an | order, that it may prove to the advantage, | not onely of the Beginners, but Proficients | of this high Art, by none hither-|to disposed in this Method. | Whereunto is added, The *Arcanum* or | Grand Secret of Hermetick Philosophy. | Both made English | By *James Hasolle*, Esquire, | *Qui est Mercuriophilus Anglicus.* | [rule] | *Our Magistry*

Theſe Hieroglyphicks vaile the Vigorous Beames
Of an vnbounded Soule: The Scrowle & Scheme's
The full Interpreter: But how's conceald.
Who through Ænigmaes lookes, is so Reveal'd.
T: W: M: D:
T. Croſs Sculp:

Faſciculus Chemicus:

OR

Chymical Collections.

EXPRESSING

The Ingreſs, Progreſs, and Egreſs, of the Secret Hermetick Science, out of the choiſeſt and moſt Famous AUTHORS.

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Dan: Both made Engliſh Kenrick

By *James Haſolle*, Eſquire,

Qui eſt Mercuriophilus Anglicus.

Our Magiſtry is begun and perfected, by onely one thing; namely, Mercury. Ventur. p.26.

London, Printed by *J. Fleſher* for *Richard Mynne*, at the ſign of *St. Paul* in Little *Britain*. 1650.

is begun and perfected, by onely one | *thing; namely, Mercury.* Ventur. p. 26. | [rule] | *London,* Printed by *J. Flesher* for *Richard Mynne,* | at the sign of St. *Paul* in Little *Britain.* 1650. |

Prolegomena: To all | Ingeniously Elaborate | Students, | In the most | Divine Mysteries | of | *Hermetick Learning.*

A Signed on f. A8 '1 March 1649$\frac{49}{50}$ *James Hasolle*' with a Postscript on f. A8^v dated '1 April 1650 James Hasolle'.

a–a4 To the Students in Chymistry, signed 'Your most devoted Arthur Dee. C. M. *Archiatros Anglus.*

a4^v–a8 To the Candid Reader, dated at end 'From my Study at Mosco, the Calends of March 1629.

B–L5 Arthur Dee Doctor of Physick, His *Chymicall Collections.*

Chap. I. Naturall Matter, what it is, and from whence. II. The Preparation: or the first work, or work of the Winter. III. The Weight in Preparation. IV. The Philosophers Fire, what? V. The Rise or Birth of the Stone. VI. The Weights of the second Work. VII. Of Imbibition. VIII. Of Fermentation. IX. Of Projection. X. Multiplication. Things to be observed pp. 144–53.

L6–S4, T.: [p. 155] *ARCANUM*: | or, | the grand Secret | of | Hermetick | Philosophy. Wherein, | The Secrets of Nature and | Art, concerning the Matter | and Manner of making the | Philosophers *Composition,* are orderly and methodically manifested. | *The work of a concealed Author.* | Penes nos unda Tagi. | The third Edition amended and *enlarged.*

pp. 157–61. To the Students in, and well affected unto Hermetick *Philosophy, health and prosperity.*

pp. 163–258. Hermetick Secrets [told in 138 paragraphs].

pp. 259–65. *To the Lovers of Hermetick Philosophy I. C. Chymierastes wisheth prosperity.*

[266] paged '252'. The Signifer of Philosophers with the Houses of the Planets.

pp. 267–8. The Times of the Stone. Finis.

APPENDIX D

WALTER MOYLE'S BIRDS OF CORNWALL, 1716

The first printed list of the Birds of Cornwall, some fifty in number, was contained in *The Survey of Cornwall written by Richard Carew of Antonie Esquire* and published in 1602. But the author, who had the advantage of being a native of the Duchy, had not had that methodical training in Natural Science which is seen on every page of *The Ornithology of Francis Willughby* as enlarged by John Ray and published in 1678, which everywhere led to a closer study of British birds and in which more extended observations on Cornish birds were included.

Such a study was made by Walter Moyle, who had previously been in correspondence with John Ray about the true Service Tree and Seaweeds, which he, in company with Mr. Stevens, had observed in Cornwall before the close of the seventeenth century.

Walter Moyle was the son of Sir Walter Moyle of Bake near Loo, who matriculated at Exeter College in 1650, was knighted in 1663, became M.P. for Cornwall in 1654–5, and was buried at St. Germans in 1701. The younger Walter also matriculated at Exeter College, in 1688–9, at the age of 16. He, too, went into Parliament, representing Saltash, and died aged 47 on June 9, 1721.

In 1713 he added a new library to his house at Bake, and soon after turned his attention to forming a collection of local birds. His interest in natural history had been stimulated by the works of John Ray, the eminent naturalist, who indeed had acknowledged Moyle's assistance in his *Synopsis Methodica Stirpium Britannicarum*.

He was an interesting writer on the antiquities of his country, and was endowed with more than average ability and sense of humour. Some of his essays and letters were printed in 1726 under the title of *The Works of Walter Moyle, Esq., None of which were ever before published*, and three of his letters relating to birds have been reprinted by Harting, *Birds of Cornwall*, 1880.

The first letter, dated September 19, 1716, described in detail a new and undescribed species of bird called a 'Petrel' by the Cornish fishermen. This is the first description of the Storm Petrel, *Procellaria pelagica*. The letter, as printed, is unfortunately unfinished. It ends abruptly: 'My brother will tell you that I have made a numerous collection of all kinds of Birds, and hope by next Winter . . . I am, Sir, W.M.'

Three years later Dr. Sherard, the eminent botanist, having returned to Oxford from his eastern tour, and being interested in birds as well as botany, wrote to Moyle, proposing an exchange of letters and specimens.

To this Moyle replied that he had not meddled with any part of natural history 'except the History of Birds that are either natives of England, or Passengers. I want a hard winter or two to complete my collections, and I shall then draw up my observations upon them.' This was in 1719.

It is noted in the Dictionary of National Biography that he entered his observations on birds in the margins of his copy of Willughby's *Ornithology*. But his collections, books, and papers were burnt in a destructive fire, and it was believed that his ornithological notes then perished likewise.

A few years ago I was fortunate enough to acquire a copy of Willughby's *Ornithology* with marginal notes, though without any indication as to the writer. The testimony of the bookseller and the inserted book-plate of G. W. F. Gregor is evidence that the volume came from a west country library,[1] while the wording of the marginal notes repeatedly referring, as they do, to birds collected for the purpose of being put up in cases for a collection in the years 1715, 1716, and 1717 leave

[1] The library of Francis Gregor, 1761–1817, of Trewarthenic, Cornelly.

no doubt in my mind that here we have the long-lost catalogue of the Moyle collection of Cornish birds.

At least 129 species of birds are noted, usually with a record of their weight when killed and with the date when they were put into the hands of the bird-stuffer.

The omission from the list of such common birds as the Redbreast, the Sand Martin, and others shows that he was acquainted with quite one half of the county fauna as recognized by Rodd in the middle of the nineteenth century.

Moyle's collection was, therefore, by far the most important early contribution to the Ornithology of Cornwall that had been made, and one that will always rank high in the annals of early bird lore of any English county.

The latest news we have of Walter Moyle is contained in a letter from Dr. Sherard to Dr. Richardson. 'Mr. Moyle (I heard this day [Sept. 7, 1721] from Stephens) has been dead about two months, which I am sorry for. I don't hear he has left the catalogue of English birds he promis'd to send me to be printed in the *Transactions*; but Mr. Stephens believes they are added in Mr. Ray's *Ornithology*, and promises to look after it and write it out.'

Marginal Notes to Moyle's Copy of Ray's Ornithology

Bald Buzzard. *Haliaëtus albicilla* L.

[At Pensans in Cornwall we saw one that was shot having a mullet in its claw: for it preys upon fish (Willughby).][1] Shot and cas'd 1717. It weigh'd about 56 Ounces. Mine was 5 feet between the extremities of the Wings extended. Mine built on Longstone had 2 young ones and one egg in the Nest.

Buzzard. *Buteo buteo* L.

Tree Kite, Cornub. 1715/16 now alive by me. It weigh'd but 24 Ounces. Black Furze Kite Devon.

Another, which was a hen, shot and cas'd 1716 weigh'd above 34 Ounces.

[1] The paragraphs in square brackets have been taken from the printed text to explain the manuscript notes. The scientific names in italics have been checked by my friend, Mr. Bernard Tucker.

Another Hen shot the same year weigh'd above 33 Ounces. Mine had a mouse in its Belly, and a Slow worm in the Nest which was built on a high Tree. It had 3 eggs as large as hens and of y^{e} colour here described [white with a few great reddish spots].

Ring-tail 'the male whereof is called the Henharrier'. *Circus cyaneus* L.

[Female.] Shot 1716 and cas'd Furze Kite Cornub. It weigh'd near 16 Ounces.

[Male.] White Hawk or White Kite Cornub. Shot and cas'd 1716. It weigh'd 11 Ounces.

Kite. *Milvus milvus* L.

Shot and cas'd 1716.

More-Buzzard. *Circus aeruginosus* L.

This as well as ye Ringtail, is call'd Furze Kite in Cornwall. Shot and cas'd 1716. It was a hen and weigh'd above 27 Ounces. The nest of mine was in a Furze Brake near a Marsh, there were in the Nest 2 Young ones just hatch'd and 2 Eggs, white and somewhat less than the Eggs of a young hen.

Hobby. *Falco subbuteo* L.

Shot and cas'd 1716. It did not weigh quite 8 Ounces.

Kestrel. *Falco Tinnunculus* L.

Cress-hawk. Shot and cas'd May 1716. It weigh'd about 8 Ounces. The Nest of mine was built in a rock on the Cliff, and had 4 Eggs of the colour here describ'd and as large as pigeons eggs.

Sparrow-hawk. *Accipiter nisus* (L.)

Shot and cas'd March 1716. It weigh'd 10 Ounces and a Quarter.

Lesser Butcher-Bird. *Lanius collurio* L.

Shot and cas'd 1716.

Cuckow. *Cuculus canorus* L.

A.D. 1715. 14 Inches in that which I describ'd, and the bird weigh'd somewhat more than 4 Ounces, and was very fat. Was shot in May a female and had 2 Eggs in it.

A.D. 1715/6. This [the well-known nesting habit of the cuckoo] Mr. Bat affirmed to have observ'd himself in Cornwall lately.

Horn-Owl. *Asio otus* L.

Now cas'd by me 1717.

Ivy-Owl. *Tyto alba* Scop.
Shot and cased 1716. It weigh'd about 13 Ounces.

Fern-Owl. *Caprimulgus europaeus* L.
Nightcrow Cornub. Shot and cas'd May 1716. It was a Cock. It was fat and tho' it appear'd bigger than the Missel bird yet weigh'd but 2 Ounces and a Dram. The head very flat, a very little tongue, and very large prominent Eyes.
The Nostrills rais'd very high, and stood up like two little pipes. The Colour of the Back very much like the Wrenecks. There was nothing [in the stomach] in mine but Oakwebs. The wing feathers and tail in mine had these white spots; but in another shot the same year which weigh'd above 2 Ounces and a half these white spots were wanting.

Carrion Crow. *Corvus corone* L.
Shot and cas'd 1716. It weigh'd 19 Ounces. It had several white feathers in the wings.

Royston Crow. *Corvus cornix* L.
Shot and cas'd 1716. It weigh'd about 23 Ounces.

Jack-daw. *Corvus monedula* L.
Shot and cas'd 1716.

Cornish Chough. *Phyrrhocorax pyrrhocorax* (L.)
[It is found not only in Cornwall, but also in Wales] W.
Shot and cas'd this January A.D. 1715/6 weigh'd 13 Ounces.

Magpie. *Pica pica* L.
Shot and cas'd 1716/7. It weigh'd 8 Ounces.

Green Woodpecker. *Picus viridis* L.
Woodwall. Shot and cas'd this April 1716. One I saw weigh'd more than 6 Ounces. Another less.
This [vermilion] Spot [under the eyes] was wanting in one of mine.

Greater Spotted Woodpecker. *Dryobates* (L.)
Shot 1715/6 in Cornwall. Now cas'd by me.

Wryneck. *Iÿnx torquilla* L.
Shot and cas'd 1716.

Nuthatch. *Sitta caesia* Wolf.
Shot and cas'd this March 1715/6. Mine tho' very fat weigh'd but three quarters of an Ounce. It was a hen for we found an

Egg in the Belly. The inmost [fore toe] in mine was the least [whereas W. had described the outmost foretoe as being the least].

Creeper. *Certhia familiaris* L.
Shot and cas'd this winter 1715/6. It weigh'd 2 Drams and a quarter.

Hoopoe. *Upupa epops* L.
Shot this Summer 1717 and preserv'd. Another shot in St. Germain parish in Cornwall, April 20, 1720. Mine was shot in Cornwall.

Kingfisher. *Alcedo ispida* L.
Now cas'd by me 1716.

Water-Ouzel. *Merula aquatica.* *Cinclus cinclus* L.
Shot and cas'd 1716. It weigh'd about 2 Ounces and a quarter. Another shot the same year being very fat weigh'd above 3 Ounces.

Persian Cock and Hen.
I have this kind of hens [called Rumkins, wanting of a rump or tail].

Indian Cock.
A.D. 1715. I have now by me the head of this bird and some years since saw it alive at Mr. Vallacks at Plymouth.

Guiny Hen. *Numida meleagris* L.
I kept two of these Birds a Male and female for some time alive A.D. 1715.

Pheasant. *Phasianus colchicus* L.
Shot and cas'd 1716. It weigh'd near 44 Ounces.

Rail. *Crex crex* (L.)
Now cas'd by me 1715.

Grous. *Lagopus scoticus* Lath.
Shot and cas'd 1716. It weigh'd about 43 Ounces. The Craw of mine had nothing in it but the tops of Heath.

Turtle-dove. *Streptopelia turtur* (L.)
Shot 1721 and now cas'd by me. The Crop of mine was full of Cloves seed.

Ring-Dove. *Columba palumbus* L.
Wood Dove or Wood Culver Cornub. Shot and cas'd 1716. It weigh'd 20 Ounces.

Rock-Pigeon. *Columba livia* Gm.
Shot and cas'd 1716. It weigh'd above 12 Ounces.

Misselbird. *Turdus viscivorus* L.
Holm Shrite Cornub. Shot and cas'd 1716. It weigh'd about 3 Ounces and 3 quarters. Another shot the same year weigh'd about 4 Ounces.

Song-thrush. *Turdus philomelus* Brehm.
Shot and cas'd 1716. It weigh'd about 3 Ounces.

Fieldfare. *Turdus pilaris* L.
Shot and cas'd this winter 1715/6. The Claw of the back Toe much longer than any of the others.

Redwing. *Turdus musicus* L.
The 'Whinard Cornub' very common in Cornwall. Shot and cas'd 1716. It weigh'd near 2 Ounces.

Blackbird. *Turdus merula* L.
'Throstle.'

Ring-Ouzel. *Turdus torquatus* Brehm.
Water Throstle. Now cas'd by me 1716.

Starling. *Sturnus vulgaris* L.
Cas'd this winter 1715/6. I have a white one now by me 1716/7.

Skie-Lark. *Alauda arvensis* L.
A.D. 1715/6 I saw and describ'd a Sky Lark shot this Winter which in all other respects agreed with the common lark and differ'd only in the Colour, this having a white breast belly etc, and was white in all High parts where the common one was Yellowish, and where the other had dusky strokes this had blacker ones. It weigh'd a little less than the common one.

Woodlark. *Lullula arborea* (L.)
Shot and cas'd this winter 1715/6. It weigh'd an Ounce and somewhat more.

Meadow pipit or Tit-Lark. *Anthus pratensis* (L.)
Shot and cas'd this winter 1715/6. It weigh'd three Quarters of an Ounce.

Spipoletta. Presumably *Anthus petrosus* (Mont.) = Rock-Pipit. (B. T.)
Shot and cas'd 1716.

House-Swallow. *Hirundo rustica* L.
Shot and cas'd 1716. [In winter they fly away to hot countries] which is confirm'd by Derham in his *Physics Theology*, p. 389.

Martin. *Delichon urbica* (L.)
Caught and cas'd 1716. It weigh'd half an Ounce.

Swift. *Micropus apus* L.
Shot and cas'd 1716. Mine weigh'd above an Ounce and quarter.

Chinese Swallow.
I saw 'em at Gresham Colledge. The best are found in y[e] Isle of Borneo, see Beckman's Voyage p. 146, 7. They are found likewise in some Islands of y[e] Coast of Cochin-China, see Taverniers Voyage to Tonquin p. 9.

Hedge-Sparrow. *Prunella modularis* (L).
Shot and cas'd 1716.

Fig-eater. *Sylvia borin* (Bodd.) = Garden-Warbler. (B. T.)
Shot and cas'd 1716.

[A small bird]
Shot and cas'd 1716. It weigh'd near half an Ounce.

Redstart. *Phoenicurus phoenicurus* (L.)
Firetail Cornub. Shot and cas'd April 1716. Mine weigh'd somewhat less [than half an ounce].

Black-cap. *Sylvia atricapilla* L.
Furze chatter. Shot and cas'd April 1716. It weigh'd a little more than half an Ounce.

Golden-crown'd Wren. *Regulus regulus* L.
Stone knocker. Shot and cas'd this winter 1715/6. It weigh'd a Silver mill'd Sixpence and three pence and very little more. Mine was not quite so long [as 4½ inches]. [In the bird that John Ray described, the breast and belly were dashed with a faint green.] So was mine.

[A little yellowish bird] *Parus major* L.
I take this Bird to be our Oxeye which I have now by me A.D. 1716.

Wren. *Troglodytes troglodytes* L.
Shot and cas'd 1716. Mine did not weigh full 3 drams.

Fallow-Smich. *Œnanthe œnanthe* (L.)
The Stone knocker or Stone breaker Cornub now cas'd by me A.D. 1716. It weigh'd 3 quarters of an Ounce.

Whin-chat. *Pratincola rubetra* L.
Shot and cas'd 1716. It weighed above half an Ounce.

Stone-smich. *Pratincola rubicola* L.
Furze Chatter Cornub. Shot and cas'd 1716. It weigh'd about half an Ounce.

White-throat. *Sylvia cinerea* Bechst.
Shot and cas'd 1716. It weigh'd near half an Ounce.

Water-Wagtail. *Motacilla alba* L.
Hen shot and cas'd 1716. It weigh'd near an Ounce.

Yellow Wagtail. *Motacilla Raii* Bonaparte.
Cock shot and cas'd 1716. It weigh'd near three quarters of an Ounce.

Great Titmouse. *Parus major* L.
The great Heckmall A.D. 1715 now cas'd by me. It weigh'd about 3 quarters of an Ounce.

Cole-mouse. *Parus ater* L.
Shot and cas'd 1716. It was a hen. Mine weigh'd a little more [than 2 drachms].

Marsh Titmouse. *Parus palustris* L.
Shot and cas'd 1715/6. It did not weigh full 3 drams. [From the point of the bill to the end of the claws it is by measure] Near 5 Inches. [The distance between the extreme tips of the wings extended is] above seven inches.

Blue Titmouse. *Parus caeruleus* L.
Lesser Heckmall Cornub. Shot and cas'd 1716.

Long-tail'd Titmouse. *Ægithalus caudatus* L.
Shot and cas'd A.D. 1715, 1716. It did not weigh 2 drams. Another shot and cas'd 1716, weigh'd above 2 drams.

Hawfinch. *Coccothraustes coccothraustes* (L.)
One of these birds was shot A.D. 1714 in the winter. They sometimes breed here and a whole Nest of them was shot in Devonshire 1714. The Countrey people gave it y^{e} Name of Chipper from its breaking y^{e} Apples to come at the Kernels. Tis now cas'd by me.

Virginian Nightingale. *Coccothraustes Indica cristata.*
Sent me dead 1718.

Green-finch. *Chloris chloris* L.
Green Linnet. Shot this winter 1714 and cas'd.

Bulfinch. *Pyrrhula pyrrhula* L.
Hoop. Shot and cas'd this winter 1715/6. It weigh'd above 3 quarters of an Ounce. [The neck, back, and shoulders blue or ash-coloured] and in mine.

Common Linnet. *Acanthis cannabina* (L.)
Shot and cas'd 1716.

Greater red-headed Linnet. *Linaria rubra major.*[1]
Shot and cas'd 1716. Mine did not weigh five drams.

Bunting. *Emberiza calandra* L.
Shot and cas'd 1716. It weigh'd more than an Ounce and half.

Reed-Sparrow. *Emberiza schoeniclus* (L.)
Shot and cas'd 1716. It weigh'd near 3 quarters of an Ounce.

Heronshaw. *Ardea cinerea* L.
Shot and cas'd 1716. It weigh'd about 3 pounds and 3 quarters.

Bittern. *Botaurus stellaris* (L.)
A Clobitern or Cloviter. Shot this winter 1715/6 and now cas'd by me. Twas shot on my ground at Milton under the way in the water.

Spoon-bill. *Platalea leucorodia* L.
This Bird was shot near the Seaside at Pouldram Castle in Devonshire A.D. 1714.

Woodcock. *Scolopax rusticola* L.
Shot and cas'd 1716. It weigh'd 11 Ounces and half.

Snipe. *Capella gallinago* L.
Shot and cas'd 1716/7. It weigh'd above 2 Ounces and half.

Jack-Snipe. *Lymnocryptes minimus* Brünn.
Hatter flitter Cornub. or half Snipe. Shot and cas'd 1716. It did not weigh more than an Ounce and 3 quarters.

Stoneplover. *Oedicnemus oedicnemus* L.
Vide Ray Synop. p. 105.
Stone Curlew. 1715/6. Two of them shot and cas'd this winter. The larger which I suppose to be y^{e} Cock weigh'd above 9 Ounces the hen about 8. In the Cock the neck was ferrugineous. The

[1] If it is really the Lesser Redpoll (= *Lineta rufuscens*) this would now be *Acanthis cabaret* (Müll.). (B. T.)

Bills of mine were above 4 Inches long. One side of y^e middle Claw was pectinated. In y^e Cock the breast or part of the belly had some brown transverse Strokes and in the back were some black and russet Strokes. In mine they were black at y^e Ends but about the Middle the inner half was white.

Curlew. *Numenius arquata* L.
Shot and cas'd 1717. It weigh'd above 25 Ounces.

Whimbrel. *Numenius phoeopus* L.
Half Curlew Cornub. Shot and cas'd 1716. It weigh'd above 13 Ounces.

Himantopus. *Himantopus himantopus* L. (Black-winged stilt.)
Shot near Penzance 1718.

Sea-Pie. *Haematopus ostralegus* L.
Shot and cas'd 1716. Mine had [a great white] Spot [under the chin].

Redshank. *Tringa totanus* L.
Shot and cas'd this winter 1715/6. It weigh'd near 4 Ounces. Another shot 1716/7 weigh'd above 4 Ounces.

Tringa. *Tringa ochropus* L.
Shot and cas'd 1716. It weigh'd near 2 Ounces and 3 quarters. Another shot 1717, of nigh the same weight.

Sandpiper. *Tringa hypoleuca* L.
Shot and cas'd 1716. It weigh'd above an Ounce and half. Another weigh'd near 2 Ounces.

Knot. *Calidris canutus* (L.)
2 Ounces ½. Ray's Synopsis.

Sanderling. *Crocethia alba* Pall.
Shot and cas'd this winter 1715/6. Called also Curvillet about Penzance in Cornwall.

Stint. *Erolia minuta* Leisler.
Bigger [than the common lark], Ray's Synopsis. An inch and quarter, Ray's Synopsis. Shot and cas'd this winter 1715/6. It weigh'd above 2 Ounces.

Lapwing. *Vanellus vanellus* L.
Hornwink. Shot and cas'd 1716. Mine weigh'd above 8 Ounces.

Green (Golden) Plover. *Charadrius apricanius* L.
Whistling Plover Cornub. Shot and cas'd this winter 1715/6. In

one which I saw this Winter the greatest part of the breast and Belly were black with some white lines or Spots.

Grey Plover. *Squatarola squatarola* L.
Shot and describ'd this winter 1715/6 and cas'd.

Sea-Lark (or Ring Plover). *Charadrius hiaticula* L.
Shot and cas'd 1715/6. It weigh'd one Ounce and three Quarters. Some others shot 1716 weigh'd above 2 Ounces.

Turn-Stone or Sea Dottrel of Sir T. Browne. *Arenaria interpres* L.
[Upon the western shores of England about Pensans in Cornwal . . . we observed many of them, where they fly three or four in company.] Shot and cas'd 1716. It weigh'd 3 Ounces 3 quarters. N.B. it was very lean.

More-hen. *Gallinula chloropus* (L.)
Shot and cas'd this winter 1715/6. Mine weigh'd somewhat less [than 12 ounces] but another weigh'd about 14 Ounces. Mine wanted y^e^ red therefore I take it to be a young Bird, but the others had it. This [red] Spot [between the feathers and the joynt of the leg] appears in my larger Morehen.

Water-Rail. *Rallus aquaticus* L.
Fencock Cornub. Shot and cas'd 1716. It weigh'd 4 Ounces and half.

Coot. *Fulica atra* L.
Shot and cas'd 1715.

Flammant. *Phoenicopterus.*
1716. Shot in Newfoundland and now cas'd by me.

Avosetta. *Recurvirostra avosetta* L.
Shot at Padstowe in y^e^ River A.D. 1720, and now cas'd by me. [A very rare visitor.]

A Bird now at Mr. Sandford's at Launceston. *Thalassodromia pelagica.*
The Bird from the tip of the bill to the tail 6 Inches. One wing when extended 6 Inches. The Tail 2 Inches, round at the ends, consisting of 10 Feathers. Bill half an Inch long, black, and the upper Mandibles hook'd at the point. Nostrills very high. Legs and feet black. Webb-footed with three toes, wanting the back lan. Legs inch and half long from knee to toe. The whole a Sooty deep dark brown, except over the Rump, and under the Belly which are white.

Penguin. *Alca impennis* L.

1716. Shot in Newfoundland and now cas'd by me. Mine is no larger than the Goosander being as I suppose a young one. Mine had but one [furrow] in y^e^ upper Mandible and two in the lower but not deeply impress'd as in y^e^ Auk. The lower mandible is longer than the Upper.

So has mine [black, flat feet]. The legs as in y^e^ Loon kind are situate backward at the end of the body and therefore it cannot walk unless erected perpendicularly. Mine wants the back toe.

Razor-bill called the Murre in Cornwall. *Alca torda* L.

Shot and cas'd this winter 1715/6.

Guillemot. *Uria aalge* Pent.

Round bill'd Murre. Shot and cas'd 1716/7. It weigh'd above 21 Ounces. Another 1717 weigh'd about 22 Ounces.

[Called by the Cornish a Kiddaw or Pope. It breeds yearly on an island or rock called Godreve, not far from St. Ives.]

Puffin. *Fratercula arctica* L.

Shot and cas'd 1716.

[In the islands of Godreve, Sillies . . . they breed yearly in great numbers. With the Auks and Guillemots, the Coulternebs for the most part fly together and build in the same places.]

Soland Goose. *Sula bassana* (L.)

Gannet Cornub. Seen and describ'd this winter, March 1715/6. Kill'd and cas'd this year 1716/7. It weigh'd about 5 pounds. Mine likewise measur'd 2 yards from wing to wing and was in length a full yard. So in mine. This Soland Goose was caught near Menegosey in Cornwall about a mile from the Shore, by a hook baited with a pilchard and fastned to a long line thrown off from a ffisher Boat. It was caught about the End of January or the beginning of February 1716/7. They breed in vast quantities in the Isle of St. Kilda. See Martin's *History of the Western Islands of Scotland,* p. 282, 3. They are likewise common in Cornwall where they are call'd Gannets. They were plentifull in Cornwall in February 1716/7.

Cormorant. *Phalacrocorax carbo* L.

Shot and cas'd 1717. It weigh'd 8 pounds and half. The Breast was all black in mine and the belly only on each side was a large white Spot. In mine from the Angles of y^e^ Mouth near five Inches.

Shag. *Phalacrocorax aristotelis* L.

Shot and cas'd this winter 1715/6. Mine weigh'd above 4 pounds and had a black tuft of feathers on y^e forepart of y^e head. Round the Angles of the Mandibles grows a yellow Skin. In mine y^e Skin under the lower Mandible was black with little yellow Specks and worn off at the ends like the Woodpeckers. In mine the feet and legs were all over black. In mine [the claw of the middle toe] it was serrate and likewise in y^e Cormorant.

There is in Cornwall Another Shag call'd the Grey Shag which differs from that here describ'd, in that it wants the Tuft or Crest of Feathers on its head, and that the inside of y^e legs, and y^e upper part of the feet and Membranes are white. It likewise differs widely in the Colour of the body all the upper part being of a greenish black with a large Mixture of Russet and some Strokes of white, and the lower part of the body of a sordid white and a dusky Crown. It agrees in weight, one weighing 4^l. 30 Ounces, tho' another (I suppose a Young one) weigh'd much less. I am assur'd that there are old hens found of both these Colours Viz. Some all black, and others Grey, which (if true) tis plain they are two different Species. In other respects it agrees pretty well with the black Shag. Shot and cas'd 1716.

The Colour of the Grey Shag in the upper part of the body resembles that of the lesser tooth'd bill Diver.

Goosander. *Mergus merganser* L.

Shot and cas'd this winter 1715/6. It was shot in the River near Keserell Mills and had in his mouth half swallow'd a trout or shot 14 Inches long.

Dun-Diver. *Mergus serrator* L.

Shot and cas'd this winter 1715/6. It weigh'd 2 pounds and quarter.

Serula.

Shot and cas'd this winter 1715/6. It weigh'd 2 pounds 3 Ounces and half. N.B. it was very fat.

Grey Loon. *Podiceps cristatus* L.

Shot and cas'd 1715/6.

A Description of a Loon shot and cas'd in 1715/6 which is probably the Same with the Ashcolour'd Loon Figur'd but not described by Mr. Willoughby. It weigh'd a pound and half.

Measur'd from bill to Toes 25 Inches, from wing to wing extended 2 foot and half.

All the upper part of the body, viz. Top the head, neck back wings when clos'd and Rump (for it has no tail) of a dark Cinereous colour. All the lower part of the body viz. Chin, Cheeks, lower part and Sides of the neck, throat, breast, belly and sides white. The feathers set thick, and soft fine like silk. The Belly divided into 2 equal parts by a trench or Furrow which begins at the middle of the body, and extends itself growing gradually deeper to the end of the rump.

The Bill from the Angles of the mouth above two Inches long, straight but a little bent toward the tip. The upper Mandible on the top of a dusky colour, of a pale red on each side near the Base, and cinereous toward the tip. The Bottom and sides of the lower Mandible of a pale red, toward the tip Cinereous. Both Mandibles of an equal length, the upper pretty long. On the head it has some loose feathers which it erects like ears.

The Legs situate backward near the Tail like other loons, short, feather'd almost to the Knees compress'd and oar like, on the exteriour side dusky, on the inner whitish. On the back part serrate with a double Row of Asperities. The back Toe loose with a large Fin or webb. The Toes long, the outermost the longest. The middle and outer Toes connected by a Web or membrane as far as an Inch from the root of the foot, the Middle and Inner about half as much. The rest is not connected but separated. The Fins or Webs reach almost to the end of the claws which are broad like human nails. The Webbs black at Bottome and pale at top.

The Larger Quill feathers of the Wing are Cinereous, the Smaller white. The ridge of the wing is white from the base to the point a considerable Depth.

Dipper. *Podiceps ruficollis* Pall.

Shot and cas'd 1716. It weigh'd about 6 Ounces. Another weigh'd little more than 4 Ounces.

Greatest speckled Loon. *Colymbus.*

Shot and cas'd this winter 1715/6. It weigh'd above five pounds and seems to be as large as the common or wild Goose. From the tip of the Bill to y^{e} end of the legs it measur'd a Yard. Between the tips of the wings extended it was 4 foot and about 4 Inches.

The Bill in mine was above 4 Inches long, and [the feet are] cover'd underneath with a Membrane that reaches to the tip of the Claw.

Great black and white Gull. *Larus marinus* L.
Shot and cas'd 1716. It weigh'd 3 pounds and 13 Ounces.

Herring-Gull. *Larus argentatus* Pent.
Shot and cas'd 1716. Mine weigh'd 34 Ounces.

Great grey Gull. *Stercorarius skua,* Brünn.
Shot and cas'd 1716. It weigh'd about 18 ounces. [The Cornish men related to us for a certain truth, that this bird is wont to persecute and terrifie the Sea-Swallows, and other small Gulls so long till they mute for fear; and then catches their excrements before they fall into the water, and greedily devours them as a great dainty. This some of them affirmed themselves to have seen.]

Sea-Swallow. *Sterna hirundo.*
Shot and cas'd 1716. It did not weigh 4 Ounces.

A wild Swan. *Cygnus cygnus* L.
Shot in January 1715/6 in Cornwall and now cas'd by me. It weigh'd 16 pounds. Measur'd from the tips of y^e^ Bill to y^e^ end of y^e^ Tail 55 Inches, to y^e^ end of y^e^ feet 30. The distance between the tips of the wings extended was 7 foot and about 4 Inches diam. It was white all over. In mine the feet were blackish. The wind pipe exactly agreed with this description.

Common wild Goose. *Anser anser* L.
Shot this winter in Cornwall $17\frac{15}{16}$ and seen by me. Mine weigh'd above 7 pounds.

Bernacle. *Branta leucopsis* Bechst.
Seen and describ'd 1716 and now cas'd by me. It weigh'd about 3 pounds and half.

Brent Goose. *Branta bernicla* L.
Shot and cas'd this winter 1715/6. It weigh'd 3 pounds and ten Ounces and is considerably larger than the Duck. Another shot the same Winter weigh'd 3 pounds 3 Ounces and a third 2 pounds and 14 Ounces.

Swan-Goose.
I have some of them tame.

Sheldrake. *Tadorna tadorna* L.
Shot this winter 1715/6 now cas'd by me. It weigh'd 42 Ounces.
N.B. it was very lean. I observ'd the same in the Bird I dissected.

Poker. *Nyroca ferina* L.
Shot and cas'd this winter 1715/16. The Tamar Wigeon Cornub.

Golden-eye. *Bucephala clangula* L.
Pyed wigeon Cornub. Now cas'd by me. 1715.

Wild Duck. *Anas platyrhyncha* L.
Shot and cas'd 1716. It weigh'd 37 Ounces.

Common Wigeon, p. 375. *Anas penelope* L.
Whistling wigeon Cornub. Shot $17\frac{14}{15}$ is now cas'd by me.
Of the 2 wigeons call'd Duck wigeons, and sent me by Mr. Bat the largest weigh'd 26 Ounces, the lesser 20. 1715–6.

Sea-Pheasant. *Anas acuta* L.
Shot and cas'd this winter 1715/6. Mine was less in weight and measure. In mine there was but one feather longer than y^e rest about half an Inch. But I believe mine was a young one. The other marks agreed well with this Description.

Teal. *Querquedula crecca* L.
Shot and describ'd this winter 1715/6. It did not weigh full 12 Ounces.

Garganey. *Querquedula querquedula* L.
Seen and describ'd this year 1716. It was shot in Devonshire.

Hooked-bill'd Duck.
I have some of this kind tame.

Stray Notes on a blank page

Garden Bird near half an Ounce.

Mr. Smithurst's Bird weigh'd about an Ounce.

Gull with cinereous back weigh'd not full 10 Ounces.
The other not 8.
The first to the tail 16 Inches between the wings above 3 feet.
The other 17 Inches and between the wings 3 feet.

Mr. Smithurst's bird of y^e^ Sanderling kind did not weigh 3 quarters of an Ounce.

27 quarter

	a	o
Grey Shag	4	3
	3	4

Greyer Gull about 15 Ounces. Other weigh'd about 14. Another 18 Ounces and half.

Mew about 9 Ounces. Another 10 and half, the third 11 and a quarter.

Mr. Bat's Bird of the Duck kind call'd by some the pyed Duck weigh'd a full pound.

Stint above an Ounce and half.

APPENDIX E

REGISTER OF PERSONS

WHO ATTENDED PROFESSOR BRADLEY'S LECTURES ON EXPERIMENTAL PHILOSOPHY AT THE OLD ASHMOLEAN MUSEUM FROM 1746 TO 1760

MS. Bradley 3.

Bradley's Lecture Notes, now stored in the Bodleian, give a good idea of the nature of his Course. MS. 1 explains that the design of the lectures was to explain several of the principal phenomena of Nature and to give some account of the Causes so far as they depend 'upon the situation and motion of Bodies and the general laws of Motion'. This is all repeated in MS. 11 with additions. Mechanics, with a note on the eclipse of Jupiter's first satellite on Nov. 28, 1737, are discussed in MS. 7. MSS. 9–10 deal with the Vibration of Strings, Hydrostatics and Magnetism respectively. MS. 8 deals with Acceleration and Projectiles: a playing-card was used as a curve for drawing parabolas. MSS. 4, 5, 6 are on Optics. MSS. 12, 13, and 17 are abridgements of courses read at Oxford in 1747.

It is stated that until 1749 Bradley was not in receipt of any stipend as Lecturer on Experimental Philosophy, so he charged a fee of three guineas for the courses of lectures which he delivered in the Old Ashmolean Museum. The average attendance at these lectures was 57. The list of persons who attended during the later period is still in existence, and with other similar lists of the period supplies ample evidence that the Ashmolean Museum was a Scientific Institution where the Natural Sciences were taught and not, like the modern Ashmolean Museum, a Museum merely of Art and Archaeology.

The list also shows that a considerable number of candidates for Holy Orders attended lectures on Natural Science before they were ordained. Although we do not recognize very many great names among Bradley's auditors, we believe that these and other similar lectures led to the diffusion of useful culture in country parishes and to the stimulating growth of Mechanics' Institutes in the following century.

The numbers at the ends of the lines indicate the year after matriculation when the student attended the lectures. Christian names, dates, and spelling have been adopted from Foster's *Alumni Oxonienses*. Absence of a Christian name indicates doubt as to the identity of the student.

Note.—The names in this list are not indexed.

ALL SOULS COLLEGE

1746.	Buller, Francis of Anthony	matric. Balliol 1741; B.A. 1746–7; M.P. West Looe 1761–†64	5
1748.	Sandford, John	matric. Oriel 1742; D.D.; Rector of Hatherop	6
1749.	Vansittart, Robt.	matric. Trin. 1745; Fellow; Regius Prof. of Civil Law	4
1752.	Popham, Alex.	matric. Balliol 1746; B.A. 1751; M.P. Taunton	6
—	St. Lo, Thos.	matric. Balliol 1747; D.C.L.	5
—	Thomas, Geo.		4
1759.	Wills, John	matric. Wadham	4
—	Cox, A. M.	Not traced	
1760.	Davenport, F. Chas.	matric. B.N.C. 1753; M.A. 1760; Rector of Brereton	7
—	Hathway, Sam.		3

1760.	Wheeler, Jas.		3
—	Jarvis, Maurice	matric. 1757; B.Med. 1767	3
—	Blackham, Ch.		3

BALLIOL COLLEGE

1746.	Mr. Acland, Arth.		2
—	Price, Chas.	Of Blount's Court, Oxon.	2
—	Luxmore, Ch.		2
1747.	Harling, Edw.	Demy of Magdalen 1747	2
—	Vivian, John	Reg. Prof. of Modern History	3
—	Pennington, Wm.		2
—	Gifford, Ri.		3
—	Davys, Th.		3
—	Dennis, Robt.		2
—	Batt, Arth.	matric. 1742	5
1748.	Collins, Sam.		4
—	Atkinson, Jonas		3
—	Kidley, John		3
—	Wight, Hen.	High Sheriff Northants. 1755	4
—	Sharrock, Robt.		3
—	Walker, Benj.		2
—	Walker, Thos.		2
1749.	Burgoyne, Wm. Courtenay		2
—	Ackland, John		2
—	Swete, Adrian John		2
—	Ackland, Arth.		5
—	Carpenter, Wm.		2
—	Master, Robt.	Fell. All S. 1749; Rector of Croston	3
—	Coopey, Hum. Brent		2
1750.	Tucker, Pet.		2
—	Morgan, Thos.		2
—	Molesworth, Sir John	5th Bart. M.P. Cornwall 1765–†75	1
—	Cox, John	matric. 1747	3

1750.	Wilson, J. E.	Vicar of Sellinge	3
1751.	Borlase, Geo.	All S. 1756	2
—	Lethbridge, Chr.		3
—	Dawson, Walker	matric. 1750	1
—	Blackmore, Ri.	B.C.L.	3
—	Tayler, Edw.		2
1752.	Molesworth, Wm.		1
—	Rodd, Francis	Of Trebartha; Col. R.C. Militia	1
1753.	Drake, Francis		3
—	Drake, Edw. Holwell		3
—	Somervile, Wm.	Vicar of Bibury	3
—	Cheap, Andrew		3
—	Cother, Wm.		2
1754.	Yonge, Julian Bargus	Inner Temple; brother of Charlotte Mary Yonge	6
—	Bree, J.		3
—	Petre, Wm.	Rector of Mawnan	2
—	Sloper		
—	Dennis, R.		9
1755.	Ford, John		1
—	Mytton, Th.		1
—	Chambers, Jas.		4
—	Lind, John	F.R.S.	2
—	Richardson, Wm.		2
—	Hippisley, John	Rector of Stow, co. Glos.	3
—	Bayley, Francis		1
—	Whitcombe, John	Rector of Walesby	2
1756.	Lloyd, Dan.		3
—	Pidding, Jas.	Rector of Yatton Keynell	2
—	Snell, Powell	Mid. Temple	1
—	Liddiard, John	Mid. Temple	3
1757.	Birch, Jas.		2
—	Tremayne, Arth.		2
—	Maby, Ch. L.		2

1758.	Cooke, John		2
—	Pettat	Rector of Quenington	2
—	Craven	D.C.L. All S.; 6th Lord Craven	2
—	Lee, John		2
—	Grove, Hugh	Rector of Melbury	3
1759.	Perry, Hugh		1
—	Blackall, Theoph.	Preb. of Exeter Cath.	7
—	Kendal, Nich. Narracot		3
1760.	Comyns, John	Reynold's Exh. Exeter Coll.	2
—	Cook, John		4
—	Buller, Jas.		1

BRASENOSE COLLEGE

1746.	Mayo, Wm.		4
—	Bouchier	B.Med. 1762	3
1747.	Curzon, Assheton	Viscount Curzon 1802	1
—	Heber, Ri.		1
—	Mainwaring, Tho.		4
—	Finch, J.		7
—	Yalden, Ri.	Rector of Greatham	3
1748.	Drake, Thos.	matric. 1745; Rector of Amersham	3
—	Assheton, Ri.	D.D.; Warden of Manchester	4
—	Jackson, Edw. Downes		1
—	Parker, John		1
—	Hodgkin		1
—	Davis, John		
—	Cotton	? Jas. Cotton of Exeter matric. 1748	
—	Mapletoft, John		1
1749.	Currer, Hen.		
—	Gower, Foot	Fellow; D.Med.	3
1750.	Wroe, Ri.		2
—	Baddily, Wm.		2
1751.	Stanley, Tho.		3
—	Bissell, Wm.		3

1751.	Kenyon, Geo.	Barrister Middle Temple	1
—	Walthel, Pet., sen.		3
—	Lester, Sir Pet.	4th Bart.; M.P. 1767	
—	Walthel, Pet., jun.		1
—	Minshull, Th. S.		1
—	Brooke, Pet.	matric. 1751	1
1752.	Heber, Reg.	Fellow	5
—	Lloyd, Wm.		2
—	Prescot, Ri.		5
—	Walton, Ambr.		1
—	Lister, Sir Pet.		
—	Tyndale, Ri.		3
1753.	Bagot, Ri.		3
—	Bowen, John		4
—	Kenrick, John		3
—	Hadfield, Jos.		4
1754.	Gorges, Ri.	See Sir R. G. Meredyth in *Foster*	2
—	Price, Ri.		
—	Cartwright, Thos.	Of Aynhoe	1
—	Nicholson, Ralph	Fellow	3
—	Mayer, Hen.	Proctor	3
—	Blair		
—	Gowyn		
—	Barroll, John		3
—	Taylor, Geo.	D.C.L.	1
—	Studley, Edw.		1
—	Sneyd, Edw.		2
—	Cocks, Ph.	Rector of Acton	2
1755.	Inge, Wm.	High Sheriff, Stafford	1
—	Leche, Wm.	High Sheriff, Cheshire	1
—	Davy		
—	Radnor		
—	Haddon, Giles	D.D.	3
—	Haddon, Pet., jun.		1

1755.	Baker		
—	Unwell		
—	Holme, Thos.		2
—	Withnel, Thos.		6
—	Kaye, (Sir) Ri. (Bart.)	F.R.S.; Dean of Lincoln	1
—	Asheton, Ri.		3
1756.	Barker	D.D.; Principal of B.N.C. 1777–85	10
—	Falkner, Jas.	D.D. of Oriel	2
—	Arderne, Ri.		3
—	Burroughs, Thos.		3
—	Bartholomew, Wm.		5
—	Higgens, Sambrooke	Rector of Norbury	4
—	Hogarth, Jas.		3
—	Strode, Wm.		1
1757.	Ratclyffe, Robt.		1
—	Falconer, Thos.	Lincoln's Inn	3
—	Heyes, Ri.		3
—	Lonsdall, Miles	Rector of Gawsworth	3
1758.	Makin, Thos.		3
—	Wilde, Jas.		2
—	Whalley, Wm.	Master of Kington Gr. School	2
—	Moore, Glover		2
—	Stopford, Wm.	Master of Louth Gr. School	3
—	Ravenhill, John	Fellow of Worcester	3
—	Owen, Wm.		3
—	Napleton, John	Canon of Hereford	3
1759.	Hobhouse, H.	Middle Temple	1
—	Maddock, Hinton		1
—	Walker, J.		2
—	Cooper, John		2
1760.	Youde, Thos.		3
—	Hyett, Benj.		2
—	Vyse, Wm.	F.R.S. Chancellor of Lichfield	2
—	Radclif, Houstonne	D.D.	2

CHRIST CHURCH

1746.	Dawnay, John	4th Viscount; M.P. Cirencester	1
—	Kendall, Jas.		3
—	Scott, Lord Chas.		
—	Douglass, Lord Ch.	Earl of Drumlanrig; M.P. Dumfriesshire	1
—	Eyre, Anth.	M.P. Boroughbridge	1
—	Dobson, John	B.A. 1746	3
—	Curzon, Nath.	5th Bart.; Baron Scarsdale 1761	
—	Gould, Chas.	Sir Ch. Morgan	3
—	Dawnay, Hen., Viscount Downe	Commanded regiments at Minden and Campen	1
—	Murray, Dav.	D.C.L., cre. 2nd Earl of Mansfield	2
—	Thomas		
—	Dolben, Sir W., Bart.	M.P. Oxford University	2
—	Nicol, John	Rector of Meonstoke	1
1747.	Russell, Wm.	Lincoln's Inn	4
—	Harley, Robt.	Lawyer; M.P. Droitwich	3
—	K(e)yte, Jos.	Usher of Westminster School	3
—	Horden		
—	Tookie, Paul		3
—	Ellys, Geo., sen.	Memb. House of Assembly, Jamaica	1
—	Ellys, John, jun.	Memb. House of Assembly, Jamaica	1
—	Bruce, Geo.		3
—	Langlois, Benj.	D.C.L.; M.P. St. Germans	2
—	Palmer, Lyttelton	Rector of Corwen	6
—	Thornton, Bonnell	B.Med.; humorist and poet	4
—	Johnson, Sam.	Vicar of Bampton, Oxon.	2
1748.	Smallwell, Edw.		3
—	Harley, John	D.D.; Dean of Windsor	1
—	Sutton, John		3
—	Amyant, Thos.	Rector of Fawley	2
—	Pettyfer	(Not in Foster's *Alumni*)	

1748.	Francis Hastings	10th Earl of Huntingdon	1
—	Selwyn, Ch. J.	Preb. of Salisbury	3
—	Sharpe, Wm.	M.P. Callington	1
—	Crachrode, Clay.		2
—	Warren, J.	Archd. of Worcester	1
1749.	Spry, Matt.	matric. 1754; preb. of Salisbury	
1750.	Boyle, Hamilton	D.C.L.; Earl of Cork and Orrery	2
—	Needham, W. Dandy	Of Mt. Olive, Jamaica	2
—	Phelipps, Edw.	matric. 1741	
—	Weston, Ch.	Preb. of Durham	2
—	Dickens, F. W. Guy		1
—	Campbell, Lord Fred.	Treasurer of Mid. Temple	3
—	Ellys		
1751.	Hearle, Francis		2
—	Burke	M.P. Great Bedwyn; supposed author of *Junius's Letters*	4
—	Keppel, Fred.	D.D.; Bp. of Exeter	4
—	Lewis, Marmaduke		3
—	Lane, Robt.		1
—	Lloyd, Philip	matric. 1746; Dean of Norwich	5
—	Skynner, Thos.	Canon of Exeter	5
—	? Orkney or Abney		
—	Lock, Thos.	Usher of Westminster School	3
—	Tryon, R.		2
—	Markham, Enoch	Master of Oakham School	2
1752.	Price, Chase	M.P. Radnorshire	3
—	Burland, Claver Mo.	B.Med. 1758 as Morris	4
—	Nelson, Wm.		3
1753.	Banks, Collingwood	bur. at Ch.Ch. 1755	2
—	Whitfield, H.	Rector of Rushall	4
—	Britton		
—	Berkley, Geo.	D.C.L., preb. of Canterbury	1
—	Harley, Wm.	Vicar of Uffington	4
—	Digby, Wm.	D.C.L.; Dean of Worcester	1

1753.	Stacpoole, Geo.		I
—	Morgan, Ch.		3
—	Baggot, Walter	Rector of Bythfield	3
—	Poyntz, Ch.	Rector of N. Creake	I
—	Bassett, Miles		2
—	Levet, Ri.	Vicar of W. Wycombe	4
1754.	French, Wm.		3
—	Wheeler, Jos.		4
—	le Hunte, Ri.		I
—	Pemberton, Wm.		6
—	Parker, John	cre. Lord Boringdon	I
—	Mostyn (Sir) Roger	5th Bart.; M.P. Flintshire	3
—	Andrew, Robt.	matric. 1751	
—	Cuff, Otway	cre. Earl of Desart	2
—	Poyntz, Wm.		2
—	Giddy, Edw.		2
—	Fairfax, Guy	Rector of Wigan	I
—	Lynch, John	Archdeacon of Canterbury	I
—	Eager		
—	Banks, Geo.	Lieut. in the Guards	I
—	Loftie, John	Vicar of St. Dunstan's, Canterbury	2
—	Fairfax, Robt.		3
—	Collins, Sam.		3
1755.	Lewis, Lewis		2
—	Cocks, Jas.		I
—	Berty, Ri.		3
—	Russell, Ri.		5
—	Glass, Sam.	D.D.; Vicar of Wanstead	3
—	Hume, Nath.		3
—	Juson, Wm.	Vicar of Chippenham	5
—	Monck, John	Mid. Temple	I
—	Garden, Jas.	Student 1754	I
—	Probyn, John	High Sheriff, Glos.	3
—	Parsons, Jas.	Preb. of Exeter	I

1755.	Cleaver, John	Vicar of Frodsham	1
—	Fitzmaurice, Lord W.	K.G.; cre. Marquis of Lansdowne	1
1756.	Tichfield, Lord		
—	Willoughby, Lord	14th Baron	
—	Glenorchy, Lord	Son of 3rd Earl Breadalbane	
—	Borlase, Walter		2
—	Walter, Nevill	Rector of Bergh Apton	3
—	Tucker, Edw.		1
—	Knapp, Primat	Rector of Shenley	6
—	Spencer, Lord Ch.	M.P. Oxon.	1
—	Woodford, Matth.	Archd. of Winchester	1
1757.	Aston, (?) Hen.		1
—	Eager		
—	Johnson, Michael		4
—	Heath, John	Judge 1780–1816	3
—	Simpson, John		1
—	Wynne, J.		3
—	Church, Wm.		3
—	Padman, Jenner		2
—	Mordaunt, Ch.	Rector of Lit. Massingham	4
—	Lloyd, Chas.	Student	3
1758.	Jones,		
—	Mostyn, Thos.	Preb. of Chester	3
—	Bromley, Wm.		1
—	Beal, Jas.		2
—	Townsend		
—	Berners, Hen.	B.C.L.	4
—	Cox		
—	Ludford, Edw.		2
—	Jones, Hen.		2
1759.	Aubrey, John	D.C.L.; 6th Bart.; M.P.	1
—	Freind, Robt.	Inner Temple	3
—	Chelshum	Student, D.D.; Preacher at Whitehall	
—	Conybear	D.D.; Proctor 1770	2

1759.	Bagot, Lewis	D.C.L.; Bishop of Norwich	2
—	Wodehouse, John	6th Bart.; cre. Baron Wodehouse	2
—	Le Maistre, S. Caesar	Linc. Inn	1
—	Pepys, (Sir) Lucas (Bt.)	M.D.; Physician to the King	1
—	Hort, (Sir) John (Bt.)	Consul at Lisbon	
—	Russell, (Sir) John (Bt.)	Linc. Inn	1
—	Williams, W.		3
—	Thomas, J.		4
—	Macdonald, (Sir) Jas. (Bt.)		1
—	Piggott, John		1
1760.	Courteney, H.		1
—	Crew, John	cre. Lord Crewe 1806	1
—	Arcedeckne, Chaloner		
—	Harpur, Chas.	Major 38th regiment of foot	1
—	Grenville, Jas.	M.P. Buckingham; cre. Baron Glastonbury	1
—	Beaucham, Lord Francis Seymour-Conway	K.G., M.P.	1
—	Way, Benj.	F.R.S.; Gov. of Guy's Hospital	2
—	Malone, Hen. or Ri.	Inn. Temple	1
—	Montagu, Lord Ch. Greville		1
—	Parsons, John	D.Med.; Reader in Anatomy	1
—	James, Wm.		1
—	Davis		
—	Sheffield, Sir J. (Bt.)		1
—	Gilbert, John	Of Emmanuel Coll. Cambridge; licensed to practise medicine	1

CORPUS CHRISTI COLLEGE

1746.	Hall, Thos.		3
1747.	Wickham, John		2
—	White, J.		1

1747.	Leigh, Ri.	M.P. East Looe	3
—	Baker, John	matric. 1734; M.A. 1740–1; Proctor 1748	
—	Filmer, Sir E.	6th Bart.; Rector of Crundale	2
—	Reeks, Chas.	Rector of Stratford St. Anthony	2
1748.	Chetwynd, Viscount Wm. Ri.	M.P. Stafford 1754–†65	2
—	Hurst, Thos.		3
1749.	Hartley, David	Fellow of Merton; M.P. Hull	2
1750.	Patten, Thos.	Of Bank Hall; High Sheriff Lancs. 1773	1
—	Weller, Edw.	B.D.	2
—	Simons, Edw.	Chor. Magd. Coll.	3
—	Lewis, Jas.	matric. Wadham 1747–8; B.A. from C.C.C. 1751; ?Rector of St. Martin's, Salisbury 1757	
—	Skinner, Ri.	Fellow	4
1751.	Bulteel, John	matric. 1749	2
—	Soresby, Wm.		2
—	Estridge, John		1
—	Hornsby, Thos.	Savilian Prof. of Astronomy; Prof. of Natural Philosophy; Radcliffe Observer; Radcliffe Librarian	2
—	Lawson, Chas.	High Master, Manchester School 1764–†1807.	4
1752.	Deedes, Wm.	Chairman Qrt. Sessions, E. Kent	1
—	Shepherd, Ri.	Archd. of Bedford	3
—	Finden, Wm.	B.D.	3
1753.	Lloyd, John	F.R.S. †1777	1
—	Forster Ch. Francis	B.C.L.	1
—	Carter, Arnold	matric. Magd. Hall 1750; B.A. C.C.C. 1753	3
—	Musgrave, Sam.	matric. Queen's 1749; B.A. C.C.C. 1753–4; Radcliffe Trav. Fellow Univ. 1760; M.D. 1775; †1780	4
1754.	Campion, H. Courthope	Of Danny	3

1754.	Mason, Geo.	Inn. Temple	1
—	Wilson, Edw.	D.D.	2
—	Willson		
1757.	Whitaker, John	Fellow	4
1758.	Wilkinson, J.		3
—	Hartley, Winchcomb Hen.	M.P. Berks.	2
—	Randolph, Herbert	Rector of Croxton, co. Lincs.	2
—	Russel, John	Rector of Helmdon and Ilmington	3
1759.	Liddiard, Wm.		2
—	Drew, Fra. Rose, sen.	Of Grange, Devon	2
—	Drew, Th. Rose, jun.	Of Grange, Devon	1
1760.	Crosse, Ri.	B.A. 1760; High Sheriff Somerset	4
—	Alder, Wm.		1
—	Methuen, Paul	Linc. Inn 1762	1

EXETER COLLEGE

1746.	Perring, John	Fellow	2
1747.	Morshead, Wm.	High Sheriff Cornwall	5
—	Taylor, Th.		2
—	Hext, Hen.	Rector of Roche	2
1748.	Travell, Fr.	Fellow	3
—	Treise, (Sir) Chr., Knt.	M.P. Bodmin	1
—	Buck, Geo.	Of Affeton, Devon	1
1749.	Beavis, Pet.	B.A.	5
—	Martyn, Robt.		2
—	Phelps		
—	Carwythien, Geo.	Rector of Manaton	3
1751.	Williams		
—	Lawrence		
—	Andrew, Nich.		3
1752.	Fowel, John, D.D.	Fellow; Prof. of Moral Philosophy	
—	Lamborn, Ri.		3

1752.	Ascot	? H. Heathcote	
—	Newbery, Sam.	Fellow	2
—	Gilberd, Hen.		3
—	Hutchins, John		2
—	Marker, Hen.	Rector of Ashton	2
—	Palmer, Ch. Sam.	Rector of Eardisley	4
—	Buckingham, Jas.		3
1753.	Baker		
—	Hole, Jos. or Thos.		2
—	May, Sam.		3
1754.	Radcliffe, Walt.		1
—	Harington, John	D.D.	5
—	Taylor, Jos.		2
—	Fowel, John, jun.		2
—	Terry, Wm.	Fellow	2
—	Reynolds		
—	Hall, Hen.		3
—	Trevanion, Nich.	Afterwards at Queen's	2
—	Bedford, Thos.		2
—	Hannon		
1755.	Hellier, Sam.	Inner Temple	2
—	Heathcote, Hen.		3
—	Parker, Geo.	Inner Temple	2
—	May, Eman.	Fellow	2
—	Whetham, J.	Archd. of Cork	3
—	Buck, Lewis	D.C.L.	3
—	Pyne, John	Pine-Coffin 1797; matric. 1754	2
1756.	Northmore, Thos.		2
—	Hammett, Ri.	matric. 1754; Fellow	3
1758.	Kingdon, John	Fellow	3
—	Foote, Ambr. Cox		2
1759.	Orchard, Paul	M.P. Callington	2
—	Noyle, Hen.		3
1760.	Tickell, J.	Fellow	5

JESUS COLLEGE

1746.	Davise		
—	Williams, John		2
—	Hopkins, David	B.D.	3
—	Bonnell, Owen		2–3
—	Hughes, Bulkeley		2
—	Jones, John		
1747.	Rogers, John		1
—	Owens, John		1
1748.	Lloyd, Hen.		2
—	Roberts, John		2
—	Roberts, Ri.		2
—	Havard, Benj., jun.		5
—	Edwards, Edw.		2 or 3
—	Owen, Edw.		2
1749.	Law, A.		
—	Hoskins, John	Assumed name Hoskyns Abrahall	3
—	Phillips, John		2
1750.	Owen, Robt.		3
—	Denham, Robt.		3
—	Williams, Thos.		2
—	Higgon, John		2
1751.	Ellis, Ri.		3
—	Owen, Thos.		3
—	Rowlands, Hen.		3
—	Carne, John	M.A. of All Souls	2
1752.	Roberts, John		3
—	Bulkley, Robt.		3
1753.	Williams, Wm.		2
—	Bowen, Jas. or Thos.		2
—	Thomas, Edw.		2
—	Rogers, John		2
—	Phillips, Geo.		1
—	Deere, Matt.		2

1753.	Bandinel, Jas.	Fellow, Public Orator, 1776	1
—	Lloyd, Edw.		1
—	Lloyd, Evan		3
—	Thomas, T.		6
—	Parry, Wm.		3
—	Hughes, Zaccheus		2
—	Taynton		
—	Hoskins, Leigh		1
1754.	Williams, John		2
—	Ellis, Zaccheus		3
—	Griffiths		
—	Traherne, Edm.		1
—	Wynne, Edw.	Mid. Temple	1
1755.	Williams, Evan		2
—	Griffiths, Ri.		2
—	Jenkins, Wm.		2
—	Thomas, J. Deere	D.D.	1
—	Jenkins, Owen		1
—	Williams, Wm.		1
—	James, Ri.	D.Med.	1
—	Jones, Ant.		3
—	Jones, Wm.		2
—	Powell, Ri.		3
—	Jones, Edw.		1
—	Jones, Cadwalader		1
1756.	Bulkeley, Robt.	B.A.	7
—	Bulkeley, Robt.		2
—	Thomas, Pet.		2
—	Lloyd, John		2
—	Higgon, Thos.		2
—	Reynolds, Owen		3
—	Lloyd, David		2
—	Marsh, John		3
—	Price, Hugh	Rector of Little Ilford	2

1756.	Floyd, John		1
—	Perrot, Walt.		1
—	Lewis, Chas.		3
1757.	Hughes		
—	Williams, J.		1
—	Evans, Ri.		2
—	Timberlain		
—	Morris, Ro.		3
—	Thomas, J.		3
—	Bowen, Jas. or Thos.		
—	Jones, Hugh		2
—	Lloyd, Owen		3
—	Morris, Robt.		1
—	Edwards, Ri.		2
—	Foulkes, John		2
—	Curre, John		1
—	Jones		
—	Lewis, David		1
1758.	Dicken, Geo.		1
—	Griffiths, Griffith		2
—	Williams, Edm.		1
—	Wilkins, Ri.	Rector of Weston Gordano	2
—	Jones, Humphrey		1
—	Williams		
—	Nanney, Ri.		1
—	Davis, H.		
1759.	Evans, Evan		3 or 4
—	Aubrey, Th.	M.P. Wallingford	3
—	Roach, John		1
—	Carne, Edw.	Fellow	1
—	Brigstock, Owen		1
—	Wynne, J.		5
—	Scourfield, H.		1
—	Jennings, Thos.		1

1760.	Basnet, Ri.		2
—	Edwards, Edw.		2
—	Jones, Robt.		1
—	Edwards, John	Linc. Inn	1
—	Anwyl, Rice or Robt.		1

ST. JOHN'S COLLEGE

1746.	Drake, Ralph		4
—	Middleton		
1747.	Jervis, John		3
—	Biddulph, Benj.		3
—	Austen, Geo.	Proctor	1
1749.	Hibbs, Wm.		2
—	Taylor, J.		3
1750.	Rouquet, Jas.		2
—	Ayres		
—	Hitchock, Thos.	D.D.; Fellow	6
1751.	Tongue	Not in Foster's *Alumni*	
—	Disney, Matt.		3
—	Fullerton, Wm.	Fellow	2
1753.	Howlet, John	B.D.	4
1754.	Bishop, Sam.	Fellow; Headmaster of Merchant Taylors' School 1783	4
—	Dickens		
—	Walker, John		2
—	Pensrow	? Penrose, Rumney Fellow	5
—	Brathwaite, Thos.		3
—	Clair, Thos.		3
—	Ward, J.	B.C.L.	2
—	Altham, Jas.		5
1755.	Hickes, Robt. Adams		3
—	Lee, ?Leigh, Jas.	Assumed surname Perrott	4
—	Warneford, Edw.	B.D.	3

1756.	Terrey ?Tew, Edm.		3
—	Porter, Moses	B.D.	3
—	Powys, Ph. Libbe	B.C.L.	3
—	Powys, Thos.	Dean of Canterbury	3
—	Collet, Pet.		5
—	Brakenridge, Arch.	B.C.L.	2
—	Rush, Montague	B.D.	7
—	Vanderstegen		1
1759.	Finch, Francis	B.D.	3
—	Johnson, Thos.	Fellow	4
—	Walker, Tilly		4
—	Agate, Wm.		3
1760.	Taylor, Thos.	D.C.L.; Gresham Prof. of Law	3
—	Peach, John, sen.		3
—	Peach, Hen., jun.		3
—	Dennis, Sam.	President of St. John's 1772–95	3

HERTFORD COLLEGE

1747.	Noyes, Thos. Herb.	Mid. Temple	3
—	Birch, John Nevil		4
—	Trotman, Sam.	Rector of Newton Purcell	6
1748.	Comings, Fowler	matric. 1746	2
1749.	Lewis, Jenkin		2
—	Harvey, Ri.		2
—	Tournay, Thos.		2
1751.	Adams, Jas.	Rector of S. Ockenden	3
—	Miller, Arth.		3
—	Cooley, Pamplin		3
—	Rothwell, Ri.		3
—	Eyre, John		6
1752.	Tournay, R.		3
—	Hill, Ch.		3
—	Blake, Robt.		1

1752.	Fletcher, Walt.		3
—	Priest, Ri.	Rector of Reepham	2
—	Birch, Thos.		2
—	Greesley, Thos.	D.D.	1
—	Morris, Thos.	B.D.	20
1753.	Guise, Thos.		2
—	Price, Thos.	Headmaster Gr. Sch. Birmingham	2
—	Humphrys, Francis		2
—	Eyre, Dan.		4
1754.	Stokes, Thos.		3
1755.	Thorold, (Sir) J. (Bt.)		3
1758.	Wright, Lawrence	Master of Bury Gr. School	4
—	Earle, Tim.		3
—	Wilkes, J.		3
1759.	Head, Ri.	Mid. Temple	1

LINCOLN COLLEGE

1746.	Clarke, John	matric. 1745	
—	Ogle, Newton	Dean of Winchester	2
1747.	Mainwaring, (Sir) Hen.	4th Bart.	3
—	Duncomb, Hen.		2
1748.	Egington, Thos.	matric. Oriel	3
1750.	Hughes, Wm.	Rector of Bradenham	4
1752.	Dobson		
—	Marsh, Geo.	Rector of Ford	2
—	Blackett, John	matric. 1753	
—	Shuttleworth, Ri.		3
—	Stephenson, Josh.	Aft. Demy of Magd.	1
—	Dobson		
1753.	Annesly, Arth.		2
—	Hervey, John		2
—	Nicoll, Ri.	Fellow; Chaplain to the King	3

1755.	Chambers, (Sir) Robt.	Fellow of Univ. Coll.; Princ. New Inn Hall; Pres. of Asiatic Society 1797	1
1756.	Banks, Wm.		6
1757.	Langham, (Sir) Jas.	or (Sir) Wm. (Bart.) B.C.L.	4
—	Daniel, Wm.	B.C.L.	4
1758.	Ellison, Nath.		3
—	Tidy, Thos. H.		3
1759.	Whalley, Palmer	Rector of Ecton	3
—	Bates, Thos.	D.D.	7
—	Blacket, John		6
—	Rayner, Thos.		2
1760.	Howson, Thos.		4
—	Deacle, John	matric. 1756	

MAGDALEN COLLEGE

1746.	Freeman, Anth.	Demy	3
—	Dawbarn, Thos.	B.A. 1746	
—	Gibberd, John	Of Magd. Hall	3
—	Beaver, Geo. or H.		
—	Robinson		
—	Cadogan, Ch. Sloane	3rd Baron; Master of Mint 1769–84	1
—	Lysons, Dan.		1
—	Hodgkins		
—	Dr. [*sic*]		
—	Hall, John	Fellow and Bursar	
1748.	Bagot, Wm.	D.C.L.; 1st Baron Bagot	1
—	Forster, Nath.		7
—	Digby, Edw.	6th Baron Digby; M.P. for Wells 1754–7	1
1749.	Panting, Matt.	B.D.; Fellow All Souls	4
—	Tyndale, Thos.		3
1750.	Ferrand, Benj.	D.L. of St. Ives, Yorks.	2

1750.	Sneyd, Wm.		I
—	Scroop, R.	Demy 1748	
1751.	Paget, Ri.	Demy 1750	3
—	Day, Wm.	Fellow 1748	I
—	Hill, Ri.	Bart., M.P. Salop	I
—	Butler, Alex.		I
1752.	Goodday, Wm.	Demy 1748	
—	Long		
—	Davie, Sir John	7th Bart.	2
—	Johnson, Geo.	Demy 1751	2
1753.	Powys, Thos.		3
1754.	Leigh, Thos.	Demy; Fellow 1761	
—	Birch, Ri., sen.	Fellow	3
—	Birch, ? John, jun.		2
—	Walker, Thos.	Fellow 1750	
—	Leigh, Thos.	matric. 1753	
—	Dean, Wm.	Fellow 1768; Rector of Woolhampton	4
1755.	Pilkington, Ch.	Fellow 1752	6
—	Child, Francis	D.C.L.; Banker	2
—	Mackworth, (Sir) Herbert (Bart.)		2
—	Godbold, John		I
—	Bowyer, Sir W. (Bt.)		I
—	Lambert, Edm.		I
1756.	Knight, Thos.	D.C.L.	I
—	Crowther, John	Demy 1752	
—	Smith, Robt.		I
—	Palmer, Wm.		3
—	Wroughton, Seym.		2
1757.	Bell		
—	Daughtrey		
—	Prouse, Geo.		2
—	Winfield, Geo.		2

1757.	Pillet		
—	Walcot, Ch.	M.P. Weymouth	1
—	Hopton, Ri.		2
1758.	Suffolk, Lord		
—	Goring, (Sir) Harry (Bart.)		1
—	Child	M.A. 1757; D.C.L. 1763	
—	Newbolt, John		4
—	Canvey		
—	Walter, J.	Demy	4
—	Delves, (Sir) Bryan Broughton (Bart.)	5th Bart.	1
—	Ilbert, Wm.	High Sheriff Devon	1
1759.	Bragge, John		1
—	Norreys, Lord Willoughby	4th Earl of Abingdon †1799	1
—	Garret, Wm.		1
1760.	Gardiner, Jas.	Demy	3
—	Sibthorp, Coningsby	Demy	2
—	Horne, Wm.	Demy	3
—	Prouse, Geo.		1

MERTON COLLEGE

1746.	Fawconer, Sam.	matric. 1744	
—	Hunt, Ri.		2
1747.	Payne	Inner Temple	1
—	Forster, Robt.		2
—	Cust, Ri.	D.D.	2
—	Carr, Ralph		2
—	Harcourt, J.		1
—	Gyles, Jas.	matric. 1747	1
1748.	Newcome, Jos.		4
1749.	Howel, Thos.		3
1750.	Green[h]al, Robt.		3

1750.	Cox		
1751.	Blencowe, Wm.		5
—	Sheldon, Fr.		4
1752.	Ring, Nehemiah		4
—	Bourne, Ri.	D.C.L.; changed name to Charlett of All Souls	3
—	Berkley		
1753.	Garth, Ch.	M.P. Devizes	3
—	Street, J.		5
—	Diggle, Thos.		2
1754.	Brown, John		3
—	Norman, Jas.	B.D.	2
—	Barrington, Shute	D.C.L. Ch.Ch.; Bishop of Durham	2
—	Kilner, Sam.	Fellow	5
1755.	Wylde, Ch.		4
1757.	Cooper		
—	Bliss, Thos.	Son of the Savilian Professor	2
1758.	Richards, Geo.		2
—	Combe, Bennet		2
—	Willes, Ch.	Chanc. of Wells	4
1759.	Earl, Wm.		1
—	Lovell, Edm.	D.C.L.; Archd. of Bath	2
—	Wigenfield	? Henry Whitfield	
—	Pindar, Robt.		1
—	Poate, Dan.		3
—	Mills, Thos.	Vicar of Hillingdon, Middlesex	2
—	Lucas, Wm.		5
—	Harvest, Wm.		2
—	Aldridge, John Clater		5
—	Willis, ? Ch.		5
—	Sainsbury, Thos.	D.D.	5
1760.	Baker, Thos.		3
—	Grosmith, Wm.		2
—	Francis	(Not in Foster's *Alumni*)	

NEW COLLEGE

1746.	Hale, Matt.	Linc. Inn	2
—	Vansittart, Arth.	D.C.L.	2
—	Blackstone, Hen.	Fellow; B.Med. 1751; Vicar of Adderbury	6
1747.	Atkyns, Sir Ri., Bart.	D.C.L.	2
—	Pye, Benj.	matric. 1744; D.C.L.	
1750.	Rashleigh, Phil.	M.P. Fowey	1
1752.	Beaumont, Geo.	6th Bart.	7
—	Mordant, (Sir) J. (Bart.)	M.P. Warwickshire	1
—	Brampston, T. Berney	D.C.L.; M.P. Essex 1779	1
1753.	Hayward, Thos.		4
1754.	Oglander, (Sir) Wm.	5th Bart.	3
—	Sturges, J.	D.C.L.; Chanc. of Winchester	1
1755.	Cornwall		
—	Somner, Wm.	Rector of Stanton St. John	6
—	Chandler		
—	Trevelyan, Sir John	4th Bart.; M.P.	2
—	Wykeham, Wm.		2
—	Lowndes, W. (Selby)		1
—	Lang		
—	Staker, John	matric. 1751; D.Med. 1774	4
1756.	Burland, Wm.		4
—	Milborne, Ch.		2
1757.	Neale, Robt.		2
1759.	Beckford, Pet.	M.P. Morpeth 1768	2
—	Coryton, John		1
—	Nichols		
1760.	Mundy, Francis		3
—	Oglander, John	D.D.; Warden of New College	4
—	Tremayne, Lewis		2
—	Bigg Wither, Lovelace	matric. Queen's 1758; B.A. from New	

ORIEL COLLEGE

1746.	Kenrick, Ri.		2
1747.	Haddock, Ch.		2
—	Taylor, Ch.		1
—	Lockwood, Wm.	Inner Temple	4
—	Barnes, Geo.	matric. 1745	
—	Egerton, Dodington		4
—	Mills, Simon	Vicar of Leek	2
1748.	Beaver, Jas.		7
—	Jones, John		3
—	Myers, Skinner		2
—	Wingfield, Rowland		2
—	? Davies, Hen.	matric. 1742	
—	Livesey, Ralph		1
—	Fettiplace, Robt.		1
1749.	Sandford, J.	Rector of Hatherop	7
—	Wright, Ranulphus		1
—	Grosvenor, Ri.	cre. Earl Grosvenor 1784	1
—	Cooke, John		3
1750.	Tyson, Ri.	D.Med.; physician to St. Bart's.	3
—	West, Fr.	D.C.L.	2
—	Chair, John de	matric. 1747; D.C.L. 1758	
—	Cobbe, Ri. Chaloner	LL.D.	4
—	Waller, Ste.	Rector of Epping	3
—	Cocks, Jos.	matric. 1749; Inner Temple	
—	Taylor, Geo.	matric. 1747	
—	Scawen, Thos.		1
—	Hare, Robt.	Canon of Winchester	3
—	Vyvyan, Sir Ri.	5th Bart.	1
—	Barnett, Ch.		1
1751.	Forester, Thos.	B.C.L.	3
—	Bewick, Wilson	D.D.	3
1752.	White, Hen.	When Gilbert White was Proctor	3

1752.	Grosvenor, Thos.	M.P. Chester	1
—	Musgrave, Jos.	matric. 1749	
—	Swann, Hen.		2
—	Lumley, Hen.	matric. 1751	
1753.	Smith, Yerbury		3
—	Cane, Basil		3
—	Tudway, Cle.		1
—	Edgell, Hen.		4
1754.	Wickham, Thos.	Rector of Shepton Mallet	4
—	Vyvyan, Ph.	Mid. Temple	3
—	Hayter, Thos.		3
—	Bayly, Jos.		3
—	Penny, Robt.	Fellow; D.D.	3
—	Savours, Wm.		3
—	Berners, Chas.	D.C.L.	2
1755.	Foley, Robt.		3
—	Webber, Ph.	D.L. Devon	4
—	Rogers, Ri.		5
1756.	Salter, Ch.		4
—	Carne, Edw.		3
—	Ray, John	Rector of West Dean	3
—	Buller, Wm.	D.D. Ch.Ch.; Bp. of Exeter 1792	3
—	Griffiths, Wm.		4
—	New, Jas.	Rector of Compton Greenfield	4
—	Griffiths, Wm.		2
1757.	Jeane, John	matric. 1754.	
—	Haynes, Ri.		3
—	Bellamy, Ri.		4
1758.	Vivian, Ri.		
—	Collins, John		4
—	Stevens, ? Hen.		1
—	Long, (Sir) Jas. (Bart.)	M.P.	2
—	Price	Not in Foster's *Alumni*	
—	Andrews	Not in Foster's *Alumni*	

1759.	Pooley, Wm.	B.D.	2
—	Children, Geo.	Experimented in Electricity	1
—	Campbell, Chas.	B.D. of Worcester	2
—	Morgan, Geo.	Linc. Inn	2
—	Morgan, Jas., jun.	D.D.	2
—	Snelson, Geoff.	Vicar of Reigate	2
—	Musgrave, Geo.	M.P. Carlisle	1
—	Lyne, Ph.	D.C.L.	2
—	Pinnock	Vicar of Norton	4
—	Pooley, Wm.		2
—	Emmet, Willshire		2
1760.	Carver, John		1
—	Grove, Wm.	D.C.L.	1

PEMBROKE COLLEGE

1746.	Baddelley, Geo.		3
—	Skinner, Wm.		2
—	Bach, John	Fellow	2
—	Parker, Thos.		3
—	Parry, Jos.		2
1747.	Phillips, Edw.		2
—	Bates or Beach		
—	Powell, Th.		2
1749.	Durell, David	Principal of Hertford 1757–75	2
—	Levett	Rector of Wrotham	2
—	Newcome, Wm.	D.D., Archbp. of Armagh	4
—	Wilkins, Francis		2
—	Le Marchant, Joshua		1
1751.	Rogers, Ri.		2
1752.	Roger, Wm.		3
1753.	Haynes, Nath.	Fellow	2
—	Williams, Robt.	M.P. Dorchester	3
—	Skinner, Benj.	Rector of Purley	5

1756.	Liptrott, Jas.	Vicar of Thorpe	3
—	Pulton, Thos.	Rector of Hitcham	3
—	Lightfoot, John	F.R.S., F.L.S.	3
—	Wintle, Thos.	Fellow	3
—	Price, John	Fellow	4
—	Jones, John		3
1757.	Carpenter, Wm.	D.D.	4
—	Sympson, Harry		3
—	Clark, Arth.		3
—	Herring, Leonard		3
1758.	Williams, Thos.		2
1759.	Pitt, Wm.		2
—	Marshall, Edw.	Fellow of Oriel	3
1760.	Gegg, Robt.		1
—	Coxwell, Ch.		3

QUEEN'S COLLEGE

1746.	Chauncy, Wm. H.		2
—	Barrington, Daines	The celebrated naturalist	1
—	War[d], Abel	Incorp. 1744; M.A. Cambridge	
—	Craddock, Ch.		2
—	Cowel, Wm.	B.C.L.	4
—	Hooke, Edm.	Afterwards demy of Magdalen; M.B.	2
—	Pennant, Thos.	D.C.L., F.R.S.	2
—	Honyborne, Jos.	Afterwards demy of Magdalen	3
—	?Crookhall, John	matric. 1743	
—	Gosley		
—	Johnson, Pat.		
—	Atkins, Francis	matric. 1738	
—	Clarke, Wilf.	matric. 1743	
—	Cooper, John	matric. 1744	
1747.	Osborne, Robt.		2
—	Pixell, J. P. P.		3
—	Kellow, Geo.		3

1747.	Stanhope, Edwyn Fr.		2
—	Harington, Hen.		2
—	Johnson		
—	Farnham, Chetle		2 or 3
—	Osborne, Jas.		2
—	Pratt, Robt.	M.P. Horsham	2
—	Combe, Ri.	matric. 1745; M.P.	
—	Gorst, Gilpin		2
—	Mackreth, Sam.		7
1748.	Lamplugh, Thos.	Preb. of York	2
—	Clayton, John	matric. 1747	
—	Wharton, Ri.		1
—	Grainger, Ch.		1
—	Day, Ch.		5
—	Fleming, Ri.		1
—	Brown		
—	Sandys, Sam.	Rector of Lexden	2
—	Urquhart, Keith		1
—	Hodson, Wm.		2
—	Rotherham, John	Vicar of Seaham	3
—	Dawson, John	Gray's Inn	2
1749.	Proctor, Thos.		2
—	Fownes, Thos.		2
—	Tyrwhitt, Thos.	F.R.S., curator of British Museum	2
—	Robertson, Jos.		3
—	Loggin, John		2
—	Weymouth, Lord		
—	Hodgson, John		1
—	Clitherow, Jas.	D.C.L. of All Souls	2
—	Nicholas, Edw. R.	Physician	1
—	Batten		
—	Niccolls, Benj.		2
1750.	Gibson, John		2
1751.	Blackwell, Lambert	3rd Bart.	1

1751.	Jones		
—	Falcon, Thos.		6
—	Hubberstee, John		3
—	Harrington, Hen.		6
—	Dishon		
—	Chester, John		4
—	Acton, Jas.		3
—	Bonnel, John		2
—	Bliss, Anth.		3
1752.	Riland, John	Rector of Sutton Coldfield	2
—	Lloyd, Fred.		3
—	Cary		
—	Barwick, Sam.		2
—	Adney, John	M.B. 1760	4
—	Wickey, Geo.	Rector of Marham	2
—	Wilson, Marmaduke		2
1753.	Russell, Sambrooke	Rector of Bruntingthorpe	3
—	Haygarth, Jas.		6
—	Beal, Thos.		2
—	Story, Geo.		1
—	Sewell, Robt.		1
—	Lamb, Matt.	D.D.; Princ. Magd. Hall	2
—	James, Wm. Rhodes		2
1754.	Hodgson, Jas.		5
—	Fisher, Edw.		4
—	Shawe, Thos.		4
—	Rogers, ? Francis		12
—	Spedding, J.		3
—	Williamson, Jas.	Preb. of Lincoln	2
—	Bruce, Rev. Jas.		2
—	Estwyck, Sam.	D.C.L., M.P. Westbury	1
—	Bowcher, Robt.		2
1755.	Robinson, Edm.		3
—	Bernard, Jas.		3

1755.	Biker, Thos.	matric. 1753	2
—	Fox, Ch.	Mid. Temple	3
—	Gawthrop, Chr.	B.D.	3
—	Adams, Conrad		1
—	Guise, Wm.	5th Bart.	1
—	Guise, John		1
1756.	Turton, J., M.D.	F.R.S.; Radcliffe Travelling Fellow	4
—	Bishop, John	D.D. of Magd. Coll.	1
—	Knapp, Thos.		3
—	Osman, Hen.		2
—	Atkinson, Arth.		2
—	Dalton, Thos.	Fellow	3
—	Clark, Edw.	matric. 1755	1
—	Cromleholm, Alex.		2
—	Watson, Wm.		1
—	Trent, J.		2
—	Chandler, Ri.	Fellow of Magdalen; traveller	1
—	Fletcher, Phil.		1
1757.	Baty, Ri.		2
—	Bayley, Ri.		1
—	Stubb, J.		3
—	Long, Jas.		2
—	Pearson, Wilson		1
—	Bishop, John	D.D. Magdalen	2
—	Whitehead, Geo.	Fellow	3
—	Bradford, John		2
—	Salis, H. J. de	F.R. and A.S.; Vicar of Wing	1
—	Mellish, Wm.	Mid. Temple	2
—	Lagstroff		
—	Rowland, Geo.		2
—	Best, Wm. Dee		3
1759.	Skipp, J.		2
—	St. John, Ellis		2
—	Hewson, Jos.		2

1759.	Beauclerk, Aubrey	5th Duke of St. Albans	1
—	Wainhouse, Wm.	Rector of Badgeworth	4
—	Sandys, Wm.	Vicar of Minver	3
—	Richardson, John		2
—	Cleeve, John		3
—	Smith		
—	Mowbray, Geo.		1
—	Thomas		
1760.	Simpkins, Ch.	Inner Temple	1
—	Mowbray, Geo.		2
—	Bowles, Oldfield	D.C.L. 1773	2
—	Gaskarth, John	B.C.L.	2
—	Tomkinson, Jas.	Inner Temple	2
—	Wilson, Francis		4
—	Bowerbank, Edw.	Proctor 1773	3
—	Watkins, Phil.		4
—	Baker, Wm.	matric. 1758	2
—	Winstanley, Clem.	High Sheriff of Leicester	2

TRINITY COLLEGE

1746.	Jones, John		1
—	Blackett, Hen.	matric. 1743	3
—	Davenport, Wm.	D.C.L. 1756	3
—	Shawe, Sir John	D.C.L.	1
—	Winnington, Sir Edw.	1st Bart.; M.P. for Bewdley	1
—	Whorwood, Hen.		2
—	Symes, Ri.	Inner Temple	1
1747.	Wells, Ri.		3
—	Greenhill, J. Russell	D.C.L.	1
1748.	Foster, Jos.	See Barham in Foster's *Alumni*	1
—	Price, Salusbury	D.D.; Vicar of Lit. Marlow	4
—	Beckingham, Ste.		1
1749.	Lewsham, Lord		
—	Evans, Francis		2

1749.	Symonds, John		2
—	Bowles, Ri.	B.D. 1767	2
—	North, Fred.	D.C.L.; cre. 2nd Earl Guilford; Chancellor of University	1
—	Cope		
1750.	Greenwood, Fr. Willes		2
—	Norcross, Thos.		3
1751.	Whorwood, Jas.		5
—	Whetham, J.		1
—	Stokes, Jos.		4
—	Millan, Sam.		3
1753.	Dodson, John	D.D. of Oriel	4
—	Stevens, Thos.		4
—	Folliote, John		2
—	Sparrow, Jas.		2
—	Dellabar		
—	Ogden		
—	Price		
—	Patteson, Edw.		3
—	Aikenhead, John	D.C.L.	1
—	Shute, Chr.		1
1754.	Clair		
—	Annesley, Arth. Hen.	D.D.	2
—	Leach, Robt.		3
—	Wheeler, Ri.		3
—	Dilke, Wm.	Of Maxstoke Castle	2
—	Rann, Jos.	B.C.L.	3
—	Williams, Wm.	Vicar of Sarrat	3
1755.	Gale, Hen.		1
—	Archer, Andrew	2nd Lord Archer	1
—	Turnour, Edw.	F.R.S.; cre. Earl Winterton	3
—	Corne, Wm.		5
1756.	Kerby, Lanc.		3
—	Olive		
—	Townsend, J.		2

1756.	Marchant, Wm.		4
—	Townsend, Jos.		2
—	Tassell, Arth.		2
—	Polhill, Edw.		2
—	Cousins		
1757.	Knight, Thos.	Mid. Temple	2
—	Hunter, Hen.	Mid. Temple	1
—	Chalmers, Pat.		1
—	Wren, Thos.		3
—	Welch, J.		2
1758.	Hallet, Southcott		3
—	Hallett, Ri.		3
—	Horne, Thos.		3
—	Wise, Sam.		2
—	Donegal, Arth.	Earl of Chichester	1
—	Price, John		
—	Jones, Roynon		1
—	Napier, (Sir) Gerard	Bart.	1
—	Parker, Ri.		2
—	Beauclerk, Topham	Book-collector	1
1759.	Budgen, John Smith		1
—	Willis, Wm.		4
—	Hunt, John		3
—	Harrison, John		2
—	Hele, Ri.	B.D.	2
—	Broadhead, Theo. H.		1
—	Gibbes, Geo.	D.D.	2
—	St. John, J.	Rector of Farley	1
1760.	Kendal, Nich.	B.C.L.	1
—	Weeks, Ralph		1
—	Davie, John		
—	Cussans, Thos.		

UNIVERSITY COLLEGE

1746.	Sharpe, Wm.		3
—	Mortimer, Ch.	Rector of Lincoln College	1

1747.	Martin, Denny		3
—	Ayerst, Francis Gunsley		2
—	Hugesson, Wm.		2
—	Rideout, John	Rector of Woodmancote	3
—	White, Wm.		2
—	Walker *or* Walters		
—	Cooper		
—	White, (Sir) Matt. (Bt.)		1
—	Parker, John	Linc. Inn	1
—	Hambleton	? John Hamilton	3
1748.	Bewicke, Robt.	Knighted 1760	1
—	Wood, J.		2
1751.	Jenkinson, Ch.	D.C.L.; cre. Earl of Liverpool	5
1752.	Tonyn, Ch. W.	Rector of Radnage	2
—	Stephenson, Wm.		2
—	Allen		
—	Frankcombe, Wm.	Mid. Temple	1
1753.	Pollard, Seth		4
1754.	Seagrave, J.		1
—	Horne, Sam.	Fellow	3
1756.	Gamman, Austen		5
—	Dod, Peirce		3
—	Calverley, Geo.		4
1757.	Ingram, John		1
—	Toke, J.	High Sheriff of Kent	1
1758.	Stone, Fr.		3
1760.	Swire, Sam.	Fellow	5
—	Richardson, Thos.		1
—	Newman, Dan.	Recorder of Maidstone	3

WADHAM COLLEGE

1746.	Woodward, Ri.		4
—	Thomas, Edw.		3
1747.	Hales, (Sir) Thos. Pym	4th Bart.; M.P. Dover	4
—	Vokes, John	matric. 1742	5

1747.	Roberts, Hen.		4
—	Pember, Edw.	Magd. Hall; B.A. from Wadham	3
1748.	Basset, Thos.		3
—	Downing, Geo.		3
—	Gough, John		2
1749.	Prosser, Ri.		2
—	Moore, Wm.		4
—	Sampson, H.		1
—	Watson, Sam.		2
1750.	Wills, J.		6
—	Slade, Wm.		3
1751.	Stillingfleet, Jas.		3
1752.	Legh, Hen.	High Sheriff of Cornwall	1
—	Stillingfleet, Edw.		3
—	Roberts, Hen.		5
1753.	Fowle, Thos.	B.C.L.; Vicar of Kintbury	3
—	Bernard, John	matric. 1748	5
—	Smyth, Geo.		5
1754.	Hugessen, Wm. Western		1
1755.	Knatchbull, Sir Wyndham		
1756.	Jervoise, Geo. H.		2
—	Wyndham, H. P.	F.R.S.	1
1757.	Bailey, Wm.	matric. 1747	
—	Boyse, Chr.		3
1758.	Foster, Jas.	Proctor 1772	4
—	Sampson, H.		8
—	Phillips, Herbert		4
1759.	Bethell, Ri.	Rector of St. Peter's, Wallingford	8
—	Allen, Bennett	killed Lord Dulany in duel 1782	5
—	Williams, John	matric. 1749	
—	Baker, Wm.	matric. 1760	
—	Jervison	Not in Foster's *Alumni*	
1760.	Strangeways, H.		1

WORCESTER COLLEGE

1747.	Dolman, Wm.		4
1751.	Cobb, Sam.		3
—	Blayney, Benj.	D.D.; Canon of Ch.Ch.	5
1754.	Hollingbery	D.D.	3
—	Hemming, Jas.		3
—	Landor, Walter	matric. 1752	2
—	Astley, Geo.		2
—	Bromley, Thos.		4
1756.	Wilkins, J.		3
—	Dandridge, Edw.	Barrister	3
—	Moore, Thos.	Rector of North Cray	3
1757.	Davis		
1758.	Pearkes, John	D.C.L., F.S.A.	3
1759.	Wynniate, Reg.		4

ST. EDMUND HALL

1749.	Hudson, (Sir) Ch. Grave (Bart.)	Director of South Sea Co.	1
—	Hughes, Edw.	From Magdalen Hall	3
1759.	Etchel, Wm.		1
1760.	Hargrave, Jas.		4
—	Gibson, Edm.		2

MAGDALEN HALL

1746.	Turner, Geo.		4
1757.	Seagrave, Edw.		2
1759.	Wills, Th.		2

ST. MARY HALL

1747.	Boyl, Lord		
—	Morant, Edw.	D.C.L.; M.P.	1
—	Dawkins		
—	Mendez, ?Moses		1
—	Bruce, Lord		
—	Pole, German		1

1747.	Mangey, John	Vicar of Gt. Dunmow	2
—	O'Connor, John		1
—	Souberry		
1748.	Becher, Hen.	matric. 1746	
—	Baldwyn, Ch.	D.C.L.; M.P. for Salop	1
1749.	Viney, Jas.		2
1751.	Coat		
—	King, Shaw		2
—	Cotton, Ch.		2
—	Cave, John	Took name J. C. Browne in 1752	2
—	Bacon		
—	Holland, Bernard		1
1753.	Popham, Francis		1
—	Pearce, John		2
—	Jenkins, Ri.		1
—	Hegen		
—	Norman, Geo.		2
—	Craven		
1754.	Musson, Barth.	Rector of Baginton	2
1755.	Gwynnet		
1756.	James, Haughton,		1
—	Townsend		2
1758.	Popham, Edw.	D.D.; Fellow of Oriel	3
—	Jeane, Thos.		2

ALBAN HALL

1747.	Goddard, Ri.	M.B.; also of Hertford and New	6

FOREIGNERS

1747. Crevoff, a Russian
1749. Chelverikoff, a Russian
1754. Wyndow, a Stranger
1758. Knight
1759. Three Russians

This list of persons attending Bradley's lectures in the Old Ashmolean Museum shows that the teaching of Experimental Philosophy, as Physics was then called, which had been proposed by Professor Gregory in 1700 and carried out by John Keill of Balliol and by

Theophilus Desaguliers until 1713, and continued by J. Whiteside of Christ Church until the year before his death in October 1729, was being actively pursued by Bradley. The syllabus entitled *A Course of Mathematical Lectures and Experiments* printed in facsimile on page 403 was actually drawn up by Whiteside, who charged his students a fee of a guinea and a half for his lecture course. He was also Keeper of the Old Ashmolean Museum, and evidently depended upon his lecture fees to supplement his inadequate pay for that office.

When Bradley succeeded to the Savilian Professorship, he, too, considered the Experimental Philosophy lectures a potential gold-mine, for the good-will and apparatus of which he paid Whiteside a sum that has been variously stated as £170 and £400, the original value having been put as high as £500, and even £800.[1]

Although Bradley for many years occupied the lower floors of the Old Ashmolean as Lecturer on Physics, in succession to Whiteside, he was not successful in his attempt to succeed him as Keeper of the Natural Curiosities upstairs. He did, however, succeed to the post of Astronomer Royal.

The later history of the Course is shown by the advertisements that were put out by Dr. Thomas Hornsby on 10 Nov. 1766, 13 Nov. 1769, 8 March 1775, 1 May 1775, 16 Nov. 1775, and at other times, and in 1790 his experimental apparatus was valued at £375 14*s*. 6*d*. by Edward Nairne. The catalogue may be consulted in MS. Top. Oxon. c. 236 in the Bodleian.

Meanwhile courses of Anatomical Lectures were being given in the Old Ashmolean Laboratory by Dr. Smith in 1759, and Chemical Lectures by Dr. Wall later in the century. The latter were continued by Dr. Kidd, who actually resided on the premises, and by Dr. Daubeny, whose popular lectures were thronged by students early in the nineteenth century.[2]

In all a vast amount of educational work in the Natural Sciences was done in the Old Ashmolean, quite independently of the Keepers of the Ashmolean Museum, whose legitimate sphere of activity was at first confined to the upper storey of the building, now occupied by the Museum of the History of Science.

It was almost entirely due to the excellent work done by eminent men of science in the Old Ashmolean Building that the Ashmolean

[1] *Early Science in Oxford*, i, p. 201.

[2] Dr. Daubeny's interesting Lecture Lists were published in Gunther, *History of the Daubeny Laboratory*, 1904.

Museum acquired a high reputation in the country. The archaeological work done there was of relatively minor importance. It is necessary to emphasize these facts, because when on May 22, 1933, arrangements had been made to celebrate the 250th Centenary of the Old Ashmolean as a venerable Institution of British Science, a most extraordinary and unjustifiable protest was published in *The Times*, signed officially by two Keepers of the new Ashmolean Museum of Art and Archaeology, who by their office had no concern whatever with any scientific celebration in Oxford.

In a lengthy letter which there is now no need to quote *in extenso* these archaeologists wrote:

> 'On the formation in 1855 of the University Museum for the Natural Sciences, the Elias Ashmole collection was transferred there. The Ashmolean Museum, then confined to its antiquarian side, prolonged its existence in its original home till, in 1894, it was transferred to a new building in Beaumont-street, and united with the University Fine Art Galleries as the Ashmolean Museum of Art and Archaeology. . . .
>
> 'At the time of the transference of the museum [by which term the writers meant collections, for the old museum was not shifted] to its new home every step was taken to ensure its historic continuity. Our second founder, Dr. Fortnum, to whom the new building was largely due, made this, indeed, a condition sine qua non. . . .
>
> 'It is astonishing, therefore, when this practical celebration is being set on foot by the Ashmolean, a function with a set [scientific] object should be widely advertised in another quarter.
>
> 'Assuming to himself a connection which is altogether non-existent with the old institution, Dr. *Gunther* has on his own authority issued invitations to attend a function celebrating the 250th anniversary of the opening of the new museum. As delegates even from beyond the Atlantic have been invited, to this wholly unauthorized celebration, it has become unfortunately necessary to make a public disavowal of these invitations.'

This public disavowal of a scientific celebration was signed by the archaeologists Sir Arthur Evans, brother of Dr. Lewis Evans the donor of the scientific collections given on condition of the restoration of the Old Ashmolean as a Museum for them, and Mr. Thurlow Leeds. The *locus standi* of these antiquarians is therefore not quite clear.

But, as was stated at the time, treated as a museum for the History of the Natural Sciences the Old Ashmolean is a national monument. It is perhaps the most important local historic scientific exhibit of the days of Charles II that is still extant in Great Britain, and to its prestige Bradley greatly contributed.

APPENDIX F

FACSIMILES OF PRINTED NOTICES OF COURSES OF LECTURES DELIVERED IN THE OLD ASHMOLEAN MUSEUM

A COURSE OF

ASTRONOMICAL LECTURES

Will begin to be read at the *Museum*, on *Wednesday* the 17*th* of *October* 1764. at half an Hour after Two in the *Afternoon*.

A COURSE OF Aſtronomical Lectures.

Lect. 1. *A general view of the Solar Syſtem.*

ORIGIN of Aſtronomy---Pythagorean----Ægyptian ---- Ptolomaic ---- Copernican ---- Tychonic Syſtems ---- Proportion of Light and Heat on the Several Planets---Size of the Suns Diameter viewed from each of the Planets---Bulk of the Sun and Planets----Secondary Planets----Comets -- Fixed Stars -- Plurality of Syſtems -- Plurality of Worlds.

Lect. 2. *Of the Doctrine of the Sphere.*

Circles great and ſmall---moveable and immoveable---Axis of the Earth---Poles---Equator, its Secondaries and Parallels---Hour Circle---Ecliptic, its Secondaries and Parallels---Horiſon---Rational and Senſible---its Secondaries and Parallels---Longitudes and Latitudes of Places---how found---Different Poſitions of the Sphere---Climates and Parallels---Zones ---Inhabitants of the Earth compared---Right Aſcenſion---Oblique Aſcenſion---Aſcenſional Difference---Declination---Altitude--Amplitude---Azimuth.

Lect. 3. *Of the Fixt Stars.*

The different Magnitudes of the Stars---Conſtellations and their Antiquity---Catalogues of the Stars ---New Stars----Periodical Stars----Cloudy Stars----Diſtance and Annual Parallax of the Stars---Aberration of the Stars---Sphere of the fixt Stars infinite.

Lect. 4. *Of the Spots of the Sun and Planets.*

Appearances of the Spots---the Changes they undergo---their Paths upon the Sun's Diſk---Hypotheſes concerning the Nature of the Spots---Rotation of the Sun on his Axis how determined---Spots on the Planets---Rotation of the Planets on their Axes------Solar Atmoſphere---Zodiacal Light.

Lect. 5. *Of the Motion of the Earth on its Axis.*

Apparent Motions of the Heavens---accounted for and explained---Objections to the Earth's Motion on its Axis anſwered---The Earth's Rotation collected from Phyſical Arguments---Proved by the Figure of the Earth---the Earth an oblate Spheroid---a Degree of Latitude on the Earth's Surface how meaſured---The Proportion of the Equatorial to the Polar Diameter of the Earth.

Day, Natural---Artificial---Aſtronomical---Civil. Hours, Equal---Unequal. Weeks.

Lect. 6. *Of the Phænomena ariſing from the Motion of the Earth round the Sun.*

Axis of the Earth not perpendicular to the Ecliptic ---always parallel to itſelf---the Æquinoctial and Solſtitial Colures---The different Lengths of Days and Nights, and the Viciſſitudes of Seaſons explained by the Orrery---by the Globe.

Præceſſion of the Æquinoxes---Tropical Year---Sidereal Year ---- Solar Year ---- Civil Year ---- Solſtitial and Equinoctial Points move backwards ---Stars ſeem to move forwards----Great Year----Poetical Riſings and Settings of the Stars---Of the Dog-Days.

Julian Stile---Gregorian Stile---New Stile.

Lect. 7. *Of the Phænomena ariſing from the Motion of the Earth round the Sun, continued.*

Obliquity of the Ecliptic---its decreaſe cauſed by the Action of the Planets on the Plane of the Ecliptic ---Nutation of the Earth's Axis---how cauſed.

Earth's Motion not equable---Orbit of the Earth elliptical ---- Ellipſe how deſcribed --- its Focus --- Axis or Line of Apſides---Mean Diſtance---Earth and Planets deſcribe Areas proportional to the Times ---Anomaly what---why the Sun's Heat is greater when the Earth is fartheſt from the Sun.

Equation of Time---Sidereal Time equal---Solar Time unequal---difference between mean and apparent Time how cauſed---1ſt, The diurnal Arches of the Equator are not equal to the diurnal Arches of the Ecliptic---illuſtrated by the Globe---2dly, The apparent Motion of the Sun is unequal.

Principles of Dialling.

Lect. 8. *Of Refraction, Twilight and Parallax.*

Refraction by the Atmofphere---greateft in the Horifon---leaft towards the Zenith---All the Stars at equal Heights have equal Refractions---Diftances of Stars diminifhed by Refraction---Length of the Day increafed by it in all Latitudes---moft remarkably in high Latitudes---Quantity of Refraction variable.

Refraction illuminates the whole Heavens --- the caufe of the Twilight---Limits of the Twilight---variable, why---Twilight fhorteft under the Equator ---lafts for feveral Months under the Poles---Height of the Atmofphere how computed.

Horifontal Parallax, what---Parallax in Altitude, Longitude, Latitude--Horifontal Parallax how found -- Diftances of the Heavenly Bodies how determined.

Lect. 9. *Of the Inferior Planets.*

Their Orbits Elliptical --- Phafes explained --- Conjunctions Superior and Inferior -- Elongations -- Motions progreffive and retrograde fhewn by the Orrery--their Stations--Inclination of their Orbits--Heliocentric and Geocentric Longitudes and Latitudes --Nodes--Tranfits and their Ufes--Account of the Satellite of Venus faid to have been difcovered.

Lect. 10. *Of the Superior Planets.*

Their Conjunctions and Oppofitions -- Phafes of Mars -- Orbits Elliptical -- Motions explained -- Parallax of the annual Orb--Saturn's Ring -- Satellites of Jupiter and Saturn -- Longitude how found by Eclipfes of Jupiter's Satellites.

Truth of the Copernican Syftem eftablifhed.

Lect. 11. *Of the Moon.*

Phafes of the Moon explained by the Orrery -- Earth illuminates the Moon--Proportion of the Light of the Moon to that of the Sun--Pofition of the Cufps --Periodical and Synodical Months -- Motion of the Moon on its Axis -- Same Face always turned to the Earth -- Libration -- Path of the Moon concave to the Sun--Face of the Moon -- Mountains and Vallies -- Height of the Mountains how determined -- Moon not furrounded by an Atmofphere.

Lunar Month--Lunar Year -- Luni-Solar Year.

Lect. 12. *Of the Horifontal Moon; Harveft Moon.*

Diameters of the Moon and Sun appear greateft in the Horifon -- Figure of the Sky that of a depreffed Arch accounted for.

Harveft Moon what--Angle of the Ecliptic with the Horifon variable -- This Angle leaft when the Autumnal Full Moon rifes--decreafes as we advance Northward--Long continuance of Moon light at the Poles -- Period of the Harveft Moon -- when moft, when leaft beneficial.

Lect. 13. *Of Eclipfes.*

Figure of the Shadow--Penumbra--Height of the Earth's Shadow -- Height of the Moon's Shadow--When an Eclipfe of the Moon can happen--When an Eclipfe of the Sun--Why Eclipfes do not happen every Month -- Inclination of the Moon's Orbit -- Limits of Lunar Eclipfes--Central and Total Eclipfe of the Moon--Partial Eclipfe--Moon fometimes vifible in a Total Eclipfe.

Moon's Shadow cannot cover the whole Earth -- How much of the Earth's Surface may be included in the true Shadow -- How much in the Penumbra--Limits of Solar Eclipfes--More vifible Eclipfes of the Moon than of the Sun--Total Eclipfes of the Sun--Annular Eclipfes.

Line of the Nodes--Nodes have a retrograde Motion --- Eclipfes their Anticipation --- Reftitution --- Periods -- Ufes of Eclipfes -- Darknefs at the Crucifixion of Chrift fupernatural--Æra of Chrift's Birth.

Lect. 14. *Of Comets.*

Comets are a Species of Planets --- Their Orbits very eccentrical --varioufly inclined to the Ecliptic -- Opinions concerning their Nature--Comets of different Figures---their Tails, always projected from the Sun---The Motions of the Comets and Planets regulated by the fame Laws---Hiftory of the Comet of 1680 --- of 1744 --- of 1682 and its Return in 1759.

At the Conclufion of the Courfe, the Principles of Aftronomical Calculation will be explained and illuftrated in the cafe of a Lunar Eclipfe: for which it will be neceffary to be provided with *Mayer*'s *Tables* and a Book of (*Sherwin*'s or *Gardiner*'s) Logarithms.

A COURSE OF Mathematical Lectures and Experiments.

MECHANICKS.

THE Universal Properties of Bodies.

Of Motion in general.

The Laws of it, as Stated by Sir *Isaac Newton*: explain'd and illustrated by Experiments.

Of the Attraction and Repulsion of the parts of Matter.

Of the Cohesion of the parts of Bodies.

Experiments concerning the Ascent of Fluids in small Tubes, and between Glass Plates &c.

Concerning Magnetical and Electrical Attraction and Repulsion.

The Universal Law of Gravitation. —— The general *Phænomena* of it consider'd.

Experiments to explain the Nature of the Center of Gravity, and to distinguish it from the Center of Magnitude, and the Center of Motion.

—— How to find the Center of Gravity in all Kinds of Bodies.

Concerning the Line of Direction and Distance of a Weight and a Power.

Experiments concerning the Sliding, Rolling, and Falling of Bodies.

—— Upon what the general Principle of Mechanicks is Established.

The Truth of it proved and illustrated by its Application to several Mechanick Powers.

The several Kinds of Leavers. —— The Properties and Uses of the Ballance of Steel-Yard.

Pulleys, single and combined.

The Weel and Axle, or *Axis in Peritrochio*.

The Wedge.

The Screw.

Several Compound Engines.

The general Method of computing the Power of any compound Machine.

How to find the Quantity of Friction in Mechanick Engines.

Experiments to shew the different Effect of the same Power, acting at the same point of an Engine, in different Directions.

Experiments to shew the Effect of two or more Powers, acting at the same time in different Directions.

Experiments to shew the Uses and Advantages of large and small Wheels in all sorts of Carriages.

Experiments concerning the Strength of Timber, with their Application to the Strength of the Bones.

Of Accelerated and Retarded Motion.

—— That the Velocities of Descending Bodies are as the times of Descent.

—— That the Spaces described, are in the duplicate Proportion of the times.

An Instrument to measure the Force of descending Bodies.

Of the Ascent and Descent of Bodies upon inclined Planes.

Of *Pendulums*.

Of the Center of Oscillation.

—— *Cycloi-*

—— *Cycloidical* Cheeks for regulating the Vibrations of *Pendulums*.

Experiments concerning the expanfion of Metals, fhewing that the *Pendulum* of a Clock is lengthened by Heat.

—— How the *Pendulum* of a Clock may be made to Vibrate in the fame time, tho' its Rod be lengthened by Heat.

The Circular *Pendulum*.

Experiments concerning *Centripetal* and *Centrifugal* Forces.

The general Motion of the Heavenly Bodies explain'd from the Nature of *Centripetral* Force.

An Experiment to fhew from the Nature of *Centrifugal* Force, that the Figure of the Earth is *Sphæroidical*.

Concerning the Motion of *Projectiles*.

An Experiment to fhew that the Line of the Relative Afcent or Defcent of a Projected Body is the fame, whether the Place from whence it is thrown, be at Reft or in a continued Uniform Motion.

—— Some Objections againft the Motion of the Earth anfwered from this Experiment.

—— That the Curve defcribed by *Projectiles* is a *Parabola*.

—— Several Experiments to explain the Art of Gunnery.

OPTICKS.

OF the Properties of Light in general.

The Principle of *Catopricks* prov'd by Experiments, *viz*. That when Rays of Light are reflected from any furface, the Angle of Incidence is equal to that of Reflection.

—— The *Phænomena* of Reflection from plain, concave and convex Surfaces.

—— The manner of tracing the Reflected Rays of Light from all forts of Surfaces, and finding the Focus of a *Speculum*.

Of Refraction.

Experiments to prove the general Law of Refraction, *viz*. That when the Rays of Light are refracted the Sines of the Angles of Incidence and Refraction, are (at all Degrees of Incidence) in a given Proportion to each other.

—— An Inftrument to meafure the Refraction of Fluids.

An Experiment to fhew the Refraction of the Air.

The Nature and Properties of plain, concave and convex Glaffes, with the method of tracing the Refracted Rays of Light thro' them.

—— The Diffection of the Eye.

—— Vifion with the naked Eye, as alfo through concave and convex Glaffes explain'd.

—— The Faults of Vifion fhewn by Experiment.

How *Myopes* and *Presbytæ* may be affifted by Glaffes.

Of the Combination of Glaffes.

Several Kinds of Microfcopes and Telefcopes.

—— The manner of their Conftruction fhewn, and their Ufes, and the reafon of their Effects explain'd.

——The Multiplying-Glafs, *Camera Obfcura*, and Magick-Lantern.

Several common *Phænomena* relating to Vifion explain'd.

Sir *Ifaac Newton*'s Theory of Light and Colours proved by Experiments.

—— Concerning the natural and permanent Colours of Bodies.

Experiments to fhew the Caufe of the Rain-Bow.

A Refracting Telefcope and a Reflecting one of the fame Length compared together. —— The great Advantage of the latter fhewn, and the Caufe thereof explain'd.

HYDROSTATICKS.

OF Fluids in general.

Of the Gravity of the Parts of Fluids.

—— That Fluids gravitate *in proprio loco*, the upper parts continually preffing upon the lower.

—— That Fluids of different Kinds may gravitate upon each other.

That the Preffure of Fluids is propagated not only downwards, but alfo upwards and fide-ways, according to all poffible Directions.

—— That in a *Compreffed* Fluid the Quantity of Preffure is proportional to the Height of the Fluid in all the parts of the containing Veffel, however it be figured.

—— How to eftimate all manner of Preffures.

An Experiment to fhew that a fmall Quantity of Water may be made to prefs with a Force fufficient to raife any given Weight.

An Experiment to prove that a competent Preffure of a Fluid may produce the feveral *Phænomena* of Pumps, Syphons, Syringes, and other Effects of the like Nature.

Several ſorts of Pumps and Syphons. —— Their manner of working explain'd.

Of the Sinking and Floating of ſolid Bodies in Fluids.

Experiments to prove that a Body ſpecifically heavier than a Fluid, when weighed in it, loſes as much of its weight, as is equal to the weight of a Quantity of the Fluid that is of the ſame Bulk with it.

—— That a Body ſpecifically lighter than a Fluid, will float or ſwim in it, in ſuch a manner, that a Quantity of the Fluid equal in Bulk to the part immerſed, will be of the ſame Weight as the whole Body.

—— That upon theſe Principles Lead or any other Metal may be made to ſwim upon Water.

—That the *Phænomena* of Glaſs-Bubbles and Images may be accounted for from the ſame Principles.

Various Methods of finding the ſpecifick Gravities of Fluids and Solids.

—— The *Hydroſtatical Ballance* explain'd, with the Method of determining the ſpecifick Gravities of all ſorts of Bodies thereby.

Of the Motion of Fluids.

— Of the Velocity of *ſpouting* Water, and the Height to which it will riſe in Fountains or oblique Jets. —— The beſt way of making *ſpouting* Pipes.

—— How to compute the Quantity of Water running thro' equal or unequal Holes at any diſtance from the ſurface of the Incumbent Water.

——— How to eſtimate the Force of *Running* Water upon the Wheels of Water-Mills, &c. And the Force of the Wind upon the Sails of Ships, Wind-Mills &c.

PNEUMATICKS.

OF the Nature and Properties of the Air in general.

The ſeveral *Phænomena* of the *Torricellian* Experiment, ſhewn and explain'd.

—- That the Air is an *Elaſtick* Fluid, whoſe Denſity and Spring is as the Force which compreſſes it, and reciprocally as the Spaces into which it is compreſſed.

—— An Experiment to ſhew that the Preſſure of the Air is not the ſame at different Diſtances from the ſurface of the Earth.

An Enquiry into the State and Limits of the *Atmoſphere*.

The Effects of the Weight and Spring of the Air in Syringes, Pumps, Syphons, Cupping-Glaſſes, Diving-Bells &c.

—— That Water cannot be raiſed higher than about Thirty-five Feet, by the Preſſure of the Air alone. —— That the Height to which it will riſe depends upon the Weight of the incumbent Air.

—— That the Height of Quickſilver in Weather-Glaſſes, is owing to the ſame Cauſe. —— That the Riſing and Falling of it proceeds from an Alteration in the Preſſure of the *Atmoſphere*.

Several ſorts of Barometers, Thermometers and Hygroſcopes.

—— An Artificial Storm, ſhewing that high Winds may make the Quickſilver in Barometers ſink much and ſuddenly.

—— The Fabrick of the Air-Pump, and manner of its working explain'd.

—— Several Experiments made with it, which directly prove the Weight, Preſſure and Spring of the Air, by the ſenſe of Feeling, by breaking Glaſs-Vials, by the *Phænomena* of Bladders and Glaſs-Bubbles, &c.

—— The Conſtruction of Condenſing Engines, and their Gages explain'd.

Several Experiments concerning condenſed Air.

Experiments concerning *Otho Gherick*'s Hemiſphæres in common and condenſed Air and in *Vacuo*.

——— The *Torricellian* Tube in *Vacuo*.

Quickſilver raiſed nearly to the uſual Height in the Barometer by the bare Spring of a little included Air.

——— The Ebullition of Liquors in *Vacuo*.

——— The ſuſtentation of Fumes and Vapours.

Experiments to ſhew that Air is neceſſary for the conveyance of Sound. — That Sound is diminiſh'd or increaſed according as the Air is rarified or condenſed.

The Influence of Air on Fire and Flame.

The Effects of rarified, condens'd and burnt Air upon the Lives of Animals.

—— The Influence of the Air examin'd as to the Cauſes of Magnetiſm, the Elaſticity of Springs, the Sphæricity of the Drops of Fluids, the Aſcent of Liquors in Capillary Tubes, &c.

Several Magnetical Experiments.

Thoſe who intend to go thro' this *Courſe*, are to Pay *Two Guineas* at the time of Subſcription.

OXFORD, May 9. 1769.

THE *Savilian* Profeſſor of Aſtronomy gives this publick Notice, that he propoſes to begin a *Courſe* of *Lectures* on the TRANSIT of VENUS at the *Muſeum* on *Wedneſday* the 24th of this Month, at Three o'Clock in the Afternoon: In which the Hiſtory of former Tranſits will be delivered; the Method of computing the Places of the Sun and Planets explained and exemplified in the Caſe of the enſuing Tranſit; the Method of computing the Effect of Parallax, and of finding the Places upon the Earth's Surface, where Obſervations may be made with the greateſt Advantage, will be pointed out; and the Manner of determining the Quantity of the Sun's Parallax from ſome of the principal Obſervations made in the Year 1761 will be ſhewn and illuſtrated by Examples.

As it is propoſed to make the principal Calculations at the Time of Lecture, thoſe Gentlemen, who are deſirous of attending the above Courſe, muſt previouſly furniſh themſelves with the following Books:

Sherwin's Logarithms, 8vo.
Or, *Gardener's* ———, 4to.
Halley's Aſtronomical Tables, 4to.
Or, Tables Aſtronomiques de M. *Hallei* publieés par M. *de la Lande*, 8vo. *Paris*, 1759.
The Abbe *de la Caille's* Tables of the Sun, as publiſhed by M. *de la Lande* in his *Aſtronomie*, two large Vols in 4to. or in his *Expoſition du Calcul Aſtronomique*, 12mo. *Paris*, 1762.

Terms of Admittance One Guinea.

OXFORD, *Apr.* 24. 1775.

A Courſe of Lectures in EXPERIMENTAL PHILOSOPHY, will begin to be read at the *Muſeum* on *Monday* the 1*ſt* of *May*, 1775, at Three o'Clock in the Afternoon.

OXFORD, *June* 4. 1776.

A

COURSE

OF

ASTRONOMICAL LECTURES

WILL BEGIN

To be read at the *Museum* on *Monday* the 10*th* of *June* 1776. at Three o' Clock.

N.B. At the Conclusion of the Courfe, the Principles of Aftronomical Calculation will be explained and illuftrated in the Cafe of the Total Eclipfe of the Moon on *July* 30, of the prefent Year.

OBSERVATORY, *May* 30. 1785.

THE PROFESSOR of NATURAL PHILOSOPHY begs Leave to acquaint the Gentlemen of the Univerſity that he propoſes to begin, at the *Muſeum* on *Thurſday* next the 2*d* of *June*, A Courſe of PHILOSOPHICAL LECTURES on *The different Kinds of Air, Natural and Factitious*, in which the principal Diſcoveries of Dr. *Prieſtley* and others will be introduced and proved by actual Experiment.

SHORT SYLLABUS.

LECT. 1. General Hiſtory—Apparatus deſcribed—Method of procuring Fixed, Nitrous, Inflammable, Dephlogiſticated Air—General Properties of each enumerated.

LECT. 2 & 3. Affections of common Atmoſpheric Air—Air attracts Water—is attracted by Water—neceſſary for Combuſtion—neceſſary for Animal Life—contaminated by Reſpiration—neceſſary to Vegetation—to the Calcination of Metals, &c.

LECT. 4. Of Fixed Air.
5. Of Nitrous Air.
6. Of Inflammable Air—Theory of Balloons.
7. Of Dephlogiſticated Air.
} Their ſeveral Properties proved by Experiment.
8. Of Acid and Alkaline Airs.

As theſe Lectures are entirely diſtinct from the Courſe of EXPERIMENTAL PHILOSOPHY, it may be neceſſary to add, that each Perſon who propoſes to attend this Courſe of Lectures on *AIR* is to pay one Guinea at the Time of Subſcription.

SYLLABUS

OF

A COURSE OF LECTURES

ON

AIR NATURAL AND FACTITIOUS.

Lect. 1.

General Hiftory.----Apparatus defcribed----Method of procuring Fixed, Nitrous, Inflammable, Dephlogifticated Air---General Properties of each enumerated.

Lect. 2 & 3. *Affections of Atmofpheric Air.*

Air attracts Water---is attracted by Water---neceffary for Combuftion---neceffary to the Calcination of Metals---neceffary for Animal Life---contaminated by Refpiration----neceffary to Vegetation, &c.

Lect. 4. *Of Fixed Air.*

Air contained in an Elaftic State in Bodies----Air in a Fixed State----why called Fixed----may be obtained by Fire, by Fermentation, by Effervefcence----it's Specific Gravity----fhewn to be heavier than an equal bulk of Atmofpheric Air---is Mephitic----and does not fupport either Flame, or Animal or Vegetable Life---is an Acid *Exp.*---precipitates the Lime in Lime-Water. *Exp.*---is abforbed by Water. *Exp.*----renders the Water heavier.----Mineral Waters imitated.----Fixed Air is Antifeptic---found in a natural State.

Lect. 5. *Of Nitrous Air.*

Method of obtaining it----is nearly of the fame Specific Gravity with common Air. *Exp.*----Extinguifhes Flame. *Exp.*---highly noxious to Animal and Vegetable Life. *Exp.*---is Antifeptic---may be abforbed in a fmall degree by Water---contains an Acid. *Exp.*---Circumftances of its red Colour----Phœnomena upon it's mixture with Atmofpheric Air exhibited.---Eudiometers---Salubrity of common Air how determined.

Lect. 6. *Of Inflammable Air.*

From what Subftances obtained---Method of producing it fhewn---Its fpecific Gravity---fhewn to be lighter than common Air. *Exp.*---Mephitic in the higheft Degree *Exp.*----will not fupport Flame. *Exp.*----Effect on Vegetables.

Phœnomena upon its mixture with common Air--Mr. Cavendifh's Experiments--Electrical Piftol---Colour of the Flame of this Air---where naturally produced--probable Caufe of fome Meteors--of Earthquakes.

Account of the Difcovery of Balloons—their Theory explained and illuftrated by Experiments.

Lect. 7. *Of Dephlogifticated Air.*

Common Air, when faid to be Phlogifticated----Dephlogifticated Air difcovered---Method of obtaining it fhewn---from what Subftances obtained---it's Specific Gravity----it's Qualities----eminently refpirable----it's Effects upon Flame fhewn---Phœnomena upon being mixed with Inflammable Air----affifts Phlogiftic Proceffes better than common Air----it's purity fhewn by the Nitrous teft.----Conftitution of the Atmofphere.

Lect. 8. *Of Acid and Alkaline Airs.*

Vitriolic Acid Air, or the fparry or fluor Acid Air.----Nitrous Acid Air or Vapour.----Marine Acid Air---how obtained---defcription of the Apparatus---general Properties.----Alkaline Air----how produced---mixed with Elaftic Fluids---Effects of the Electric Spark on it----Phœnomena exhibited upon mixing it with Vitriolic Acid Air.---General Obfervations.

APPENDIX G

LIST OF TOPICAL ALLUSIONS IN THE MAP OF OXFORD

Title. The Supporters are Roger Bacon, Linacre, and Robert Hooke, Father of Microscopy, with his Spiral Spring applied to the Balance-wheel of a Watch. An Ammonite at his feet. Hooke's Law, *Ut tensio si vis.*

1 and 2. A Radcliffe Astronomer at his Observatory before 1935, when it became the Nuffield Institution of Clinical Research.

3. The Oxford University Press.

4. Radcliffe Infirmary. Grotesque of Aesculapius.

7. University Museum.

12. Wadham College, the nursery of the Royal Society whose motto *Nullius in verba* was supplied by Evelyn. Sir Christopher Wren.

13. St. John's College. R. Fludd's Castle of Health being invaded by microbes.

14. Ashmolean Museum of Art and Archaeology. Mummy.

16. Worcester College. Dr. J. Wall, originator of Worcester China (Mark *W*) and advocate of Malvern Waters.

18. Balliol College. Professor J. Bradley and his Zenith Sector.

19. Trinity College. Harvey studying generation. *Ex ovo omnia.* To the east are Broad Street residences lately demolished to make way for Bodleian books.

22. New College. Halley's Comet and Observatory on the City Wall. Duncan, Keeper of the Old Ashmolean and the Dodo.

25. Radcliffe's Camera. The Doctor with his Gold-headed Cane.
26. The Old Ashmolean Museum of the History of Science.
27. Exeter College. Charles Lyell and Etna.
28. Jesus College. Edward Lhwyd and Leek.
30. Brasenose College. Elias Ashmole, transmitter of Tradescant's collections to Oxford.
32. All Souls College. Recorde and his signs of Multiplication and Equality. J. Mayow.
33. University College. Leonard Digges, inventor of Telescope. Near by Hooke made the Air-pump for Boyle. Boyle's Law $PV = P'V'$.
34. Queen's College. Dr. J. Floyer, advocate of Cold Bathing.
35. St. Peter in the East. Burial-place of first British Aeronaut, James Sadler.
37. St. John's Hospital and Pilgrim's Gate.
    Magdalen Hall. Sydenham and the Gout.
    Magdalen College. Daubeny, co-founder of the British Association. Deer Park and remains of Largest Tree in England, nourished by bones of Mammoths and Bears, *Ursus anglicus*.
    Physick Garden. Uprooting of a Mandrake.
39. Merton College. Walter de Merle recording Weather for 7 years. Students training as Astrolabists on the City Wall.
40. Corpus Christi College. Pelican.
41. Oriel College. Gilbert White and Swallow.
42. Christ Church. Burton, Lower and Heart, Willis and Brain. Skeleton Corner.
43. Pembroke College. Dr. Johnson's Teapot. Sir Thomas Browne and his *Religio Medici*.
    Carfax Church Font, now in All Saints' Church, with Shakespeare acting as godfather to Sir William Davenant.

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