Early medical and biological science : extracted from 'Early science in Oxford' / by R.T. Gunther.

EARLY MEDICAL AND BIOLOGICAL SCIENCE

Extracted from

'EARLY SCIENCE IN OXFORD'

BY

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PREFATORY NOTE

This part of the Author's larger book on 'Early Science in Oxford' has been reissued without the plates at the request of friends who have expressed regret that the cost of the complete work places it beyond the reach of a large number of students of the sciences for whom it was written.

The subjects treated in the four volumes already published are as follows:

Vol. I. Chemistry, Mathematics, Physics, and Surveying.

II. Astronomy.

III. The Biological Sciences and Collections.

IV. The Philosophical Society of Oxford.

CONTENTS

I

EARLY MEDICINE

THE science of Medicine in Britain owes its origin to sources that are not less diverse than are the races from which its practitioners have sprung. By a scholarly investigation of the few old Leech Books, that are preserved on the shelves of Bodley and of the British Museum, the learned Dr. Payne has given to British Medicine the glamour of an Anglo-Saxon descent. And, as supporters of the recent feminist movement in the University will doubtless note, the first historical examples of medical practice in Oxford are associated with a lady doctor. ST. FRIDESWIDE (d. 735) used water (traditionally drawn from Binsey well) in which she had previously washed her hands, to restore the sight of a blind girl of seven years of age. She treated cases of sudden blindness by prayer. Kissing was her remedy for leprosy. And she was equally successful in the cases of Alward, the Sabbath-breaker, who, while cutting wood with an axe on the Lord's day, found his hand fixed so tightly to the handle that he could not let go; and of the Thames fisherman who was seized with a violent fit and had to be bound.[1] To her credit, too, is the cure of the earliest known case of an undergraduate requiring a doctor. Stephen of York, a comely youth, was sore stricken with incurable fever: his means were being squandered in paying fees to the leeches (*inanibus se sumptibus eviscerans*); and, as a last resort, he implored the help of Frideswide. She gave him some of her holy water in a cup, and he was restored to health.[2]

After the Norman Conquest there was a break, during

[1] Parker, *Early History of Oxford*, Oxf. Hist. Soc. 1884.
[2] *Acta Sanctorum* Octobr. viii, p. 579.

which science slept until its disciples were reinspired by contact with the great School and Sanatorium of Salerno and by the Hellenic lore hoarded by the Arabian savants and translated into Latin during the eleventh and twelfth centuries. The first man in Oxford to utter the long-hidden secrets of the old Greek Masters of Medicine was doubtless our admirable ROGER BACON. One of his last writings, 'Of the Cure of Old Age and the Preservation of Youth', was printed at Oxford in 1590 and translated in 1683. When a copy of this book was displayed as an exhibit on the occasion of the Bacon Celebration in Oxford in 1914, many who read the opening sentence for the first time agreed that its reference to the existence of microbes is a remarkable example of fore-knowledge even from so prescient an author as Bacon.

'As the world waxeth old, Men grow old with it: not by reason of the age of the World, but because of the great Increase of living Creatures; which infect the very Air, that every way encompasseth us, and Through our Negligence in ordering our Lives, and that great Ignorance of the Properties which are in things conducing to Health, which might help a disordered way of Living, and supply the defect of due Government.'

It has been held by some historians that there was a Jewish, or other school of Medicine established in Oxford in the twelfth century, but Dr. H. P. Cholmeley, who has investigated the opportunities given in our city in the Middle Ages for the study of medicine, has come to the conclusion that there is no evidence for such belief. There were, however, Leeches (*Medici*), but the earliest mention of them does not suggest great efficiency, for, in the case of Stephen of York, their treatment was less efficacious than that of St. Frideswide in the eighth century. The Oxford Franciscan, ROBERT GROSSETESTE, (1175-1253), was one of those who acquired sufficient medical knowledge to be appointed physician to a bishop: this implies that medical teaching was obtainable at Oxford before 1200, which is a traditionally accepted date for the foundation of the University. Grosseteste was an ardent advocate of temperance. In 1236 he urged that strong drink should be avoided, since it 'deprives a man made in the image of God of the use of his reason,

brings on the worst diseases, shortens his life, is the stepping stone to apostacy and engenders other innumerable evils'. Food, sleep, and good humour are in his opinion the best means to temporal salvation.[1]

Another early name on the roll of Oxford physicians was REGINALD DE STOKES, who became a 'Master of Physick' in attendance on the Bishop of Lincoln *c.* 1250.[2]

Clinical experience was doubtless to be obtained at one or other of the charitable foundations established

ST. BARTHOLOMEW'S HOSPITAL CHAPEL.
From Parker, Antiquities of Oxfordshire.
Block lent by Mr. Parker.

in the twelfth and thirteenth centuries. A hospital for lepers, founded by Henry I, 1100-35, and dedicated to St. Bartholomew, was situated a quarter of a mile beyond St. Clement's, but is stated by Wood to have been allowed to fall into decay when a rumour was spread that leprous folk overseas had, at the instance of the Saracens, 'poisoned the fountain of sweet gliding streams'[3].

'In 1329, Edward III to gratifie his scollers of Oriel Hall, conferred on them the hospital, which was then

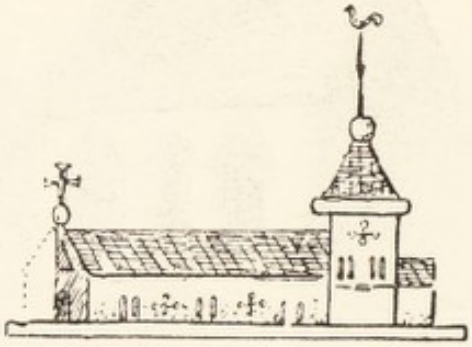
[1] Stevenson, *Life of Grosseteste.* The first Franciscans landed in England in 1224, just seven hundred years ago, under the leadership of Agnellus of Pisa. Their Oxford house was built on land obtained from Richard the Miller in what is now Church St., St. Ebbe's, near which Agnellus himself is said to be buried.

[2] *Mon. Franciscana* i. 113; Rolls Series.

[3] Wood, *City*, ii, 509.

much decayed, so that they might have the use of wholesome air in times of pestilential sickness.'

The master of the hospital, who was in priest's orders, had at his command a valuable assortment of amuletic medicines with which to cure his patients. It boasted St. Edmund the Confessor's comb,[1] one of the ribs of St. Andrew the Apostle, the bones of St. Stephen, and the skin of the patron saint of the hospital. 'Those who were troubled with continuall headaches, frenzies or light-headed, were by kembing their heads with St. Edmund's combe, restored to their former healthe; or



THE HOSPITAL OF ST. JOHN, *c.* 1250
After Matthew Paris. Brit. Mus. Roy. MS. 14 C vii, f. 221.

those troubled with a weaknesse of joynts or halting, were by the handling and applying those bones to the places affected, restored to their pristine state.' The equipment may have been worth as much as is an ounce of radium to a modern hospital, and with the recrudescence of superstition after the great war of 1914 might have had a modern value had it survived.

The second 'infirmarie for ye sicke', or St. John's Hospital, appears to have been founded in or before the reign of King John, who gave it lands. It was refounded in 1233 by Henry III, who gave it a new site and buildings, a mill, and Statutes. The care of the infirmary and its inmates was vested in a 'sacrist', who, as one of the brethren, wore a gown of brown stuff with a cross on the left breast, and over this a cloak marked with a double cross in front. Considerable portions of the old buildings

[1] Edmund the martyr was born at Abingdon, which accounts for his comb being preserved in the neighbourhood. Edward the Confessor was also born near Oxford, at Islip.

of the old hospital may still be traced in and under the later buildings of Magdalen College.[1] Patients treated in this hospital were narrowly limited by statutes which expressly forbade the admission of any sick persons who could not confess, or who might be suffering from leprosy, paralysis, dropsy, mania, epilepsy, fistula, pregnancy, or incurable diseases. This would practically ban all cases except the specific fevers, ague, and such complaints as pneumonia and bronchitis. This rule appears to have been common at a time when it was desired to prevent a hospital becoming an infirmary. Sir D'Arcy Power informs me that it still holds good at St. Bartholomew's Hospital in London founded in 1123. Surgical patients and accidents, of course, were always admitted.

In Edward II's reign, according to Miss R. M. Clay,[2] several brethren who had caused dissensions elsewhere were transferred to St. John's hospital in Oxford. Small wonder that a subsequent visitation of St. John's should reveal misrule, dissolute living, disobedient and quarrelsome brothers, sisters, and ministers. An Order to admit the King's Chaplain, 'finding him and his clerk food, drink, robes, shoe-leather, wood, litter and a fitting dwelling place' in the hospital, reads very like a forerunner of the ordinances of Royal Commissions of our own times.

The following list of medieval hospitals has been extracted from the same authority.

The Medieval Hospitals of Oxfordshire.

Leper houses are marked with asterisks.

Date.		Founder.	Patron.
1126	*St. Bartholomew, Oxford	Henry I	Oriel Coll.
1142	*St. Mary Magdalene, Crowmarsh	—	Osney Abbey
?1158	St. Giles, Cold Norton	—	Priory
1166	*St. Leonard, Clattercote	—	Bishop, Priory
1180	St. John Baptist, Oxford	re-f. Henry III	Crown
1219	'Bethlem', Oxford	—	—
1226	St. John Ev., Burford	—	Private
1228	— Eynsham	—	Abbey

[1] Appendix to Salter, *Cartulary of St. John's Hospital.* Oxf. Hist. Soc. lxix.

[2] R. M. Clay, *Medieval hospitals of England.*

Date.		Founder.	Patron.
1231	*St. Cross, Woodstock	—	—
1234	Domus Conversorum, Oxford	Henry III	—
1241	St. John B., Banbury	R. Whiting	Bp. of Lincoln
1307	*St. Leonard, Banbury	—	—
1330	St. Giles, Oxford	—	—
1338	St. Peter, Oxford	—	—
1339	St. Mary V. & S.M.M., Woodstock	—	—
1345	St. Clement, Oxford	—	—
1355	St. Mary V. & S.J.B., Bicester	N. Jurdan	—
1437	God's House, Ewelme	De la Pole	Private
1457	Great Almshouse, Burford	—	—
1460	St. Christopher, Thame	R. Quartermayne	—
1501	New Almshouse, Banbury	—	—

Then there were the infirmaries of the great religious houses such as Osney Abbey and St. Frideswide's Priory, where, according to Wood, 'there was the infirmary where the monks that were sick retired, and had the benefit of physicians and their medicines'. But, as Cholmeley points out, the monastic physicians were a kind of lay brother, or at least could take fees as did Walter of Brakelond.

Opportunities for gaining clinical experience must therefore have been very limited, 'but as no clinical study was necessary for a degree, probably no student, unless unusually enthusiastic, would trouble about it'. The medieval physician was not uncommonly an ecclesiastic who undertook the cure of the body as well as that of the soul, and licence to practice in both faculties was granted by bishops.[1] Among others, we may mention Albert, afterwards a Cardinal, who accompanied Lanfranc on his visit to Egleward; John of St. Giles, the friend and physician of Robert Grosseteste; and Ranulphus Besace, physician to Richard I.

We have already alluded to the apothecaries' quarter in the High Street in the first part of this work,[2] but the earliest record of apothecaries in Oxford is even older than is there indicated. As early as 1230 a Roger Spicer lived in Grope Lane, now known as Grove Street, and from 1240 to 1285 the name of William le Spicer de Winton, sometimes associated with that of his brother

[1] It was necessary, at any rate in later years, for a candidate to show that he had cured a certain number of poor people. (D'A. P.)

[2] *Early Science in Oxford*, vol. i, p. 3.

Alfred le Spicer, 1246–57, frequently appears as a witness in the deeds of St. John's Hospital; his daughter Maria figures in 1263, and his son Richard le Spicer had a house on the site of 80 High Street in 1308, being probably the individual of the same name who paid 4*s.* for a shop near Carfax in 1297. The name written RICHARD LE ESPECER appears frequently from 1289 to 1312 and written RIC. 'IPOTECARIUS' in a rental of 1293-4 of St. Martin's parish for his holding 'apud Karefouk', 'in Quarefuc', 'in quadreuio'. Meanwhile the name of a Thomas le Spicer appears in 1248, 1250, 1253, 1257, 1263, and he is followed by Tho: Apotecarius in 1280, and in 1293-4 as renting land in All Saints parish, and 'against the town walls opposite Kybaldestreet'. In 1277 a district called the 'Spicery' was specially allotted to apothecaries and spicers for their trade. This in 1293-4 was localized as 'In vico Cattestrete' and xii *d.* was paid for it. John le Especer rented a messuage in 1283 and Iwo Ipotecarius in 1293-4 occupied two shops 'sub magna camera de Borouwaldescote' which is Broadgates or Burwoldscot Hall. It is of course obvious that some of these 'Ypotecarii' may only have been private persons, but it is also probable that a fair proportion were really engaged in the trade of Oxford in the thirteenth century.[1]

Two early deeds, quoted on the occasion of the British Medical Association meeting at Oxford in 1904, are worth repeating. The earliest is a Release by John Sencer of Oxford to John, son of William Espicer, of Oxford,

'of all his lands, tenements and rents which he has by extent under a writ of elegit (seizure of property of a party legally declared unable to pay a debt), viz., A messuage in the parish of St. Mary the Virgin, three shops adjoining it, two shops in the Apothecaria in All Saints parish, and one shop in the tannery (*peletria*) in St. Martin's parish. Dated, Oxford, Monday next before the Ann^{n}. of our Lady, 1315'.

Another deed, dated 1341, relates to a taper-maker and an apothecary:

'1341 (15 Edw. III). In the King's Court. William the Tapermaker delivered to John of Denton his Ypotecary-stall with all its utensils, and 20 lb. of wax and spices existing in

[1] Salter, *loc. cit.*

the stall to keep a merchandize for him, and to give account of the same at the four seasons of the year. He now complains he cannot get the account from John of Denton.'

The power of electing and admitting apothecaries came to be vested in the Chancellor, who usually appointed a commissary to act on his behalf. An instance of this is recorded in 1526, when our first Wolsey lecturer heard one David Styles take the following oath.

'I swear that I will always have in my shop all medicines, species of medicines and confections which concern the art and mystery of an Apothecary, and are necessary for the health of man.

'That I shall be contented once a year (at least) that certain physicians practising in the University shall visit my shop upon the account of good and bad medicines, in the month of November, or any other time if occasion shall require it, to be adjudged of by the Vice Chancellor, one of the Proctors and the practising physicians here; and these searchers and tryers of medicines being of the Vice Chancellor's and Proctors' appointment, shall have power to destroy and throw away all bad and unprofitable medicines and drugs.

'That I will sell all things appertaining to my trade at a low and reasonable price, and as sold in other places in England.

'That I will not make up any compound medicines without the presence and advice of some physician admitted to practice, who shall judge those samples fit to be made up into compositions.

'That I will observe these things without fraud or deceit.'

The Pharmacy pots in which the old apothecaries kept their drugs have been found in excavations in many parts of central Oxford and a selection has been figured in the plate facing page 6 of volume i. In the 13th century the Arabs glazed pots with a waterproof glaze of tin dioxide, which circ. 1299 was made at Faenza (Ravenna), where Luca della Robbia learnt the method.[1] The mark of the apothecary was the mortar, and it is remarkable that no very early Oxford specimens of Apothecaries' Mortars should be known. The elaboration to which this necessary utensil afterwards attained is noted on page 44.

It is curious that Shakespeare should not have alluded

[1] Feldhaus, *Die Technik der Vorzeit*. Leipzig 1914.

to this *alter ego* of the needy apothecary of Mantua, whose shop Romeo described in such detail.

> I do remember an apothecary,
> . . . meager were his looks,
> Sharp misery had worn him to the bones,
> And in his needy shop a tortoise hung,
> An alligator stuff'd, and other skins
> Of ill-shap'd fishes; and about his shelves
> A beggarly account of empty boxes,
> Green earthen pots, bladders, and musty seeds.

The first lecturer on medicine whose name is preserved to us is NICHOLAS TYNCHEWYKE or TINGEWICK, M.D., Fellow of Balliol College, who was gratefully remembered by Edward I as the physician 'to whom, after God we owe thanks for our recovery from the illness which lately oppressed us'.[1] The list of drugs used by Tingewick included distilled oil of turpentine, aromatic flowers for baths, carminative electuaries, plasters and ointments of various kinds, the oils of wheat, ash, and bay, water of the roses of Damascus, wine of pomegranates, remedies prepared from pearls, jacinths, and coral, and many other drugs. The king was taken ill at Carlisle, and the cost of conveying these remedies from London to that city amounted to £159 11*s.* 10*d.*, the apothecary's bill for the medicines being £134 16*s.* 4*d.*[2]

In Oxford Nicholas Tingewick read physick lectures in the Physic School[3] adjoining his Inn on the east side of Cat Street on the site of the Cloisters of All Souls College. It is reported that, having read in Mirfield's medical MS. *Breviarium Bartholomei* that 'lice (*pediculi*) of sheep, bruised and compounded with honey and water (*hydromel*) can cure jaundice (ycteridia), . . . he rode 40 miles to an old woman who had by this remedy cured an infinite number, so to speak, of persons, and that he gave her a sum of money for instructing him in the cure'.[4] Tingewick died in 1324.

[1] On Oct. 7, 1306. Rymer, *Foedera*, ii, 1077–8, quoted by Norman Moore, *Linacre Lecture*, 1913.

[2] Thompson, *Alchemy and Pharmacy*, 1897.

[3] Maclean, *History of Pembroke College*. See the plan on p. 21.

[4] Herburwe hall on E. of Cat St. was given to St. John's Hospital in 1265: it lay between Corbets Hall, afterwards known as Tingewick's Inn on the N. and Goodgame Hall on the S., and must have

There is no evidence that our predecessors in Oxford may lay claim to so much perspicacity as to have spontaneously realized the need of studying anatomy. That insight into the craft came to them from abroad, where Mondinus had already practised dissection about 1309, and the Emperor Frederick II had ordered that all surgeons should undergo a course of human anatomy before being allowed to practise; and gruesome stories of vivisection are told.

The study of physick was, however, accorded an honourable place among the courses of early Oxford. In the original statutes of the University, set out *c.* 1325, those skilled in medicine are reckoned more learned than others, since to their discretion are committed the cure of the sick, the perils of death, and the ordering of life. Great care must therefore be exercised that only competent persons are allowed to practise or incept in that faculty.

For inception in Medicine, a candidate was to have read one book of the *Tegni* (= τέχνη) of Galen, or one book of the *Aphorisms* of Hippocrates, *pro majori parte*. These sufficed for Theory. For the practice of medicine the candidate must have read one book of the *Regimentum Acutorum* of Hippocrates, or the *Liber Febrium* of Isaac, or the *Antidotarium* of Nicolaus. A candidate must also have responded to the Masters Regent in the faculty for two years. Graduates in Arts were let off with a two years medical course, but from others eight years study were required. For licence, candidates had to have heard 'Medicinalia' for six years, to have read *cursorie* one medical book *de practica* and another *de theoretica*, and to have responded and opposed in all the medical schools for two years. Apparently no other book-learning was required and no mention is made of clinical experience or of anatomical knowledge.

In some colleges the study of medicine was not encouraged, indeed in Merton it was expressly forbidden by Statute, but such was the spirit of contrariness among the members of Merton College that they early began to

been where the great gates of All Souls quadrangle stand. The name dates from about 1200. By the end of the thirteenth century it was known as the Magna Scola, and in the fifteenth century as Physick Hall. Salter, *Cartulary of St. John's Hosp.*

seek medical knowledge and degrees. In 1284, only ten years after the foundation of the College, when a visitation was held by Archbishop Peckham, among the abuses which had to be corrected was 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, remarks a recent Warden, his injunction was neglected: medical science continued at Merton as a part of 'philosophy'; and it is remarkable how many of its Fellows devoted themselves to Physics, as they were then understood.

One of the first of the Merton doctors was JOHN OF GADDESDEN who graduated D.M. about 1309 and wrote a treatise on Medicine, the *Rosa Medicinae*, in the seventh year of his 'lecture'.

The 'Rosa Anglica', as John's book is more usually called, though largely a compilation from the works of earlier physicians, also contains many personal observations which show that Gaddesden must have had a large practice. Some of his clinical pictures, e.g. of ascites with obstructive jaundice, are said to be wonderfully vivid, and many of his remedies anticipate modern practice. Incision for dropsy, urea as a diuretic for cure of a hydropic child, red-light treatment for smallpox, treatment for phthisis, are all noted. His list of signs of leprosy is most detailed, and he mentions a rapid clotting of the blood which is confirmed by the observation of Boeck and Danielssen that the fibrin ferments largely increase in the blood of lepers. His surgical operations did not go far beyond tapping for dropsy, an operation for hernia, and the reduction of dislocations; that of the lower jaw being well described. His contemporaries looked upon him as an authority in the diseases of women. He also includes directions on diet, cookery, and the lucrative business of a beauty specialist.[1] With Bernard of Gordon[2] and Gilbert the Englishman,[2] Gaddesden is mentioned by Chaucer in the *Canterbury Tales*.

[1] Cholmeley, *John of Gaddesden*.

[2] Bernard was the author of the *Lilium Medicina* and Gilbert of the *Compendium*.

Blood Letting.

A surgical operation of everyday occurrence was that of blood letting. This practice has a long and complicated history, and many were the treatises and rules which guided the practitioner. The general utility of bleeding was well known to the ancients. The Rules of Health of the School of Salerno (*c.* 1100) governed its details in the Middle Ages, and would have regulated venesection in Oxford.

The choice of the vein from which blood was drawn was considered to be of great importance. In the *Treatise on Bleeding* it is stated that 'There is also a vein in the fore-finger which anatomists call the Salvatella. This must be opened on the right hand in congestion of the liver, but on the left in congestion of the spleen'. Many physicians held that a complete cure was only possible if the bleeding took place between certain hours, and when certain planets or signs of the zodiac were in the ascendant. Their belief was inherited from antiquity, as the following extract from an Anglo-Saxon Leech-book shows:

> The old leeches laid it down in Latin books that in every month there are ever two days which are very dangerous for drinking any medical potion, or for blood letting; because there is one hour on each of those days, on which if any vein is opened, it is loss of life or long disease. A leech tested this doctrine, and let his horse bleed on that hour, and it soon lay dead.[1]

And this in spite of the warning of the Venerable Bede that 'No Christian man shall do anything of witchery by the moon: if he doth, his belief is naught'.

The powers of the greater lights, the sun and the moon, were evident to all. The belief in the influence of the stars on human life received authority from the mistranslation of a passage in Hippocrates, τι θεῖον in disease being rendered by *coeleste* instead of *divinum*.[2] And the old Greek doctrine of the influence of particular planets on particular organs became the physician's guide, and

[1] *Leechdoms of Early England*—illustrating the History of Science before the Norman Conquest, p. 153.

[2] E. Withington in Little's *Roger Bacon Essays*, 1914.

helped him to shelve many of his responsibilities on to the stars. An interesting survival of the ancient bond between astronomy[1] and medicine is the sign of Jupiter, ♃, with which every modern prescription begins.

The phlebotomist was greatly helped in his practice by diagrams which were based upon an original scheme worked out by an early Christian bishop, Priscillian, to indicate the particular organs over which the twelve signs of the zodiac preside. The scheme was doubtless of service to innumerable physicians and their patients, but Priscillian was executed in A.D. 385, a martyr for his special form of science.[2] The Priscillian scheme was much used in the fourteenth century and appears in several of the Ashmolean manuscripts, and on the Oxford instrument which we have already figured and described as no. 68.[3] The latter example is engraved upon the side of a Physician's Quadrant. The twelve signs of the zodiac are distributed over the various members of the body according to the accepted scheme. The following pictures of Zodiac Men occur in manuscripts in Oxford:

The Zodiac Man in Manuscripts

1. Zodiac Man. **xiv cent.**

Coloured. f. 363 MS. Ash. 789.

Reproduced in vol. ii, p. 238.

2. Zodiac Man. **xiv cent.**

f. 7 MS. Savile. 39.

Another copy similar to the last. On the same page as a Volvelle.

3. Zodiac Man. **xiv cent.**

f. 34[b] MS. Lib. Mus. Ash. A 5.

Reproduced in vol. ii, p. 170.

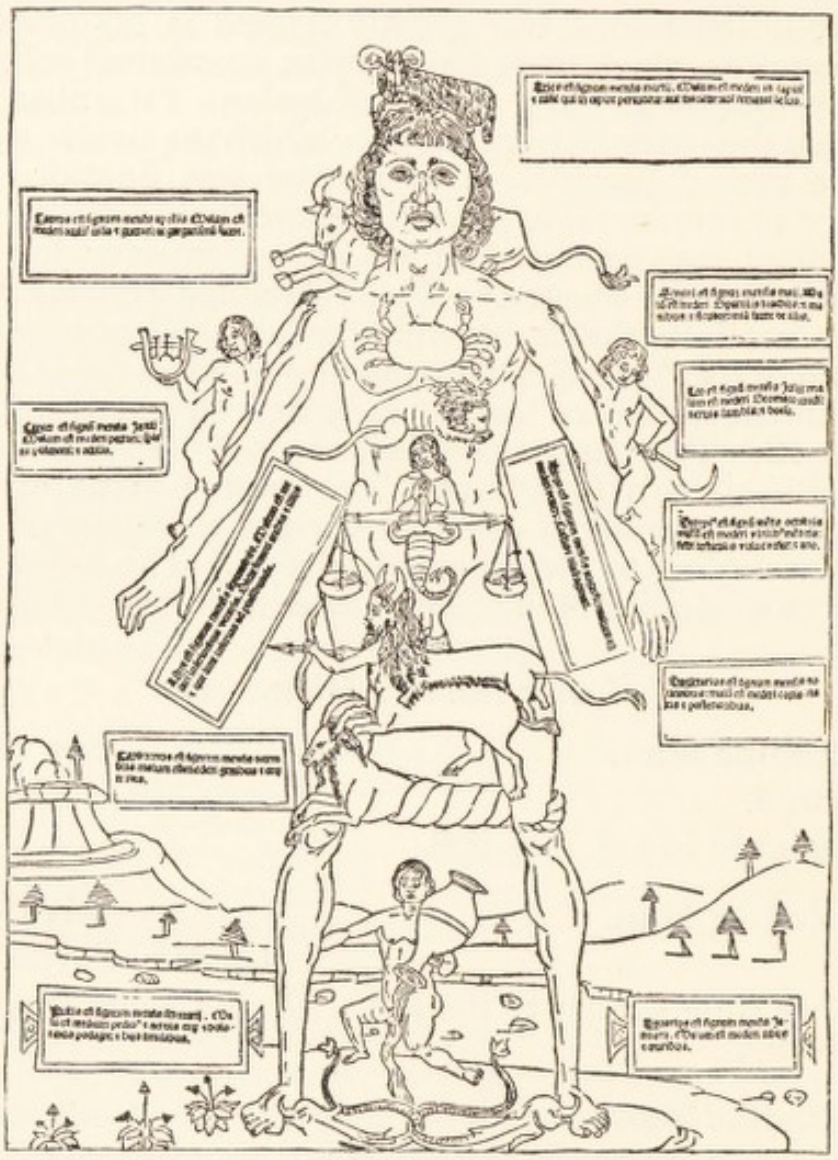
[1] At the time of which we are writing 'Astronomy' and 'Astrology' were so intermingled that, as in our previous volume, we use the term Astronomy whenever the practice of that science is involved, even though it be exercised by astrologers.

[2] 'Ad hanc insaniam pertinet prodigiosa illa totius humani corporis per duodecim signa coeli distinctio, ut diversis partibus diversae praesideant potestates', Leo, *Epistola* xv.

[3] *Early Science in Oxford*, ii, p. 170.

4. **Zodiac Man.** **xiv cent.**
MS. Ash. 8.

Less carefully drawn than the last.



KETHAM'S ZODIAC MAN.
Fasciculus Medicinae, 1491

5. **Zodiac Man.** **1424.**
MS. Ash. 370.

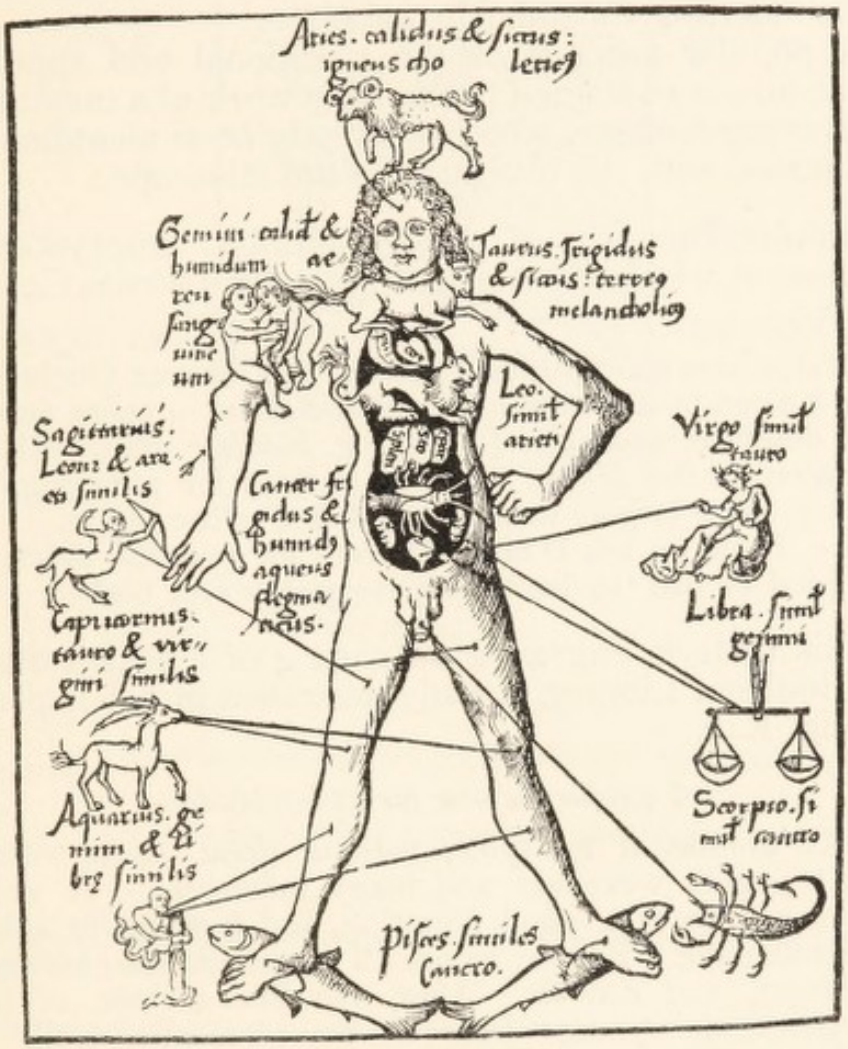
Brightly coloured.

6. **Zodiac Man.**

MS. Ash. 210.

7. Zodiac Man. xv cent.
MS. Ash. 391.

Finely coloured and protected by a veil of silk gauze.



Reisch's Zodiac Man.
Margarita philosophica, 1504.

Later the Zodiac Man diagram appeared in printed books. One of the earliest of these diagrams to be printed from wood blocks appeared in 1475 in the Calendar of Regiomontanus. It was a crude production, but the art of block cutting improved so rapidly that by 1491 craftsmen were producing work as fine as that used to illustrate the fine work by Ketham. The somewhat later drawing of the Zodiac Man of 1504, printed by Reisch, has a special charm.

Special calendars were prepared for the use of medical men and were soon multiplied by the printing press; indeed the Purgation Calendar of 1457 is believed to be the first printed medical publication. It was followed by a Blood-letting Calendar in 1462.

A popular account of the traditional and approved procedure is contained in the later work of a member of University College, who has already been mentioned in connexion with the invention of the telescope:

LEONARD DIGGES. *A Prognostication*: imprynted at London, within the blacke Fryars, by Thomas Gemini. 1555.

First ye have many pleasant chosen rules for ever, ⟨including⟩ 'No. 9 a conducible note of all the *euel daies* in euery *moneth*: with other necessaries: for letting bloudde also, with the dominion of the *Moone* in mans bodye: for pourging, and bathing, more largely then by the Table tofore sayde.

The Table on fol. D iii v declareth for ever the daies that are good or bad 'to let bludde, to purge and bathe'.

This table is engraved on page 4 of a pocket dial in the Bodleian Library, already described in vol. ii, p. 282. On sig. E. is

A conducible note for letting bludde.

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, watchinges,* and *c. c.* &c. After, vse fine meates, of light digestion: abstayninge from all the aforesayd, vntill 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 dominion of the Moone in mans bodye.

FRom the *chaunge,* to the *firste quarter,* a mete tyme to let yonge men bludde.

From the *firste quarter,* to the *ful,* good for middle age.
From the *ful* to the *laste quarter,* apt for aged folke.
From the *laste quarter,* to the *change,* best for olde men.

Beholde the figure.

DIGGES'S ZODIAC MAN 1555.[1]

Prognostication.

Signes mete for the complexions.

ARIES, *Sagittarius* } for the *fleumaticke*: the head, and thyes excepted.

Libra, *Aquarius* } for *melancholike*: buttockes, and legges excepted.

Cancer, *Scorpius*, *Pisces* } for *cholerike*: brest, membres, and fete excepted.

For the *sanguine*, all be apt that tofore are named good.

In the *springe tyme* let bludde at the right side.
In *Haruest time* at the left syde.

The learned Phisician will consider, beside all that is sayde, the *Coniunctions*, *Oppositions*, and *quadrate aspectes* of the Planetes: with many other thinges *Astronomical*, most necessarie, both in bludletting, purging, bathinge, &c.

For to take purgations, and to bathe.

THe metest time to take purgations &c. is neither in hote, nor colde dayes: that is, from the tenthe of *Marche*, to the twelfthe of *Iune*.

[1] Engraved by C. I.

Further, by rules Astronomical, it muste be perfourmed when the *Moone* is in cold moyst, and watry signes, as *Cācer, Scorpius* and *Pisces*: conforted by aspectes, and radiations, of planetes fortifienge the vertue of the bodye expulsive.

The *Moone* in *Aries, Taurus* and *Capricornus*, naughte. One cause of vomiting the purgation, is the *Moone* having aspect to any planet *retrograde.*

The *Moone* in these signes folowinge, very good to bathe: *Aries,* Leo, Sagittari, *Cancer, Scorpius* & *Pisces.*

These ensuyng are euel to bathe: *Taurus, Virgo,* and *Capricorne.*

Of .... hear clipping: shaving: and geldinge.

Heare cutte groweth well, the *Moone* encreacing, beynge in *Tauro, Virgine,* or *Libra.*

Cuttinge, shaving, clipping, in the wane, causeth baldnes: what is then cut, groweth litel. *Calamitium prohibet, oleum Tartari.*

The best tyme of Gelding is in *Cancer, Scorpio,* or *Pisces* in the wane.

It is scarcely surprising that some medical Pegasus should also have found an inspiration in the theme of 'what veins to bleed in':

> Ye that wyll lette gude men blode
> And vaynes wyth all yowre liues fode
> Some vaynes vse ye
> And mony other lette ye be.[1]

The practice may not have been less thorough in Oxford than it was in the East, and at the right hour on the right day the High Street by St. Mary's may, like the streets of Bagdad, have been seen running with blood from the barbers' shops.[2] And bleedings continued through the centuries: indeed as late as the beginning of the nineteenth century the practice of many Oxford physicians did not differ greatly from that of the celebrated Dr. Lettsom (*d.* 1815):

[1] Egerton MS. 2572.

[2] My friend Sir D'Arcy Power has, however, pointed out that this could not have happened if the Master and Wardens did their duty, for the by-law always ran as in London that 'No barber shall be so bold or so daring as to put blood in their windows openly or in view of folks, but let them have it carried privily into the Thames'.

When any sick to me apply,
I physicks, bleeds and sweats 'em;
If after that they choose to die,
What 's that to me,

I. LETTSOM.

Once a belief in horoscopes was firmly rooted, it followed that the conscientious physician must be skilful in the use of mathematical instruments, for it was the position of the stars, and tables and computation, that helped him to secure a correct diagnosis. Indeed, if he knew enough Astronomy, he need hardly know any medicine at all, for the relations of the planets, and later of the zodiac, to the parts of the body, were reduced to diagram form. Several of these diagrams, beautifully coloured, occur in Bodleian codices of the fourteenth and fifteenth centuries.

It may be here noted that in the sixteenth century the connexion between medicine and astronomy led on to a weird connexion between medicine and mathematics; for instance, there was a belief in the potency of certain numbers, particularly three and seven, and in geometric squares and figures such as mystic trigrams, pentacles, &c., the use of which was often closely intermingled with calendrical or astronomical factors. Drugs also, physicians believed, should be compounded so as to bring out their *dynamidiae*. This no doubt led thoughtful men like Arnaldo de Villanova (1235–*c.* 1313) to the study of mathematics. Again, a profound belief in the influence of comets upon human health made it needful that physicians of the sixteenth century should have enough mathematics to fix the position of comets in the heavens,[1] which they did by the help of astrolabes and armillary spheres.

Among the medico-mathematical scholars of the sixteenth century was Leonardo da Vinci (1452–1519), one of the world's greatest anatomists. And the advantage of an early training, both in medicine and in mathematics, is exemplified in the cases of Galileo, Copernicus, and Cardano, and also later on in the case of our own Robert Recorde. Oxford in this followed the trend of thought of the time. Astronomy was certainly considered

[1] A work that was much consulted was that of Fernandez Raxo y Gomez (d. 1595) *De Cometis*, Madrid, 1578.

a necessary part of the medical curriculum, for it has been noticed that almost all the early astronomers of Oxford were also medical men; especially was this the case in Merton College, to which most of them belonged. Indeed, a course of preliminary horoscopy was probably of far greater utility to the fifteenth-century physician than preliminary botany is to his twentieth-century successor. John of Burgundy in his treatise *de Pestilentia* emphasizes the point:

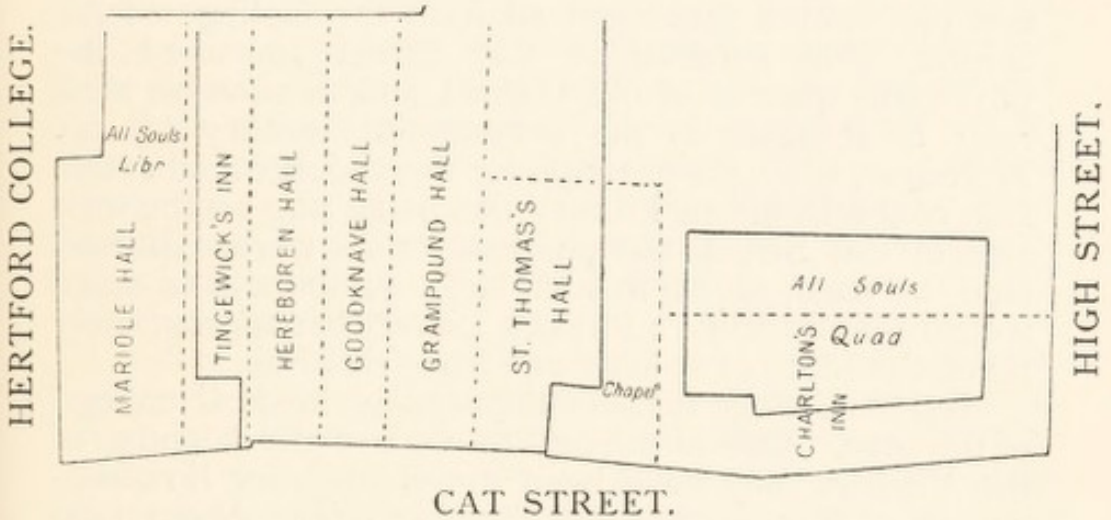
'And by cause that ther have bene many grete maistirs and ferre lernyd in theoric or speculacion and groundly in sight of medecyne but they bene but litill proued inpractik and thereto allefully ignorant in the sience of Astronomy the whiche science is in phisik wonder nedeful! as wittenessith ypocras in epidemia sua seying what phisician that ever he be and kan not astronomy no wyse man owt to putte hym in in his handis for why astronomye and phisik rectifien yche other in effect and also that one science sheweth forthe the many thinges hidde in the other alle thynges in thynge may not be declared. And I 40 yere and more have oftyn tymes proved in practice that a medecyn given contrary to the constellacion all though hit were both wele compownyd or medled and ordunatly wroght after the science of phisik yit wroght nowther aftur the purpose of the worcher nor to the profite of the pacient.' [1]

John goes on to explain that heavenly or firmamental bodies are the first and primitive cause of sickness, and that those who know not the causes, who have not 'dronkyn of that swete drynke of Astronomye', can put to sores 'no perfite remedie'. It would be hard to give a more cogent reason for the close study of the heavenly bodies. The wonder to us is not that medical Fellows of Merton should have attained to eminence as astronomers, but that one of the most eminent of them all, John of Gaddesden, should have practically omitted all mention of astronomical matters in his *Rosa Anglica*.

But obviously astronomy had its uses, for did not Eschenden foretell the Black Death from the consideration of an eclipse of the moon in 1345? The medical practice of a surgeon of the first class who lived in the Midlands through the time of the Black Death is illus-

[1] Sloane MS. 3449, f. 6, quoted from Cholmeley.

trated by the works of John Ardern, of which copies are preserved in the Ashmole and Digby collections.[1] Ardern, 1307–77, wrote an interesting account of his operation for Fistula, which gives us an excellent idea of the methods in use in the times that followed the period of the School of Salerno and terminated with the fatal year 1349. He is, moreover, the only contemporary authority for the story of the way in which Edward the Black Prince obtained the ostrich feather, an anecdote which immediately follows a discussion on internal piles.



PLAN OF OLD HALLS ON THE SITE OF ALL SOULS COLLEGE ALONG THE EAST SIDE OF CAT STREET.

THE PHYSICK SCHOOL ADJOINED TINGEWICK'S INN.

From a sketch by H. E. Salter. Cf. p. 9 note.

THE PHYSICK SCHOOL.

For the better training of members of the profession it was ordained in 1357 that the Vespers of Physicians should be kept in 'scoliis propriis' belonging to the faculty.[2]

The Physick School was a 'great Hall in the Street of Cats in the Parish of St. Mary', which according to

[1] MSS. Ashmole 1434, ff. 11–107; 829, ff. 76–115; Digby 161, f. 23. For the work of a nearly contemporary surgeon, see Lanfrank Science of Cirurgerie, *c.* 1380, in MS. Ashmole 1396.

[2] Wood, *Hist.* 1796, p. 765.

Wood was 'knowne by the name of Physicke Scoole and Hall and perhaps before Herberowe Hall'. 'There was a very fair school therein, which with the Hall itself (inhabited by physicians) belonged to St. John's Hospital. All I can find material of this school, is that it with others of the same faculty were repaired by one John Major, an inceptor in the same faculty in 1426. After the divinity school now standing was finished, the students in physic did their exercises therein.'[1] The last contemporary allusion to the Hall is perhaps contained in a charter dated 1484–5, when for a certain garden in Cat Street 'where was the school and Hall called Phisick Hall', 20*s.* per annum was received from the College of All Souls. For generations Cat Street remained the physicians quarter of old Oxford, and as such we shall refer to it again in the seventeenth century (p. 44). Moreover, when the great pit for the underground extension of the Bodleian Library was being dug on the west side of Cat Street, old pharmacy pots were exhumed (and, we trust, saved) in such large numbers as to make it clear that Radcliffe's Physick Library has appropriately taken the place of at least one Physick Shop.

Merton College became the leading medical college of the time. One of the first to witness the keeping of the Vespers may have been the elder JOHN KYLLINGWORTH of Merton, who flourished *c.* 1360. About 1386 JOHN CHYLMARK, also of Merton and remembered as the author of the *De accidentibus Planetarum*, was lecturing 'in Scholis Oxoniae in plateâ Scholarum positis'. To these two succeeded a band of eminent doctors. Among them were NICHOLAS COLNET, 1398, who accompanied Henry V to France as his physician, and was present at the battle of Agincourt. JOHN SOMERSET, Inceptor in medicine and physician to the Household of Humphrey Duke of Gloucester, was sworn a supervisor of the London physicians on 27th June 1424. JOHN KYLLINGWORTH the younger, proctor in 1441. WALTER HART, a worthy disciple of the elder Kyllingworth, and like him an astronomer. So high was his reputation that Chichele nominated him as one of the first twenty Fellows of All Souls. He acquired two medical treatises by Simon

[1] Gutch.

Bredon, which his brother, acting as his executor in 1484, gave to Merton. JOHN CURTEYS or CURTEIS, M.D.,[1] noted as a physician and astronomer, was elected a Fellow in 1442. THOMAS BLOXHAM, M.D., admitted B.Med. 1455, was celebrated as a practitioner; on one occasion 20*d.* was due to him for attendance and medicines supplied to a scholar who died.[2] To him succeeded the astronomer physicians HENRY SUTTON, M.D., elected 1458, and JOHN STACY, elected 1462, the last of whom was accused of treason and was hanged at Tyburn (Leland). And more eminent than all, JOHN CHAMBERS or CHAMBYR, M.D., elected Fellow 1492, who will be mentioned again as Court Physician to Henry VIII, co-operated with Linacre and De Victoria in obtaining a charter for the Royal College of Physicians in 1518. He had studied in Paris 1502-6, taking his M.D. there, and again in Oxford in 1531. PHILIP DENSE elected Fellow 1500, and JOHN BLYSSE, M.D., elected 1509, have already been mentioned as astronomers of repute. We think of them now as physicians. Neither lived long. Dense was cut off 'morbo pestilenti' in 1507; Blysse practised in London, and died at Blackfriars in 1530; he had been selected by the University in 1510 to dispute with a Spaniard of the University of Montpellier. Contemporary with him was WILLIAM LORYMER, elected 1509, who resigned his fellowship in 1511, being 'medicus et uxoratus'. At a later date All Souls College also became a leading medical college. Among their early alumni were Walter Hart of Merton, NICHOLAS HALSEWELL, fellow 1468, whose arms were formerly in the cloister windows; RICHARD BARTLOT M.B. 1503 'very famous for his great knowledge of physic' (Caius), and THOMAS GWYN M.D. 1528. To New College belonged THOMAS BENTLEY M.D. 1518. JOHN CLEMENT, the friend of Sir Thomas More, and WILLIAM FREEMAN were also Oxford men, but their college, if they had one, is uncertain.

About 1400 there appear to have been so many townsmen and illiterates advertising themselves as medical

[1] There is no evidence that the degree of doctor of medicine was conferred at Oxford before 1449 when THOMAS EDMONDS received it. In 1451 it was conferred on JOHN FACEBY, physician to Henry VI. The Register from 1455 to 1505 is missing.

[2] Anstey, *Mun. Acad.* ii, p. 664.

men, that the University passed a statute against unlicensed persons and resolved to proceed against them in future as disturbers of the public peace.[1]

About the middle of the fifteenth century several Englishmen were pursuing their studies in Italy.

The more eager students either mistrusting the depth of their instructors' knowledge, or finding no prospect of advancement in their own country, elected to study abroad. Of interest to us is a small party of Oxford scholars, mostly Balliol men, who worked with Guarino Veronese at Ferrara. The party consisted of Grey, Free, Gunthorpe and Tiptoft of Balliol, and Fleming of Lincoln. JOHN PHREAS or FREE (d. 1465) of Bristol, the best known of them, went to Italy to study Greek and Medicine, and is said to have made money by teaching medicine at Padua, Ferrara, and Florence. Ten of his letters, probably written at Ferrara in the autumn of 1457 and in 1458, are in the Bodleian Library and have been recently described.[2] Free translated the *Phalakras egkomion* of Synesius. His *de Laudae Calvitiae* was printed posthumously with the *Praise of Folly* at Basel 1510-20, 1521, and in an English version by Fleming in 1579. It was a paradox proving that baldness is more desirable than a thick crop of hair.

Few of our worthies deserve more to be had in remembrance in Oxford than Dr. GILBERT KYMER, d. 1463, the cleric-physician attached to the house of Humphrey, Duke of Gloucester. Kymer was Chancellor of the University 1431-33 and was M. B., B. C. L., M. D. before 1420; Proctor 1412-13; Principal of Hart Hall 1412-13; presented to the living of Lutterworth, Leicestershire, 16 Dec. 1420 whilst yet a layman. Dean of Wimborne Minster and Treasurer of Salisbury Cathedral; ordained subdeacon 28 Feb. 1427-8; presented to St. Martin's Vintry 1434; Dean of Salisbury 1449; sworn Rector of the medical men in London 27 Sept. 1424. He was called to attend Henry VI at Windsor in June 1455. Physician with Dr. Somerset to the Household of Duke Humphrey, whom he induced to leave his library to the

[1] *Mun. Acad.* 236. Note by Gibson, O.

[2] Spingarn, *Unpublished Letters of an English Humanist.* 'Journ. Comp. Literature', i, 1903. The originals are in MS. Bodley 2359.

University. He was the author of a treatise addressed to Humphrey, *Diaetarium de Sanitatis Custodia*.[1]

The first surgeon known to have been admitted and licensed to practise his art in Oxford was PETER DE ALCOMLOWE, who is mentioned in a statute dated Nov. 7, 1462, as having been examined. Another fifteenth-century medical man was WILLIAM GODDARD, a Grey Friar of Oxford, whose recipe for making Aqua vitae is among the Sloane MSS.[2]

UROSCOPY.

To determine the nature of a malady the physicians of the fifteenth century, having inherited the methods of their predecessors in the Middle Ages, placed an exaggerated reliance on conclusions drawn from the pulse and the urine of their patients. So universal was the latter method of diagnosis, that the glass flask of peculiar shape, termed a urinal, that was used for this inspection became the adopted sign of the physician. Our drawing of a urinal, taken from the book of an Oxford physician of the sixteenth century, and reprinted in 1651, shows us that the shape of the flask remained practically unaltered from its appearance at least five hundred years previously.

As early as 1181 the statutes of the hospital of St. John of Jerusalem prescribed that there should be a uroscopist on the staff of the hospital. One of the earliest Oxford manuscripts on the subject dates from the thirteenth century (MS. Digby 79) and includes a *Tractatus de urinarum sciencia*, f. 18. About 1220 MICHAEL SCOT compiled certain Medical Receipts paying especial attention to the urine of the patient. (*D. N. B.* and J. Wood Brown, *Life of M. Scot*, 1175–1232.)

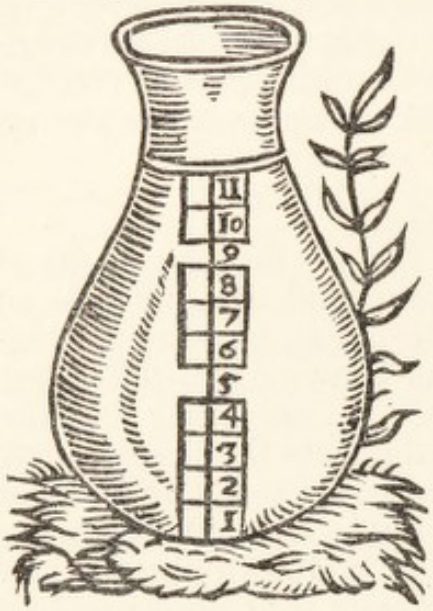
Uroscopists with their glass flasks are depicted in medical writings as early as the eleventh century.[3] They became a customary illustration in the first printed medical books, where they may be studied in a great

[1] Two chapters have been published by Hearne in *Liber Niger Scaccarii*, pp. 550-9 (Bodl. Douce h.h. 152). The MS. is in the British Museum. Information from Sir D'Arcy Power.

[2] *Aqua vite secundum doctrinam magistri Godard per Johannem Grene medicum scriptum:* a short recipe in English, *c.* 1468. MS. Sloane 4, p. 77.

[3] Cf. the eleventh-century Anglo-Saxon MS. in Brit. Mus. figured in *Anglo-Saxon Leechcraft*, 1912, p. 32, and the thirteenth-century miniature in MS. Ashmole 399, Dr. Singer, *Proc. R. Soc. Med.* ix, 1915.

variety of woodcuts.[1] But there are not many examples in sculpture which can compare with the fine figure of the Doctor of Medicine on a buttress on the west side of the cloisters of Magdalen College.[2] It dates from 1506, and therefore represents a physician of the fifteenth century. In his gown, with the hood thrown across the shoulder, he is in the act of performing a uroscopy, and perhaps thus earning a fee to put into the somewhat empty purse carried in the left hand. The limpness of the purse may indicate that uroscopy, in spite of the high esteem in which it was held, was not a very paying business. At Frankfurt the customary fee was 12 pfennigs.[3]



RECORDE'S IMPROVED URINAL, *c.* 1550.
Urinal of Physick, London 1651.

All the possible appearances of urines were tabulated

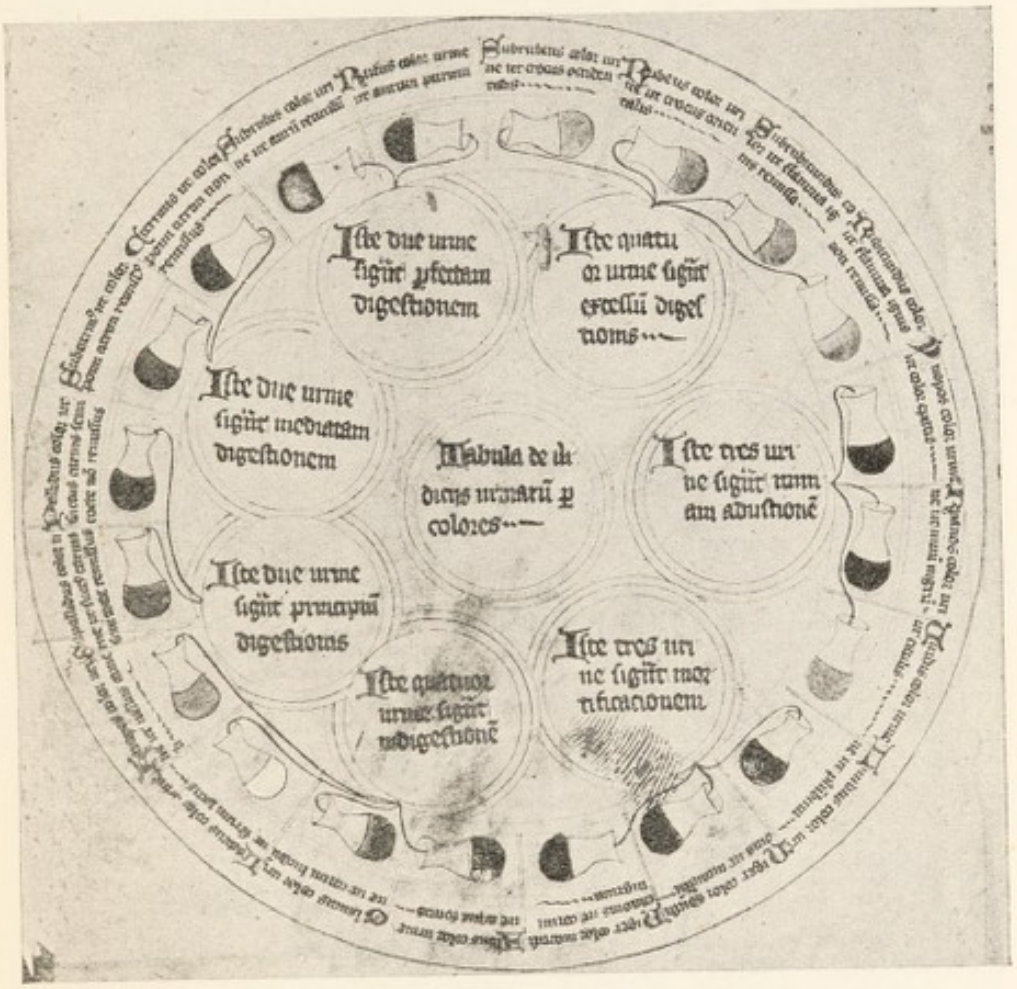
[1] Megenberg, *Buch der Natur*, 1478.
Rodericus Zamorensis, *Speculum*, Augsburg, 1479.
J. de Cuba, *Hortus Sanitatis*, 1485, 1492, 1498.
Tallat, 1502.
Eyn nyge kalender recht hollende, Lubeck, 1519.
Brunschwig, *Buch der Kunst zu destillieren*, 1512.

[2] A description of the Magdalen uroscopist was written about 1696-8 during Hough's presidency and was included in the curious dialogue between the three interlocutors, A, B, and C. It was entitled *Collegium Magdalense* and may be consulted in MS. Rawl. D. 912, f. 332.

A. Haud procul hinc medicus fixis explorat ocellis
Urinam vase inclusam. (B) Medicus ne explorat ocellis
Urinam vase inclusam? bene multus in hisce
Sal video latitat; tamen et puto, saxeus aequè
Aegroti morbum cyatho deprendat opaco;
Ac qui conclusas in vascula limpida guttas
Concutit humoremque vitro conspectat amarum.

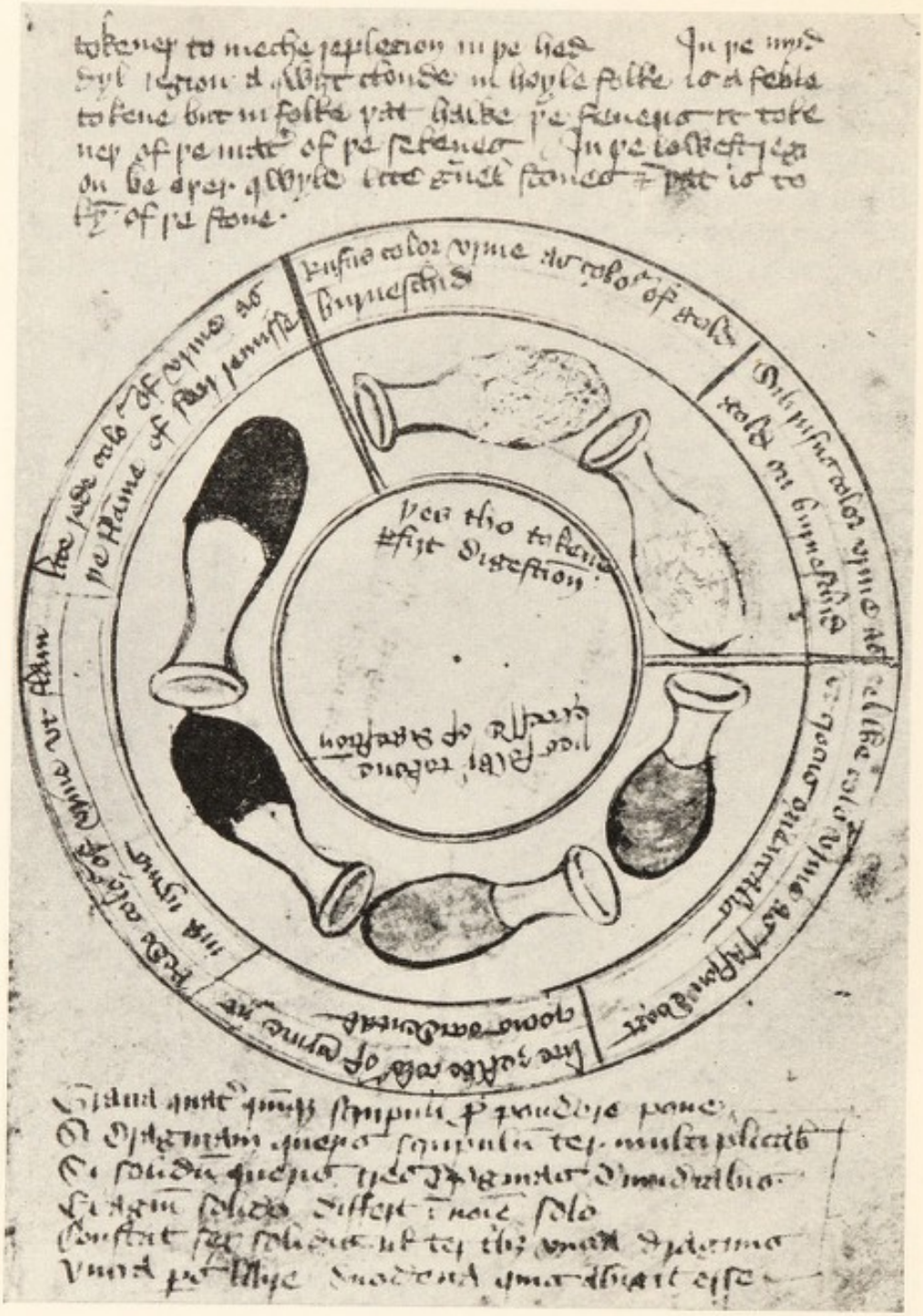
[3] Baas, p. 334.

and co-ordinated with the supposed corresponding states of the patient. Rules for this systematizing occur in many medical manuscripts, some going back to the thirteenth century. They were also rendered in the form of a circular diagram, known as the Urine-Ring, of which there were several examples in the Ashmolean Museum.



URINE RING IN LATIN MANUSCRIPT OF THE XV CENTURY.
MS. Savile 39, f. 7v.

In MSS. Ashmole 391 (xiv cent.), 789 (xv cent.), and in MS. Savile 39, twenty urinals with coloured contents are arranged circumferentially in two symmetrical groups of ten, with mouths upwards. They are described as 'albus' to 'rufus' in the left-hand group, and as 'niger mortificationis' to 'subrubeus' in the right-hand group. The indications of the various

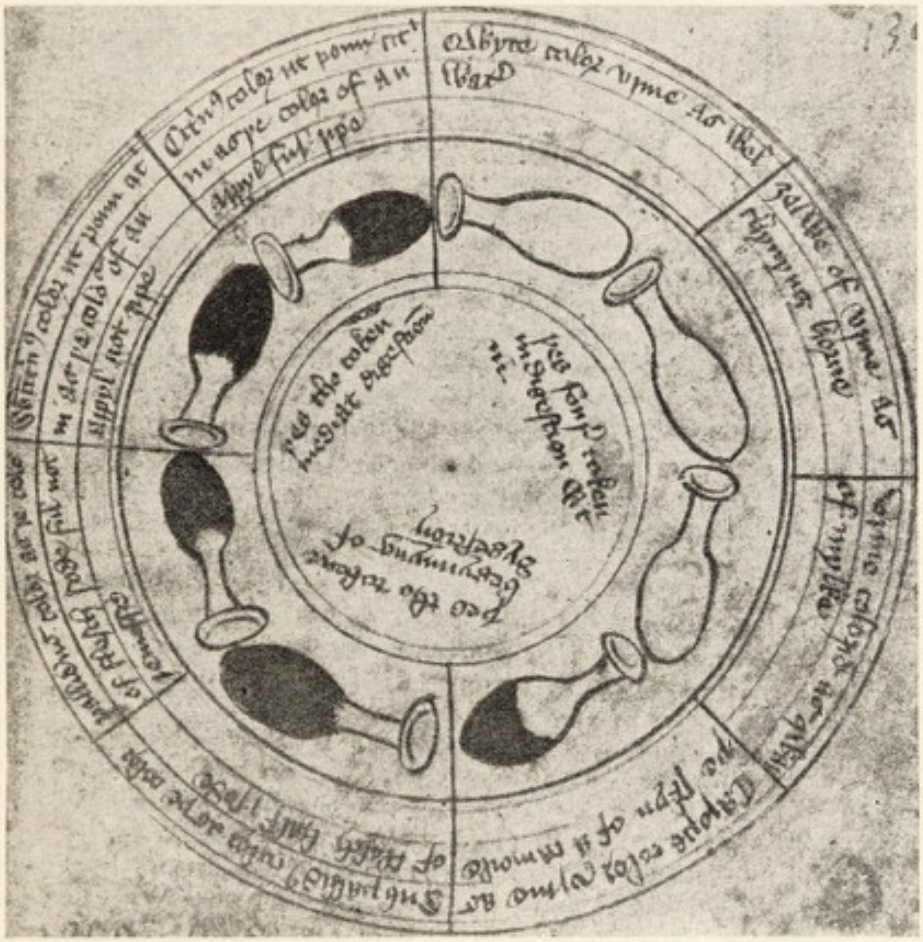


URINE RING IN ENGLISH XV CENTURY MANUSCRIPT.
MS. Digby 29, f. 129.

Inscriptions in outer ring:

Rufus color urine as color of gold burneschid.
Subrufus color urine as gold on burneschid.
Thes tho tokene perfeyt digestion.
Yelwe color urine as safron Cooxt ut crocus orientalis.
lite yelwe color of urine ut crocus occidental.
Rede color of urine ut flamina ignis.
lite rede color of urine as the flame of fuir remisse.
Thes fowre tokene excesse of digestion.

urines are defined in seven interior circular labels which are connected with the various urinals by coloured lines.[1] In MS. Ashmole 1481 there is also a fourteenth-century figure of a urine-ring, but it is apparently unfinished for the flasks have not been painted in it.



URINE RING. XV CENTURY.
MS. Digby 29, f. 130.

Inscription on Urine ring:

{Subcitrinus color ut pomi citrini as ye color of an appyl not ripe.
Citrinus color ut pomi citrini as ye color of an appyl su ripe.
Thes tho token mediate digestion.

{Wyte color urine as Wel Water.
Yelwe of urine as chynyng horne.
urine colorid as way of mylke.
Carops color urine as the skyn of a camoile.
Thes fowre token indigestion.

{Sub-pallidus color as ye color of flesch half i-sode
pallidus color as ye color of flesch sode ful not remisse.
Thes tho tokene begynnyng of dygestion.

[1] A similar device is carried out in a French MS., *Codex Brux. No.* 5876, f. 154 v, described by Pergens in *Archiv. Gesch. Med.* for April 1908.

In a rather later example, the twenty urinals may be arranged radially, mouths outward (MS. Leipzig, 1192), and there are eight (instead of seven) indication labels within the circle of urinals.[1]

A special arrangement in three circular diagrams is found in an English Treatise, *To knaw the state of man and woman be thare water*, of the fifteenth century. MS. Digby 29, f. 125 et seq. This treatise is followed by a *Judicia urinarum secundum Egidium.*

In several of the fifteenth-century manuscripts the urinals with variously coloured contents are drawn upright, one or more on a page. They may be drawn in the margin as in MS. Digby 29 (XV cent.) f. 76, &c., or in the text, as in the *Book of Urinals and Medicines*, fifteenth-century MS. Ashmole 1447, pp. 165–85, or in groups of four, as in the fifteenth-century English manuscript, MS. Ashmole 1393, f. 62^{v}, which begins 'A leche yt schalle see waters ye first tyme he most loke yt ye urynal be clene'. MS. Ashmole 1413 (XV cent.) contains *An exposition of the urines in order*, with roughly scribbled and coloured urinals. MS. Ashmole 1498 is nicely rubricated, but contains no figures.

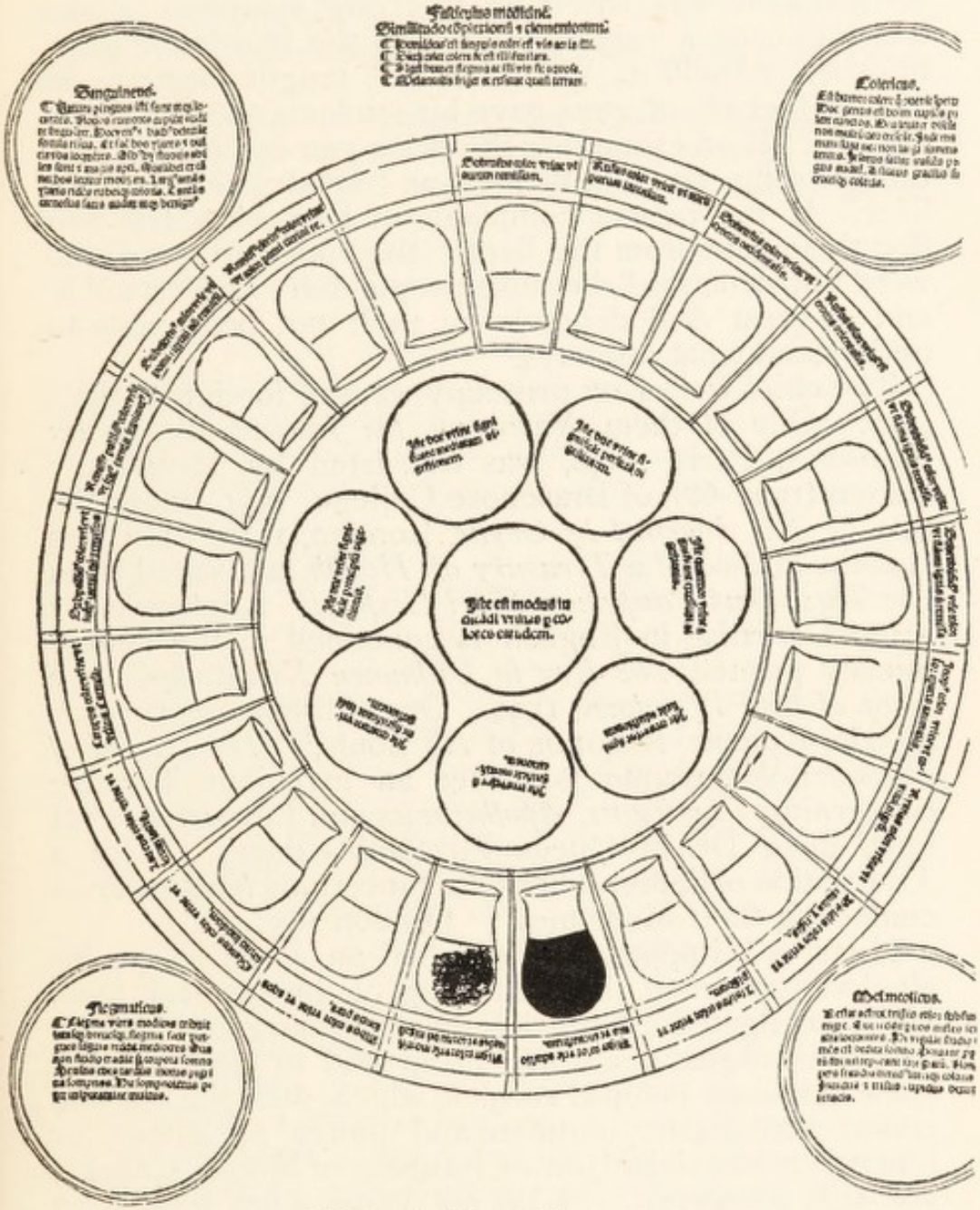
We are not aware of any English printed book in which the Urine-ring appeared, but it figured in the first edition of Dr. John de Ketham's *Fasciculus Medicinae*, printed at Venice in 1491. This book contains a diagram of twenty-one urinals grouped radially in a ring with mouths to the centre. Their purpose is explained by the central inscription, *Iste est modus indicandi urinas per colores earundem.* At the four corners are defined the characteristics of the four temperaments.

One of the first works on the subject by an Englishman was the *Urocrisiae* by Henry Daniel, a Dominican, written in 1379 (MS. Ashmole 1404). And this was followed in Oxford by *The speculation of urynns*, by H. Hare of Christ Church (MS. Ashmole 1405). Richard Napier (1608–76) (MS. Ashmole 1414), Simon Forman, and all the astro-physicians dabbled in Uroscopy.

After following the direction given above as to cleanliness, the uroscopist would hold the glass up to the light and carefully scrutinize the contents. 'If you want to know what is the matter with a man the colour of his urine will tell you. If it be red and thick, it means that he is a *sanguinicus*, that his blood is strong and that his body has a good colour. If the urine be thin and red, it

[1] Sudhoff, *Tradition und Natur beobachtung*. Leipzig, 1907.

means that the man is a *cholericus*; and that he has too much blood and too little moisture. He must necessarily



KETHAM'S URINE RING, 1491.

be in a state of chronic anger, for the gall burns so strongly inside him that the moisture cannot withstand it.' According to Recorde, urines might vary greatly in

colour from claret red and crimson to purple, green, popinjay green, blew, ash-colour, and black.

It not unfrequently came to pass that a whole course of treatment was based on this one symptom alone, which opened a very wide door to the fraudulent practitioner. Arnold de Villanova, who taught medicine at Montpellier about 1300, gave his students the following advice. 'If on examining the urine you cannot find anything wrong, say that there is an "Obstruction" of the liver. If the patient complains of headaches, tell him that they come from the liver. But take care to use the word "obstruction", because people don't understand it, and a great deal depends on their not being able to understand what one says.'

The chief works on uroscopy were of foreign authorship. One of them, Vassaeus, *De Judiciis Urinarum Tractatus*, Paris, 1548, was translated by HUMPHREY LLOYD (1527–68), of Brasenose College, 1551, under the title of *The Ivgemēt of Oryne*, London, 1553. He was also the author of a *Treasury of Health*, translated from the *Thesaurus Pauperum Petri Hispani*. Another early printed treatise in English is contained in the anonymously printed *The Key to Unknown Knowledge, or a Shop of Five Windows*, 1599. One of the last works was by Dr. ROBERT RECORDE of All Souls,[1] '*The Urinal of Physick*: Whereunto is added an ingenious Treatise concerning *Physicians, Apothecaries* and *Chyrurgians* set forth by a Dr. in Queen Elizabeth's dayes. With a Translation of Papius Ahalsossa concerning Apothecaries confecting their Medicines'. London 1651.

Henry VIII appears to have had an attentive eye for all that concerned the well-being of the medical man. He promulgated Statutes relating to surgeons during five of his regnal years and he is said to have devised some elaborate medical recipes, which, with the not less complicated plaster, ointment and 'pultes' prescribed for him by his physician JOHN CHAMBRE, of Merton College, are still preserved.[2] I do not know what fees John Chambre received, but his servant was given 13*s.* 4*d.* regularly every New Year's Day from 1529 to 1541.[3]

[1] See vol. i. facing p. 189 and vol. ii. p. 70. [2] MS. Sloane, 1047.
[3] Account for Payments by Henry VIII to Physicians, etc., in the Record Office.

The Statutes of Henry VIII relating to surgeons are :

3 H. VIII. 11 requiring examination and licensing and forbidding unlicenst folk to practise.

5 H. VIII. 6 discharging surgeons from duty as Constables, etc.

22 H. VIII. 13 alien surgeons not to be handicraftsmen.

32 H. VIII. 40 empowering physicians to practise surgery.

32 H. VIII. 42 An acte concernyng Barbours and Surgeons to be of one company.

34 and 5 H. VIII. 8 unlicensed folk empowered to treat simple diseases without penalty under 3 H. VIII.

The last act but one was the most important, for it united the fraternity of Surgeons with the Company of Barbers and so formed the United Company of Barbers and Surgeons which lasted until it was dissolved in 1745. Holbein's picture in the Barbers Hall commemorates the event.

The first two names of the six physicians specially mentioned in the letters patent of Henry VIII dated 23 September 1518 for the foundation of the Royal College of Physicians were those of the King's Physicians, John Chambre, M.D., Fellow of Merton and Warden 1525, and Thomas Linacre, M.D., Fellow of All Souls 1484. Both had studied and had graduated at Padua : both held positions in the Church.

Thomas Linacre (1460–1524), Fellow of All Souls, must be regarded as the principal transmitter of the spirit of the Italian renaissance into England. He had the good fortune to accompany an embassy sent by Henry VII to the court of Rome. At Florence he attracted the attention of the illustrious patron of Italian literature, Lorenzo the Magnificent, who permitted him to attend the lessons of Politian, the teacher of Lorenzo's own children. Linacre also began the study of Greek under Demetrius Chalcondyles, the editor of the great edition of Homer, published in 1488. At Rome he put his newly acquired learning to immediate use by reading Aristotle and Galen in the originals—he is said to have been the first Englishman to do so. He studied medicine and natural philosophy under Hermolaus Barbarus, who had found him in the Vatican reading Plato's *Phaedo* in the original Greek and introduced him to the work of

Dioscorides. He also visited Venice and Padua, where he graduated M.D.

On returning to Oxford Linacre gave temporary, or 'Shaggling', lectures on physic, and taught the Greek language, Sir Thomas More of Canterbury College being one of his pupils. But his reputation stood too high to permit of a continuance at Oxford. He was called to court by Henry VII, and was entrusted with the care both of the health and of the education of Prince Arthur (1501); and in the next reign he succeeded to the position, even more responsible and honourable, of guardian of the King's (Henry VIII) health, with a salary of £50 a year.

But the greatest public service of all those rendered by Linacre to medicine and to the cause of suffering humanity, was the use of his influence to secure the foundation of the Royal College of Physicians in London. He had beheld with concern the great evils which resulted from the treatment meted out to patients by quacks and empirics, who were often illiterate monks, licensed by bishops, themselves without medical experience. Through his interest with Cardinal Wolsey, Linacre obtained a charter from Henry VIII, dated 1518, constituting a corporate body of approved physicians, in whom should reside the sole privilege of admitting persons to practise as physicians within the city and a circuit of seven miles round it.

The need was rehearsed in the charter.

> Before this period, a great multitude of ignorant persons, of whom the greater part had no insight into physic, nor in any other kind of learning; some could not even read the letter on the book, so far forth, that common artificers, as smiths, weavers and women, boldly and accustomably took upon them great cures, to the high displeasure of God, great infamy of the faculty, and the grievous hurt, damage and destruction of many of the King's liege people.

Linacre was elected the first president, and continued in that office during the seven remaining years of his life. The meetings were held in his private house in Knight Rider Street, which he bequeathed to the College at his death. He carefully supervised the granting of licences to practise medicine. Among his learned friends were

numbered Latimer, Melancthon, Tunstal, Lily, Sir Thomas More, and Erasmus. With the last-named he was on intimate terms, and some of their correspondence is still extant. In a letter written in 1506 from Paris, after a chill caught whilst crossing the Channel, Erasmus, having enumerated his troubles, laments: 'No Linacre is at hand, who might free me by his art.' Linacre's most notable contribution to literature was a translation of Galen's *Methodus Medendi*. Erasmus, sending a copy to a friend, wrote, 'I present you with the works of Galen, now, by the help of Linacre, speaking better Latin than they ever before spoke Greek.'

His last act was the founding of the three lectureships that bear his name, two at Oxford and one at Cambridge. In assigning the two Oxford medical lectureships to Merton College, Bishop Tunstal, Linacre's executor, was influenced by the belief that 'there were more physicians in that house than in any other in the University'.[1] The lecturers were obliged to expound Hippocrates and Galen. The Cambridge lecturer had to explain the treatises of Galen *De Sanitate Tuenda* and the *Methodus Medendi*, as translated by Linacre. No doubt the lecturers kept to the strict letter of their obligation: certainly at the end of the seventeenth century their instruction was still limited to the exposition of the teaching of the two great masters, and to lectures every Tuesday and Friday morning during Term. The first person to benefit by the Linacre endowment was THOMAS MOSCROFFE or MUSGRAVE, who was officially styled the first Wolsey lecturer. One of Moscroff's official duties was to act on occasion as commissary for the Chancellor, in whom was vested the power of electing and admitting all apothecaries. The case of one David Styles in 1526 has been quoted on page 8.

A few years later we find two persons delivering Shagglyng lectures on medicine, and finally, in 1536,[2] Henry VIII appointed JOHN WARNER, Warden of All Souls, to be the first of a long line of distinguished Regius Professors of Physic. It does not appear, however, that any royal endowment was attached to the regius chair of medicine until the reign of James I, who gave it the mastership of the Ewelme Almshouse, and

[1] Wood, *Annals*, i, p. 863.

[2] *D.N.B.* gives 1544.

thus became the real and substantial founder of the Regius Professorship of Medicine. But the Regius Professor was granted special powers of examination, and for an exceedingly good reason:

'because divers Scholars upon a foresight of the ruin of the Clergy, had and did now betake themselves to Physick, who as yet raw and inexpert would adventure to practise, to the utter undoing of many, they the said visitors ordered therefore, that none should practise or exercise that faculty unless he had been examined by the Physick professor concerning his knowledge therein.
Which order being of great moment, was the year following confirmed by the King, and power by him granted to the Professor and successors to examine those who were to practise according to the Visitor's order.' 1535.[1]

In the meantime the Linacre endowment was used to pay a Superior and an Inferior Lecturer in Merton College. Their instruction was given in the refectory, and was open to members of the University. The roll of Lecturers, commencing in 1558 with Robert Barnes, is printed as Appendix F. When we remember the high distinction of the Founders, of whom Erasmus wrote, 'If it happened that I had Linacre or Tonstall for a teacher, I should not long for Italy', or the pious hopes with which these Lectureships were founded, it is sad to think of their subsequent history. The pristine dignity of the Lectureships was not destined to be maintained. There was serious misapplication and abuse of the funds, the appropriation of which had been so specifically prescribed. And the appointments gradually sank to the position of college lectureships, and ultimately sinecures held by Fellows, till the splendid revival of the foundation in the present Linacre Professorship of Human and Comparative Anatomy.[2]

Among Oxford physicians who rose to eminence during the first half of the sixteenth century special note must be taken of three eminent educationalists:

Edward Wotton (1492–1555), Fellow of Magdalen, famous as the author of the first Zoology for medical students, will be again noticed below, p. 157.

Thomas Phaer (1510–60), of Oxford and Lincoln's Inn, was the first Englishman to help his countrymen to under-

[1] Wood, *Hist.* 1796, ii, p. 62; Reg. 1, fol. 1.
[2] Payne, quoted by Osler.

stand medical science, as well as Virgil's works, in their own language. His medical treatise, *The Regiment of Life*, a version of the classical textbook of Salerno, became very popular: an enlarged edition was printed in 1596

The achievements of ROBERT RECORDE, of All Souls College, *c.* 1530–50, have already been described (vol. i, p. 99, vol. ii, p. 175). His *Urinal of Physick* had a great influence in the sixteenth and seventeenth centuries.

The following Oxford men are mentioned in Munk's *Roll of the Royal College of Physicians* in the sixteenth century:

ROBERT HUICKE, Merton, M.D. 1538.
GEORGE OWEN, Merton, M.D. 1527.
THOMAS HUYS, Merton, 1548.
ALBAN HYLL, M.D., F.R.C.P. 1552.
RICHARD MASTER, All Souls, M.D. 1554.
JOHN HOWELL, All Souls, M.D. 1555.
JOHN SYMINGS, M.D. 1554.
GILES WALE, M.B. 1555.
JAMES GOOD, New Coll., M.D. 1560.
RICHARD CALDWELL, B.N.C., M.D. 1554.
THOMAS FRANCIS, Ch. Ch., M.D. 1554.
JOHN GEYNES, M.D. 1535.
JOHN WARNER, All Souls, M.D. 1535.
SIMON LUDFORD, London apothecary, M.D. 1560.
EDWARD ATSLOWE, New Coll., M.D. 1554.
RICHARD SMITH, M.D.
ROGER GIFFARD, Merton and All S., M.D. 1566.
HENRY WOTTON, Ch. Ch., M.D. 1567.
RICHARD FORSTER, All Souls, M.D. 1573.
Ephemerides Meteorologicae ad annum 1575 *secundum positum Finitoris Londoni.* 8vo. London, 1575.
THOMAS JEESOP, Merton, M.D. 1569.
ROGER MARBECK, Ch. Ch. and Oriel, M.D. 1573.
MS.—*Brief and true Discourse of the late honorable Voyage into Spaine; and of the wynning, sacking and burning of the famous Towne of Cadiz there*—In the British Museum.
CHRISTOPHER JOHNSON, New Coll. 1571.
Counsel against the Plague, or any other infectious disease. 8vo. Lond. 1577.
RICHARD DEW, Oxoniensis, *c.* 1582.
THOMAS HALL, Broadgates, M.D. 1581.
CHRISTOPHER ATKINSON, M.D. 1585.
HENRY ATKINS, M.D. 1586.
THOS. D'OYLIE, Fellow of Magdalen, M.D. 1571.
J. OSBOURNE, M.D. 1588.
HIPPOCRATES D'OTTHEN, *c.* 1589.
JOHN NOWELL.
SIR W. PADDY, St. John's, 1591.
WILLIAM DUNNE, Exeter, M.D. 1582.
WILLIAM CLARKSON, Broadgates and St. John's, M.D. 1590.

JOHN BANISTER, M.B. 1573.
A needful, new, and necessary Treatise of Chirurgerie . . . cure of Ulcers. 8vo. Lond. 1575.
The History of Man, sucked from the Sap of the most approved Anatomists. fol. Lond. 1578.
Compendious Chirurgery. 12mo. Lond. 1585.
Antidotary Chirurgical. 8vo. Lond. 1589 and 4to 1633.
STEPHEN BREDWELL, 1594.
Helps for Suddain Accidents endangering Life. 8vo. Lond. 1633.
Physick for the Sicknesse commonly called the Plague. 4to. Lond. 1636.
THOMAS TWINE, C.C.C., M.B. 1598.
New Counsel against the Plague. Translated from P. Drouet.
Physick against Fortune. Translated from F. Petrark. 8vo. Lond. 1579.
RAPHAEL THORIUS.
EDWARD JORDAN, Hart Hall, M.D. 1591.
A briefe Discourse of . . . the Suffocation of the Mother . . . 4to. Lond. 1603.
A Discourse of Natural Baths and Mineral Waters. 4to. Lond. 1631.
JOHN GIFFARD, New, M.D. 1598.
MATTHEW GWINNE, St. John's, M.D. 1593.
Vertumnus. 1607.
A Book of Travels, and other works.
THOMAS HEARNE, B.N.C., *c.* 1600.
SIR MATTHEW LISTER, Oriel, *c.* 1605

In the thirty years from 1571 to 1600 less than fifty medical degrees are recorded, thirty-five licenses in medicine and only one in surgery.[1]

An otherwise unknown physician, NICHOLAS GIBBARDE (*c.* 1541–1608) of Magdalen College, has again been recalled to memory through his library of carefully chosen books, which he bequeathed to his college in these terms, 'all the rewe of bookes begininge from Hippocrates and Goollen to the ende of the shelfe in my upper studie against St. Maries, my notebooks and writings excepted, to Magdalen Colledge conditionallie that they be good unto my wif and childe in performinge of the coppiehould over against Magdalen Colledge.' After being scattered for many years, his row of books has once more been brought together on the shelves of the Magdalen library, and it represents to us, more nearly than any other, the working library of an Oxford physician of the days of Queen Elizabeth. Gibbarde's medical practice does not seem to have been very lucrative—perhaps it was based too much on book-learning—but, being also of a practical turn, he was

[1] Clark *Reg.* ii. 411, quoted from Mallet *Oxford* ii. 133.

able to eke it out by 'wasching honestlie all linnine as perteyneth to the church of the College' and to act as master of the Almshouse. From this he derived an income of £4 13*s.* 4*d.* a year.[1]

Better known was THOMAS COGAN, M.B. 1574, of Oriel College, who wrote about the Plague, and provided several generations of Oxford men with a text-book on Health.[2]

John Warner was followed in the Physick Chair by THOMAS FRANCIS in 1554, WALTER BAYLEY in 1561, ANTHONY AYLEWORTH in 1582, BARTHOLOMEW WARNER in 1597, and THOMAS CLAYTON in 1611. Of these the first three were all physicians to Queen Elizabeth, Dr. Bayley, of Winchester and New College, being the best known. He was the author of three small works, privately printed, which he appears to have given away as presents to his friends. *A briefe Treatise touching the preseruation of the eie sight*, 1586, begins with a consideration of things affecting the sight: 'Southerne wyndes doe hurt the sight; so do low rooms, places full of dust and smokie are noysome. Meates are best which are easie to be digested and which do not stay long in the stomache; amongest such a young henne is greatly commended; so is partridge and pheasant.' He advocates the use of a drink made with *eiebright* or *euphragia* used in beere, in ale or meade or wine rather than in water. In some cases fenill seeds may be added with advantage. When distilled water is prescribed, Bayley wishes 'the same to be artificially done in stillatories of glasse, that the qualities of the herbes may remain in the distilled waters; and therefore I do not allow of the common manner of distilling in stillatories of leade, by the which the waterie parts onlie are drawne'.

In the next year appeared *A Briefe Discours of certain Bathes of medicinall waters in the Countie of Warwicke neer unto a village called Newnam Regis*, 1587; and in 1588 *A Short Discourse of the Three Kindes of Peppers in common Use*. The three medicines made from the three peppers were: *Diatrion pipereon*, which 'hath facultie to

[1] *The Row of Books of Nicholas Gibbard of Oxford.* Annals of Medical History, 1921, iii, p. 324.

[2] *A Preservation from the Pestilence with a short censure of the late sickness at Oxford*, 1575. *The Haven of Health*, 1586, 2nd edit. 1596, repr. 1605, 1636. Smout, the carrier, was indebted to him for 13*s.* in 1594. Clark, *Reg. Univ. Oxon.* i. 317.

warm the stomach', *Diaspoliticon*, which 'keepeth the belly loose', and *Diacalaminthe*, which 'having more subtletie in substance doth penetrate further'. He adds a note that 'although he has never seen a pepper tree living, yet, 'I have often seene at Poole in Dorsetshire and also in London, the whole clusters of pepper preserved in brine and in salt: these clusters are long and thin and not so thicke together as the cluster of grapes'.[1]

During Bayley's tenure of the Professorship a further important statute was enacted in 1565. Under it 'a student in physick was not obliged to proceed to Master of Arts in order to acquire the degree of batchelor of physick, but he was to attend the publick lectures in that faculty for six or seven years for the said degree'. At a later period, after the student had taken a bachelor's degree, 'he is to wait four years for a doctor's degree, and to read either six solemn lectures from one o'clock till two each day, on any part of Galen's works at pleasure, or three cursory lectures, by expounding some one of Galen's books'.

'Every doctor of physick after his admission is allowed to practice in all kinds of physick, but no other is suffered to practice thus in Oxford unless he be a Master of Arts and taken a batchelor's degree and be admitted by the congregation to practice.'

'No one is allowed to practice surgery within the university without the Chancellor or Vice Chancellor's licence first obtained, and if anyone shall presume contrary he shall be punished as a disturber of the peace. A student in surgery is admitted to practice throughout England, if he has been exercent therein for seven years, and has gone through two operations in Anatomy, and performed three cures at the least, and be also approved of under the hand-writing of the King's professor of physick and of one doctor in the same faculty, or of any three doctors of physick residing within the university, and then his grace on supplication is granted with a condition, that he cures gratis four poor persons (at least) when required thereunto.'

Medical discussions were a part of the ordinary exercises of the faculty, and even served as entertainments on great occasions. For the delectation of Queen Eliza-

[1] D'Arcy Power, *Dr. W. Bayley and his works*, Medico-Chirurgical Trans. XC. pp. 415-49.

beth such a disputation in Physick was arranged in St. Mary's on Thursday, September 5, 1566. The performance lasted 'from two of the clock or thereabouts untill seaven, before the Queen's Majesty; who gave very attent care unto them and tarryed till the full end thereof'.

The questions in physick were:

1. Vita potest prorogari arte medica.
2. Cibi tardæ concoctionis præferendi sunt cibis facilioris concoctionis.

In the which questions

Dr. Huicke	Dr. Barnes	were ready to oppose
Dr. Bayliie, Senr.	Dr. Slethurst	but for lacke of time
,, ,, Jun.	Dr. Gifford	only the three first
Dr. Atslo.		opposed.

Dr. Francisce was Respondent. Mr. Masters was Determiner.'

On a later visit to the University city in 1592, Her Majesty was again entertained by a 'medical disputation' in St. Mary's. The record reads: 'Sept. 26th, 1592. Presently succeeded a Disputation in Physicke which was answered by one Dr. Thomas Dochin; who (after his congés as afore and a short preface concerning himself) greatly magnified Hir Majestie "for hir gratious favor in vouchsafing hir presence at this exercise, being so excellent a prince, and so singularly well seene even in this very faculty, among many other hir virtues and great excellency of knowledge and learning which he wished she might have in use of hirself." And so entered into a short exposition of one of the questions, viz.: "Quod Aere magis mutantur Corpora humana quam cibo et potu", wherein he was soon cut off by the Proctors and the Replyers called for, who were six in number, viz.: Drs. Ailesworth, Dalliber, Bust, Ratcliff, Bently, and Case.'

Bayley bequeathed a part of his library to New College, and is buried in the Chapel there. To his son-in-law, Dr. Ailworth, he left his 'skeliton of bones in Oxford' and 20 physicke books.

At Corpus the Statutes gave opportunity for a physician in residence who was probably expected to attend to the medical needs of his fellow inmates of the College. By Poynet's interpretation of the Statutes in 1551, such *medicinae deputati* were exempted from the obligation of taking Holy Orders.

List of Medicinae Deputati of Corpus Christi College.[1]

Hieronymus Raynolds	1559	John Shepheard	1673
James Tonge	1566	Phineas Ellwood	1675
John Pottle	1576	Arthur Parsons	
John Norton	1579	William Creed	1696
George Sellar	1589	Thomas Healy	1723
John Chennell[2]		John Hardress	1736
Stephen Bridges	1630	Thomas Crawley	1740
James Hyde		William Vivian	1754
Josiah Lane		George Williams	1788
Norton Bold	1661	Frederick Holme	1837
William Drury	1671		

The writings of SIMON FORMAN (1552–1611), of Magdalen College, show that he practised freely on himself as well as on others. His encyclopaedic notebooks in the Ashmolean Museum collections, MSS. Ashmole 1491 and 1494, with additions made near the end of his life, contain many recipes for the ailments, for the cure of 'wondes', for purginge, for poisons, with notes on various 'appoticarie druges' in use at the time. His graduated urine-still is figured on p. 1275 v. Perhaps the most sensational of his remedies was 'the medison I mad for my self 1610 the 12 of October, ad renovandum juventutem'.

'And it is manifest that a snake eaten the head and taille cut of and ye bowells taken outt and so boiled and eaten doth make a man yong and lustie again, for yt was seen in Sir Michaell Sandes foole. . . . And this was about Anno 1590 and he was lyvinge 1606 and S[r] Michell Sands told me this alle himselfe.

And 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 yers old & many toke me not to be above 40 or 42.'[3]

[1] Fowler, *Hist. of C.C.C.*

[2] JOHN CHENNELL M.B. (1562–1613) dwelt in a house backing on Cat Street, and acquired a garden in School Street from Philippa, widow of the apothecary John Williams.

[3] MS. Ash. 1491, f. 938. Simon Forman's treatise on the Plague is contained in MS. Ashmole 1403. *A Particular Treatise of the manner of purging the body and his partes by stoole and vomit, and by Cutting, Cauterizing giving of Chysters and boxing. Collected and written by Simon Forman, gent., student in Astronomy and Physick,* is in MS. C.C.C. 169. It contains receipts dated 1607–21. On f. 41 v. is Sir Arthur Throckmorton's Course of Physick and on

The Hon. Robert Dudley, of Christ Church (1587), is credited by Plot as the first inventor of the Pulvis Cornachinus, a mixture of Diagridium, Tartar and Diaphoretic Antimony with Cream of Tartar, the proportions varying *pro re nata*[1], a medicine of such general and excellent use, that Marcellus Cornachinus (from whom it has its name) wrote a whole treatise concerning it, commending it to the world as highly useful in all diseases whatever requiring Purgation.[2] His senior contemporary, Th. Allen (1542–1632), Fellow of Trinity 1565, was noted for his skill in mathematics and astrology; and the great number of instruments and glasses in his room made the vulgar look upon him as a magician; his servitor would tell them 'that he met the spirits coming up the stairs like bees'.

It was an age of humbug. Even a Fellow of New College, one Richard Haydock, was not above endeavouring to increase his daytime reputation as a physician by pretending to have the power of preaching in his sleep. So widespread was his reputation, that at last he was invited to 'sleep' and preach before the King. Although for some time he kept up a pretence of being asleep, his deception was eventually discovered by James I, and Haydock confessed to the error of his act. He said that having discovered in himself of a greater ability and freedom of invention, memory and speech in that mild, quiet, and silent repose of the night, than in the day, his ambition to attract public attention had led him to pretend to preach in his sleep by Revelation. He left New College in 1605 and settled in Salisbury as a successful physician. We of the twentieth century have however little cause to criticize the impostors of the sixteenth. Is not ours also an age of all manner of quack remedies? of electric belts, iron finger-rings to charm away rheumatism, mascots for man, beast, and even for machine? Instead of Christian Astrology: we have Christian Science. As Lord Bacon truly remarked, 'the weakness and credulity of men is such

f. 169 a *Letter* from J. M. of Gaiton ((?) near King's Lynn) to the noted empirick D. Francis Anthony, requesting some of his 'Aurum potabile'.

[1] Jo. Schroderi, *Pharmacop. Medico-Chym.* ii, c. 77.

[2] Plot, *The Natural History of Oxfordshire*, 1677, p. 300.

that they will often prefer a mountebank or witch before a learned physician'. And the great advances made in scientific discovery, only give the greater opportunity to the skilful quack.

Yet if we translate his flies into 'microbes', we shall find that the ideas of health and disease of ROBERT FLUDD (1547–1637) of St. John's come very near to the truth.

As an example of the curious blending of ignorance and knowledge of the time we may quote the following directions as to the use of mortars of various kinds. It shows the care that was often taken over unessentials. It is quoted from *A Doctor of Physick in Queen Elizabeth's days. A detection of some Faults in Unskilful Physitians, Ignorant & Careless Apothecaries.* London 1651.

> Of Morters likewise they ought to have divers sorts for all precious Stones, (that enter into Electuaries) and Corall, ought not to be beaten in a brasen morter, but Pearls and Corall ought to be beaten in a morter of white marble; precious stones must be made or grinded into pouder upon a stone called in Latine, *Lapis Porphirius*, which is a kind of red marble. Also Purgations, or Electuaries, Pills or powders mingled with any Syrrups ought not to be dissolved in brazen morters, but in morters of glasse, of stone, or of some fine wood; yea, and if they were of silver for great men of high degree, it were best. Also some Ointments ought to be made in morters of lead. (p. 161.)

A schedule of the cost of drugs in 1608 is contained in MS. Ashmole 1432.

The 'Harley Street' of sixteenth- and seventeenth-century Oxford lay round about All Souls. There Dr. TH. DOCHEN had the lease of a house 'abutting to the back syde of All Soulen College and the highe streete' in 1602, and he was succeeded by Dr. EDWARD LAPWORTH in 1610. Both were Linacre Lecturers.

With the end of the sixteenth century and of Elizabethan England we reach the close of the great period of preparation, the period of the Renaissance, which, beginning with the infusion of Greek culture, with an acquaintance with the world of science as known by the ancients, ended with the popularization of practical science that was the necessary prelude to the successful cult of pure science for its own sake which characterized the Carolinian Period that we are about to enter.

II

MEDICINE IN THE SEVENTEENTH CENTURY AND AFTER

Oxford owes the effective foundation of her principal Medical Professorship to James I. The two lectureships which Linacre had endowed in 1524 were consolidated into one by Edward VI. It remained for James I to add a royal endowment. On March 9, 1611, Thomas Clayton was appointed Regius Professor of Medicine, and the King added to the emoluments of the chair in 1617 by annexing thereto the Mastership of the Hospital of Ewelme, for the Professor's better sustentation, even though he be a mere layman and have not taken orders. Also, the King allocated the Canonry of Shipton in the cathedral church of Salisbury for the maintenance of the stipend. Clayton married a daughter of Dr. Bartholomew Warner, his predecessor in the medical lectureship, and in 1623 he received a further augmentation from the Tomlins fund.

It had become generally recognized that anatomy was of sufficient importance as part of the medical curriculum to merit a separate course of instruction, and so R. Tomlins of Westminster endowed an anatomical lecture; directing that a readership in anatomy should be established, tenable by the Regius Professor of Medicine, who, out of the funds left for the endowment, should employ a skilful surgeon or dissector to make public demonstrations of the human subject at certain stated times. See page 87.

An insight into the nature of the Lectures by the Regius Professor, as presented by the notes of a first year student, may be gained from the diary of John Ward who was in Oxford from 1649 until 1660, when he took orders and moved to London. In Ward's notes

there is no suggestion of Harvey's discovery of the circulation. The professor's views on the 'causes of purgatives are represented as (1) Extreme bitter as in Aloes and Colloquinta. (2) Loathsome and horrible taste as Agarick and black hellebore. (3) By secret malignity many times not appearing in the taste as Scammony and Antimony: and if anything purge which hath not one of these 2 former virtues in it, it is to be suspected for poison.

If we drink a great quantity of new milk it purgeth; that a mordication or vellitation of the orifice of the veins especially of the Mesentery veins: that almost all purges cause a kind of twitching etc.'[1]

Clayton was Regius Professor until 1665, but resigned the Anatomy Chair to his deputy, Sir Wm. Petty, in 1650. Two of his pupils rose to great distinction: Sir Thomas Browne, and Dr. George Joliffe, M.A. Oxon., M.D. Camb., the reputed discoverer of the Lymphatics, and lecturer at the College of Physicians in 1653. Another who became a physician of note in his own line was Percivall Willughby (1596–1685) of Magdalen College in 1620–21, the uncle of the eminent naturalist Francis Willughby, the friend of Ray (p. 168). He was widely known, especially in London and Derby, for his success in obstetric practice. He wrote several works but did not publish them.[2]

A less reputable personage was Sir Kenelm Digby (1603–65), of Gloucester Hall. He advertised the miraculous healing powers of a 'powder of sympathy', a preparation made of vitriol and applied to a bandage, not to the wound itself. But as he was 'the very Pliny of our age for lying' (Stubbes) and 'an arrant mountebank' (Evelyn) his assertions were not taken very seriously. He was a Roman Catholic. His methods as a beauty specialist were also open to criticism. In order to preserve her beauty, he fed his wife, Dame Venetia Stanley, a lady of 'perfect healthy constitution', on

[1] D'Arcy Power, *An address on the Rev. John Ward and his Diary*. Trans. Med. Soc., London 1917, vol. 40, p. 11.

[2] According to the *D.N.B.* a quarto, *De Puerperio Tractatus*, by him is in the British Museum. Sloane MS. 529 and other works are in private hands. One, *The Countrey Midwife's Opusculum, or Vademecum*, was privately printed in 1863.

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'.[1]

The general trend of medicine at this time was towards the acquisition of a habit of exact observation. As an example we may cite one of Clayton's contemporaries, who practised in London. Sir Theodore Turquet de Mayerne was a Court physician, who made use of his opportunities to leave detailed notes on the cases of his royal patients. He recorded observations of the fatal illness of Prince Henry, and made a complete study of the state of health of James I in 1623.[2] His 'Notes' have compelled the admiration even of the specialists of the present day.

But in the judgement of posterity the chief light of his age was WILLIAM HARVEY.

Harvey, born at Folkestone on April 1, 1578, was educated at Canterbury, and at Caius College, Cambridge, to which he was admitted on May 31, 1593, and under Fabricius at Padua where he graduated at the age of twenty-four years in 1602. In 1615 he was appointed Lumleian Lecturer in anatomy and surgery at the College of Physicians, and delivered those lectures in which he first promulgated his demonstration of the circulation of the blood, a doctrine that was not published before 1628, in a work[3] which he dedicated to Charles I.

It was his attachment to Charles I that brought Harvey to Oxford. On October 23, 1642, the Prince (afterwards Charles II) and the Duke of York were left in the charge of the doctor at Edgehill. During the fighting, Harvey withdrew with the young princes under a hedge, and began reading a book, when a cannon-ball came near enough to suggest a prudent withdrawal.

At Oxford, in spite of the distractions of the Court and the overcrowding of the city by Royalists, Harvey made opportunities for scientific work. He was still

[1] See vol. i, p. 38.
[2] Moore, *Medicine in the British Islands.*
[3] Harvey, *Treatise on the Motion of the Heart and Blood.*

fretting over the loss of valuable notes on his experiments, destroyed when his lodgings at Whitehall were plundered, and wished to continue his researches. He was incorporated Doctor of Physic on December 7, 1642, and in 1645 was made, by the king's mandate, Warden of Merton College, in the room of Dr. Nathaniel Brent, who had temporarily left the University. Harvey would thus have been one of the importations from Cambridge whom Wood described, with Wallis, Seth Ward, and Dr. Wilkins, as 'the dregs of the neighbour University', commonly called 'Seekers'. He makes fun of their mortified countenances, puling voices, and eyes lifted up; their short hair, commonly called 'the committee cut', and shabby attire, making them look more like antiquated schoolboys than academicians. Harvey's friends included George Bathurst of Trinity, whose collaboration in embryological studies on the chick are mentioned elsewhere, Dr. Charles Scarborough, and Dr. George Ent.[1] Scarborough was a young physician who was inclined to neglect his medical studies for the more seductive profession of arms, a training which did not commend itself to Harvey. To check this military enthusiasm, Harvey advised the young doctor to come and share his lodgings, saying, 'Prithee, leave off thy gunning, and stay here; I will bring thee into practice'. And sure enough he did. Scarborough attained sufficient distinction in his after career to be knighted by Charles II.

In 1646, after the king's escape from Oxford, Harvey returned to London and lived at Cockaine House in Broad St. with his brother Eliab, probably until 1649, when he is believed to have visited Italy with his Cambridge friend Dr. George Ent, to whom two years later we owe the publication of Harvey's *Exercitations on the Generation of Animals.*

Harvey was becoming a recluse. As do some anchorites he would retire into a cave and meditate. The political struggles had affected him profoundly. 'When the state is so agitated with storm . . . were not my mind solaced by my studies and the recollection of the observations I have formerly made, there is nothing which should

[1] Sir George Ent, 1604-89, was the author of *Opera omnia Medico-Physica.* Leyden, 1687.

make me desirous of a longer continuance.' In the course of conversation Dr. Ent, finding that Harvey had still some unpublished papers, asked to see them, and after 'some modest altercations' obtained permission either to publish them immediately or to suppress them 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 on Generation, part of which was connected with Harvey's Oxford period.

At Oxford 'Under Dr. Clayton were fostered, in an inquiring age of faery and imaginative Baconianism, the medical studies of that last of the great nurslings of Broadgates and first of the eminent sons of Pembroke, Sir THOMAS BROWNE . . . "the cardinal example of the thought and manner of the time", uniting in an extraordinary degree fantastic speculation with scientific research. . . .'

The celebrated author of the *Religio Medici,* Sir T. Browne (1605–82), received his early education at Winchester, and came up to Oxford as a gentleman commoner to Broadgates Hall (Pembroke College) in 1623. After taking his M.A. in 1629 he read medicine as a pupil of Clayton, and also began to practise his profession for a short time in Oxfordshire. His 'wander-jahre' were spent in Ireland, France, Italy, and Holland. He attended the medical courses at Montpellier and Padua, and was created a Doctor of Physic at Leyden, returning to London about the year 1634. He is supposed to have written the *Religio Medici* in the following year.

In 1636 he settled at Norwich, where he soon acquired a large general practice and threw himself into those literary labours and that assiduous pursuit of knowledge which, rather than any great contribution to the advancement of his science, have made his name famous all over the world. He was proud of the standing of his profession which in a quaint literary conceit he describes as of the highest antiquity, since its first operation was performed in that far distant dawn of history when, by the physician's art, Adam was thrown into a deep sleep and

surgery attained its first triumph in the extraction of his rib.[1]

He was incorporated M.D. from Padua in 1637, received the honour of knighthood from Charles II on the occasion of a royal visit to Norwich in 1671, and died October 19, 1682.

The work of NATHANAEL HIGHMORE, 1613-84, will be appropriately entered in the section on anatomy, p. 93, but as a successful physician educated at Trinity College, he must be mentioned here as the author in 1651 of a somewhat slight work on the cure of wounds by sympathy, and of a more important work on Hysteria,[2] which was thoughtfully studied by John Ward of Christ Church. Ward having read that sneezing brings a paroxysm to an end asks 'whether itt is not very proper to cause histerical women to sneeze by putting up Orange pill [= peel] into their noses or some other way'. Highmore's work led to a controversy with Dr. Willis, who 'used with histerical women this method:—first vomited ym; next gaue ym pills and cured several'.[3]

Dr. CHRISTOPHER MERRET, 1614-95, of Gloucester Hall, was nominated by his friend Harvey to be first librarian of the College of Physicians. After the great fire he was retired from his appointment as it was felt that he had not done all in his power to save the books, and also that he had gone away into the country during the plague leaving the treasure chest of the College to be looted. His chief interests seem to have been botanical, but he also left writings which enable one to form a good idea of the status of medical men in his day.[4]

[1] 'For though physick may plead high, from that medical act of God, in casting so deep a sleep upon our first parent, and chirurgery find its whole art in that one passage concerning the rib of Adam.' *Garden of Cyrus.*

[2] Highmore, *Exercitationes duae: quarum prior de Passione Hysterica; altera de Affectione Hypochondriaca.* 12mo., Oxford, 1660.

[3] D'Arcy Power, *The Rev. John Ward and Medicine.* Trans. Med. Soc., London 1920. Vol. 43, p. 256.

[4] C. Merret, *Short View of Frauds and Abuses committed by Apothecaries and of the only Remedy thereof by Physicians making their own Medicine.* 1699.

The accomplisht Physician, the Honest Apothecary and the Skilful Chyrurgeon detecting their necessary connexion and dependence on each other. 1670.

Some observations concerning the Ordering of Urines. 1682.

Several speculative works on the causes of disease issued from the pen of WALTER CHARLETON, 1619–1707, a young doctor of Magdalen Hall, who published a general physiology entitled *Oeconomia animalis* in 1659. Charleton believed that calculi were formed by a definite stone-forming spirit,[1] and held other equally weird theories.[2] He became physician in ordinary to the king.

A contemporary Oxford practitioner of note was HENRY SAYER or SAWYER, M.B. 1642, Clerk of Magdalen College, who is mentioned both by Ward and by Plot.

Ward records that it was Sayer's practise 'to give vomits with admirable success to his patients; so he did in a young dropsie, and severall others and yn a sweat; in ye plague and yn malignant disease which reigned here in ye king's time and he judges itt best now in this straunge kind of feavour'. [Nov. ?, 1660.]

'The famous physician Mr. Henry Sayer of Magdalene College Oxon, who commonly made use of a cinereous Earth, somewhat tending to yellow, and finely *chamletted*, that he found at the Quarries, in the gullies of the Rocks in the Parish of Heddington: with which, as I am informed by my worthy Friend Mr. *Cross* once his Apothecary, and still living, he did as frequently, and as well procure Sweats, as with any of the Foreign earths whatever.'[3]

No physician has exerted so beneficial an influence over the actual treatment of disease as THOMAS SYDENHAM (1624–89) of Magdalen Hall. He effected a real revolution in the practical application of medical knowledge by recommending physicians to follow the footsteps of nature and of experience that is gained by observation at the bedside of the patient, rather than trust in the quack-remedies of herbalists or prognostications of astrologers and mathematical physicians, whose vagaries were still the vogue. Travelling quacks occasionally got as far as Oxford. In 1626–7 J. B. de Succa set up in Allhallows churchyard; in 1639–40 Dr. John Pundeen erected his stage in St. Mary's churchyard by the dial, and in 1652 over against Bodicote's Tavern; in 1661 Dr. Vincent Lancelles, a Venetian, set up over

[1] *Spiritus Gorgonicus*, 1650.
[2] *Exercitationes pathologicae*, Lond. 1661.
[3] Plot, p. 61.

against Cobb's. 'Stupendous cures' were done by their nostrums. One of the worst of the brotherhood issued and circulated in Oxford in 1661 a printed handbill, purporting that he was a 'High Dutch Physitian' able to cure all sorts of diseases 'through God's mercy.' It ended 'The professor hereof, James Themut, is a native of Vienna in Austria, and now lodgeth at', after which is put in writing 'the S(ar)rasin in Oxford'. Wood's notes on it are, 'The vulgar apt to admire strangers. They flocked to this man and left the Universitie phisitians'.—'Feb. 1660(-1) within a mounth after this man's comming, he rann away and cozenned his patients of grat quantity of money that he had taken of them beforehand'.[1]

Sydenham's undergraduate studies were interrupted by the war. He matriculated at Oxford on May 20, 1642. At that time his college, Magdalen Hall, had become one of the most successful societies in Oxford, chiefly owing to the high reputation of the Principal, John Wilkinson, Fellow and afterwards President of Magdalen College. Sydenham's sympathies were all with the Puritans and the Parliamentary party, and led to his leaving the University as soon as it became a garrison for Charles I, which happened after the battle of Edgehill. It is in the highest degree improbable that Sydenham could have become acquainted with the great discoverer of the circulation of the blood, then in attendance on the unfortunate monarch, for while Harvey was a Royalist, Sydenham served as a Parliamentarian, ultimately becoming a captain.[2] Moreover there is no evidence that young Sydenham had shown any interest in medicine at that stage. Not before he had had some conversation with a physician who had been called in to attend on his brother, was Sydenham persuaded to return to Oxford, for the purpose of enjoying 'leisure and opportunity to pursue medical studies'. Here he set to work in real earnest. He entered as a Fellow Commoner at Wadham in 1647, and was created Bachelor of Physic on April 14, 1648, at the visitation of the University by the Earl of Pembroke.

On October 3, 1648, he was elected to a Fellowship[3] at

[1] Wood, *Life*, edit. Clark, vol. i, p. 377. [2] Cf. Payne, *Sydenham*.
[3] At All Souls Sydenham is believed to have been chamber-

All Souls College, where he became Senior Bursar, and began to suffer from the gout, on which he wrote the classic work. He pursued a post-graduate course at Montpellier and finally settled as a practitioner in Westminster. In the year 1660, when he was only thirty-six, he was seized with an exceedingly violent attack of gout, which kept him in bed for two months and by extending his personal experience conduced to the assistance of other sufferers.

'Without doubt men will suppose that either the nature of the disease I now treat of is in a manner incomprehensible, or that I, who have been troubled with it thirty-four years, am a very dull fellow, seeing my observations about it and the cure of it little answer their expectations.' With the graphic pen of one who has suffered the terrible martyrdom of this disease in his own person, he describes—'How the patient goes to bed and sleeps well till about two o'clock in the morning, when he awakes with a pain seizing his great toe, heel, calf of his leg, or ankle; it is at first gentle, increases by degrees, and resembles that of dislocated bones: towards the following night it reaches its height, accommodates itself nicely to the various forms of the bones of the instep, whose ligaments it seizes, resembling the gnawing of a dog, and becomes, at length, so exquisite, that the part affected cannot bear the weight of the clothes upon it, nor the patient suffer any one to walk hastily across the chamber. The severity of this first attack continues for twenty-four hours, when the sufferer enjoys a little ease, begins to perspire, falls asleep, and when he awakes finds the pain much abated, but the part swollen. The next day, and, perhaps, for the two or three following days, towards evening, the torture returns, but remits towards the time of cock-crow. In a few days, the other foot is destined to endure the same excruciating agony.' Sydenham goes on to enumerate the catalogue of complaints that afflict the gouty person,—'till at last he is worn out by the joint attacks of age and of the disease, and the miserable wretch is so happy as to die.'

Sydenham was admitted a Licentiate of the Royal College of Physicians on June 25, 1663, but he was never elected a Fellow.

His great chance came in 1665. Towards the close of the preceding year two or three persons had died

fellow with Dr. Thomas Millington, afterwards Sedleian Professor of Natural Philosophy and President of the College of Physicians. Sydenham resigned on marriage in 1665.

suddenly of symptoms that were soon recognized by those who remembered a former visitation to be those of the plague, but no efficient steps were taken to isolate the infected areas until the contagion had extended into several parishes and was beyond control. Sydenham treated his plague patients by copious and frequently repeated bleeding, and in a particular case where he was not successful, attributed failure to the bleeding having been insufficient. He thus repeated a treatment that had been previously found to be beneficial in cases of smallpox in Oxford. 'At New Coll. in Oxon in the yeare 1662 the small pox raged with much malignity and proved mortal to many, but it was apparent that few (if any) died who were let blood; wheras on the contrary those that were not phlebotomised, did all (or generally) decease.'[1] He remained on duty till about the middle of June 1665, when the weather had become very hot and the death roll had increased to an appalling extent, reaching 7,000 a week in September. The Court left London on June 24 and moved to Hampton Court, Salisbury, and finally to Oxford on September 25. Sydenham returned to London while the plague still continued violent and, as he modestly put it, 'by reason of scarcity of better physicians'.

In 1666 he took the opportunity of a printer[2] being still at work to bring out his *Methodus Curandi Febres*. It was published by J. Crook 'sub Signo *Navis* in Coemeterio D. Pauli', and was dedicated to Robert Boyle. It is noteworthy both on account of the description therein contained of the treatment of smallpox, and also because it contains no hint that he thought that smallpox could be transmitted by contagion. A chapter upon the great plague was added to the second edition which appeared two years later, prefaced by a Latin poem by John Locke.

Sydenham's greatest work was built up on his study of Hippocrates, but especially on his observations of

[1] H. Stubb, *Epist. discourse concerning phlebotomie*, 1671, as emended by Wood, Clark's edit. of his *Life*, i. 461. The treatment may have dated from the time of Rhazes, A.D. 923, for the Anglo-Saxon Leeches ordered, 'Against pockes; very much shall one let blood, and drink a bowlful of melted butter'.

[2] Perhaps John Bill and Christopher Barker who printed the official *Directions . . . for Cure of the Plague* in 1665.

epidemic diseases in London from 1661 to 1675, with considerations on pleurisy, pneumonia, rheumatism, and other diseases. It was the outcome of his first small work on Fevers, published under a new title in 1676, *Observationes medicae circa morborum acutorum Historiam et Curationem.* In spite of many shortcomings, the admirable descriptions of diseases and their symptoms are so complete that it will always remain one of the greatest of medical classics.

It would take too much space to summarize all Sydenham's treatments. Peruvian bark, already used by Brady and Prujean, though distrusted by him in 1666, was commonly prescribed by him ten years later, in fact he seems to have been the first to give it as a tonic, considering it 'as wholesome and innocent as the Bread that you dayly eat'.[1] Steel he used to give literally as steel filings, rather than in the form of chalybeates to 'restore the blood'. Mercury he banned even in Syphilis, but Opium was such a favourite drug with him that he was called 'Opiophilos', and his invention of liquid Laudanum was sold for a couple of centuries, and especially on the continent, as *Laudanum Sydenhami.* It replaced the solid preparation of Laudanum previously sold. Plain Water as a beverage, pure and unboiled, he regarded as dangerous, and doubtless in his day in London there was good cause for condemnation. He himself used to drink small beer from a silver tankard. He lived on the north side of Pall Mall, next door to an apothecary's shop, the 'Pestle and Mortar' kept by an ancestor of Malthus, the economist, near the bottom of the Haymarket. The rural surroundings of this quarter had their drawbacks, as appears from a story told by Charles James Fox, that as Sydenham was sitting at his open window looking on to the Mall, a thief once made off with his tankard, and escaped 'among the bushes in Bond Street'.

Here he took pupils. One, Hans Sloane, arrived with an introduction as 'a ripe scholar, a good botanist, a skilful anatomist'. Sydenham having read the letter, looked hard at the young man, and said, 'This is all very fine, but it won't do. Anatomy—Botany—Non-

[1] Letter to Major Hale, 1687. The first authenticated cure of fever by Peruvian bark was in 1638, in Peru.

sense! Sir, I know an old woman in Covent Garden who understands botany better, and as for anatomy, my butcher can dissect a joint full as well; no, young man, all this is stuff: you must go to the bedside, it is there alone you can learn disease'.[1]

Another house pupil, the notorious buccaneer and physician Dr. Dovar, did indeed 'learn disease' by the bedside. He caught the small-pox and was treated by Dr. Sydenham. But these educational methods succeeded. Dr. Dovar's name is now known all over the world as the inventor of Dover's Powder, and that of Sloane as the virtual founder of the British Museum.

The following note of Sydenham's treatment is preserved in John Ward's *Diary*.

> There was a great phlogosis in ye Duke of Cambridge his bowels. Dr. Sydenham kept ye Duke alive 3 weeks and the Dutchess thought he would really have cured him. Hee did it by some cooling water or other wch hath got him some credit. Hee was allso with Sir Richard Bishop for his gout but did little except pultisse him with milk and crumb of bread. He advised Mr. Bishop to fast one day in a week for his rheumatismus so as yt humour would spend ittself.[2]

Nevertheless, among the less well-instructed practitioners a firm belief in the power of the stars still held ground. The Astrological methods of the preceding century were too securely founded upon the truths of astronomical science to be readily overthrown, and indeed it is one of the remarkable facts of history that *pari passu* with great advances in the realm of pure science, made by the only true method of substituting facts for appearances and demonstrations for impressions (Ruskin), the doctrines of the wizards were more seriously accepted than at any other time (except perhaps at the present day in America). The work of Simon Forman, Archbishop Laud, Kenelm Digby, and Allen of the last century, was continued by Sir Jonas Moore, William Lilly, and John Booker. Of Oxford men, the 'venerable Rosicrucian', WILLIAM BACKHOUSE (1593–1662), of Christ Church 1610, became 'a great encourager

[1] J. F. Payne, *Thomas Sydenham*, 1900, p. 190.

[2] *John Ward and his Diary*, Trans. Med. Soc. London, 1917, vol. xl, p. 18.

of those that studied Chemistry and Astrology, especially Elias Ashmole, whom he adopted as his son and opened himself very freely to him the *secret* which he afterwards told him in syllables, and bequeathed it to him as a legacy'.[1] Ashmole became a Fellow of the Royal Society in 1661, the very year in which he recorded in his *Diary*, 'I took early in the morning a good dose of elixir and hung three spiders about my neck, and they drove my ague away'.

For those medical men who might distrust their skill to use astronomical instruments in reading the stars, there were books of *Tables* computed for long series of years which provided them with the positions of stars, the times of their rising and setting throughout the year. An important example of this indispensable adjunct to the equipment of a wise physician were the Astronomical Tables 'reduced to this our age' by John and Timothy Gadbury and published in 1656. The work was blessed by the astrological confraternity who described themselves as Philo-Medicus, Astro-philosopho-medicus and ἰατρόφιλος, and was dedicated 'To the Truly Noble and Most Accomplished Enciclopaedian Elias Ashmole Esquire', by the 'Reall Honourers of You and Your Incomparable Vertues John Timothy Gadbury.'

John Gadbury, 1627–1704, was born at Wheatley, near Oxford, and educated at Oxford, and recalculated the tables of 1594 of Hartgill for the period 1670–1700, and for the latitude of Oxford.

In his *POSTSCRIPT to the* Reader he remarks

READER, Thou maist wonder at our Referring the Tables foregoing to the Elevation of the University and City of *Oxford*, and not to *London*, being the Metropolis and Mother City of *England*, &c. To this we answer; first, the matter of difference is not above ten Minutes in Latitude and not above five minutes in their Meridians, which can breed no sensible variation, and againe we may tell you, that the City of *Oxford* is neerer the middle of *England* then *London* is; therefore that which is fitted for *Oxford* will better serve all *England*, then that which is fitted to the Elevation of *London*.

Secondly, *Oxford* is the *Muses* seat, and one of *Englands*

[1] Wood, *Athenae*, iii, p. 576.

Stayes; the *Sun*, the Eye, and the Soul thereof, the very source and most clear spring of good Literature and wisedome; from whence Religion, Civility, and Learning are spread most plenteously into all parts of the *Realm*. Many places in divers Coasts and Climates of the World, we read to have flourished at sundry times in the Study of divers Sciences; but the University of Oxford is found to be (for foundation) more ancient; for plurality of Sciences more generall; in profession of the Catholique truth more constant; and in the multiplicity of priviledges more excellent, then all other Schooles.

To the sounder science of ROBERT BOYLE medicine owes more than can be readily defined, so wide was his influence in securing a proper physical and chemical basis for the study of the human body in health and disease. In details we are always coming across his work in unexpected directions: for example, we wonder how many of the thousands, who have taken ammoniated quinine for influenza, have realized that they owe the ammoniacal part to Boyle? He tells us that Volatile Alkalies have been 'so prosperously made use of in Physick since the year 1656 (about "which time" as he moderately puts it) I had the good fortune to contribute so to introduce them, as to bring them by degrees into request, by divulging easy ways of making them as well as by declaring their Vertues'.[1]

Boyle rendered a real service to the more scientific study of medicine by his advocacy of the extended use of Simple medicines in lieu of the elaborate mixtures then in vogue. He truly says that if, in one Receipt 'a multitude of Ingredients are mingl'd, if not confounded, 'tis almost impossible to know with any certainty, to which of the Simples the good or bad Effect of the Remedy is to be attributed, or whether it be not produc'd by a Power, resulting from the particular Quality's of all of Them, united into one Temperament, and by its means acting conjointly, and, as the School men speak *per modum unius*.'[2]

[1] Boyle, *Nat. History of Humane Blood*, 1683, p. 206.

[2] Boyle, *Of the Reconcileableness of Specifick Medicines to the Corpuscular Philosophy. To which is annexed A Discourse about the Advantages of the Use of Simple Medicines*. Lond. 1685, p. 169: To Boyle is also attributed three little posthumously printed volumes

Among the minor medical lights of the time we may mention THOMAS TRAPHAM of Magdalen College, who published *A Discourse of the State of Health in the Island of Jamaica*, 8vo, London 1679, which was noticed in No. 141 of the *Philosophical Transactions*; DANIEL CAPELL, also of Magdalen, author of a *Tentamen medicum de Variolis*, *c.* 1660; WILLIAM COLE, 1635–1716, of Gloucester Hall, M.D. 1666, practised at Worcester, and was highly respected by Sydenham. His *De secretione Animali cogitata*, 1674, is a conjectural explanation of secretion on mechanical principles without any experimental basis. Apoplexies he attributed to the effect of cold, and dates the supposed increase in the number of such attacks to the severe winter of 1683.[1]

The praises of Dr. THOMAS WILLIS as a physician have been sung by Plot. 'The Pharmacea', he says, 'has been enriched by Willis's invention of his Spiritus Salis Armoniaci succinatus, Syrup of Sulphur, Preparation of Steel without acids, and from thence of his artificial Acidulae. In general he greatly advanced this part of Physic, that what was formerly empirical, and but lucky hits, is now become most rational, by his making the operation of Cathartic, Emetic, Diaphoretic, Cardiac, and Opiat Medicines, intelligible by Mechanical Explications; having subjoined to each most neat and artificial formulas, as well chymical as others. . . And where nature is exorbitant in any of these evacuations, he has likewise taught us how to check and reduce her; adding for the better illustration of the whole, a new Anatomy of the Stomach, Intestines, Gula, Veins and Arteries. Which he has seconded with a further discovery and rational account of Thoracic and Epatic Medicines, and of the Diseases belonging to those parts; discoursing also of Venesection, stopping of Hemorrhagies, of Issues and Cutaneous Distempers. In all which it may be observed, what is almost peculiar to him; that there is nothing trivial, most new, and all most ingenious.'

Willis was the son of Oxfordshire parents. His

of *Medicinal Experiments: or, a Collection of Choice and Safe Remedies, for the most part Simple and easily prepared: Very useful in Families and fitted for the Service of Country People.* 3rd edit., 1696–8.

[1] W. Cole, *Physico-medical Essay concerning the late Frequency of Apoplexies*, 1689.

father was a farmer who lived at Handborough, 'a retainer of St. John's College', retired to North Hinksey, and was killed in the siege of Oxford in 1646. Thomas Willis was educated at the private school of Edward Sylvester, and being connected with the family of a Canon of Christ Church, matriculated there in 1636–7. Ten years later he graduated in Medicine and set up in practice in a house opposite Merton College. His first contributions to medical learning were *Diatribae duae medico-philosophicae*, one on Fermentation, the other on Fevers, which he followed up with a *Dissertatio Epistolaris de Urinis*, 1659. His diatribes led to a reply by Meara and a defence, *Vindicatio Diatribae Willisii*, by Dr. Richard Lower and dedicated to Robert Boyle. The Willisian controversy was followed with such interest on the continent that Gerbrand Schagen, one of the enterprising publishers of Amsterdam, brought out in 1663 and 1667 an edition of all the papers which he stated on the title-page to be 'the latest, far more correct and enlarged than the others'. It is embellished with a delightful frontispiece and title, and to it is appended Sydenham's *Methodus curandi febres* 1666, and a most interesting treatise on the inheritance of diseases by Meara, entitled *Pathologia Haereditaria*.

In the *de Fermentatione*, edition of 1659, Willis adopted Vibration as the keynote to his natural philosophy. According to his view Fermentation is a decomposition brought about by communication of a vibratory motion to the particles of must, and the consequent shaking apart of their loosely combined components. When disunited these components can enter into new combinations, of which one is alcohol. Forty years later Stahl developed the theory further, and it was resuscitated by Liebig only to be finally abolished by the genius of Pasteur.

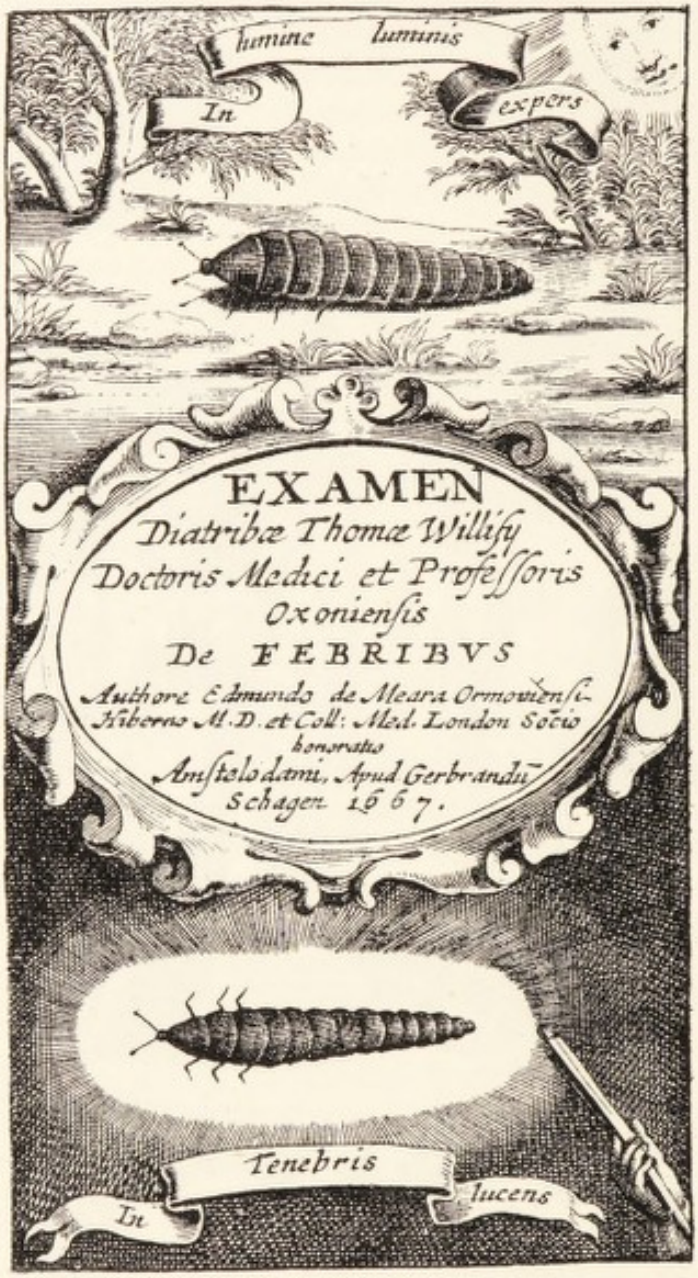
Fevers, classified as intermittent, putrid, and malignant, were supposed to be due to Fermentations in the juices. His great *Anatomy of the Brain*, appearing in 1664, was followed in three years by a *Pathology of the Brain* in which he gave an account of several mental and nervous cases, and later by a work *Affectionum quae dicuntur hystericae et hypochondriacae pathologia spasmodica*, 1670, a lengthy discussion of hysterical cases and their treat-

ment. He was a great worker and especially to be remembered as the discoverer of saccharine diabetes.

WILLIS *De Fermentatione.*
Frontispiece, 1663.

Willis's collected works were printed at Geneva in 1680, at Amsterdam in 1682, and in English form in 1681.

At this time the leading apothecaries in Oxford were Hazlewood and Crosse who made up prescriptions for



EDMUND DE MEARA'S *Examen* OF WILLIS'S *Diatribae de Febribus.* Frontispiece, 1667.

Dr. Willis, and Stephen Toone. Robert Boyle lodged with Crosse, and John Ward with Toone.

Willis was said to have made much use of a syrup of sulphur in his practice. 'Itt is his owne composition

and no Apothecarie hath itt or knowes itt but ye two forementioned. Itt may be taken and is so usually with a Liquorish stick. It is a compound not above 4*d.* an ounce, but it is most used in Colds and distempers of the Lungs.' 'Dr. Willis uses to give more [than $2\frac{1}{2}$ oz. of quicksilver]: ye more you give ye less is ye danger. Itt does by its own weight passe quickly. Doe but mix itt with a plaister and heat itt a little and presently itt flies away, but boyling hurts itt not at all.'[1] Dr. CONYERS, 1622–66, of St. John's College, gave $2\frac{1}{2}$ oz. of quicksilver to a patient with the 'Iliack passion'. 'Hee uses nothing else almost but his emetick powders.'[1] According to Munk he was one of the few doctors who remained in London during the Great Plague, and fell a sacrifice to it.

After long concentration on the brain it was natural that Willis should not lose the opportunity presented by an autopsy. He 'hath got a new way of opening ye Brains, as to cut them on all parts from what holds them and so to turn them upside down'. 'My Lady Windsor is dead: her brain was good as Dr. Willis said, but her liver was rotten and corrupt much. Dr. Willis lays much store uppon ye brain nowadays'.[1]

Among the Oxford practitioners were Dr. BATE of New College,[2] EDMUND DICKENSON[2] of Merton, physicians, and SMITH, surgeon. We learn many details about them from the pages of the diary of the Rev. John Ward of Christ Church, himself a competent physician, and, as his biographer Sir D'Arcy Power has pointed out, a man of unusual versatility at a time when the prevailing type of mind was versatile. 'In many respects he was a true disciple of the Honourable Robert Boyle; interested in medicine, he would have made a good practitioner; as a physiologist, he would have advanced the science as a friend of Lower; Willis could have utilized him, and, had he stayed a little longer at Oxford, he might have come under the spell of Mayow, the most gifted of the band.'[3]

The prescriptions they made up indicate the increas-

[1] Sir D'Arcy Power, *The Rev. John Ward and his Diary*, Trans. Med. Soc. London, 1917, vol. xl, pp. 17, 18.

[2] GEORGE BATE, 1608–69, physician both to Cromwell and to Charles II, was the author of the posthumously printed *Pharmacopoeia Bateana* 1688. DICKENSON, see note on p. 122.

[3] Sir D'Arcy Power, xliii, p. 283.

ing use of the metallic salts employed by the new school of chemical physic as opposed to the older herbalist physicians, who relied rather on plants for their remedies. Chymical Medicines were officially recommended for the Plague in 1665.

THOSE that are delighted with Chymical Medicines onely, may make use of some of these following, being honestly prepared according to the Description of the Authours, and cautiously administered.

Fourteen of these medicines, one of which was *Aurum vitae*, were enumerated in *Certain necessary Directions as well for the Cure of the Plague as for preventing the Infection with many easie Medicines of small Charge, very profitable to his Majesties Subjects.*[1] Salt of Tartar, Antimony, filings of iron and metallic mercury were all ordinarily prescribed by Dr. Willis. The iron filings were taken in *aq. Limacum composita* and *aq. Lumbricorum* (= slimy liquor of slugs and worms). His patients were duly appreciative, and Willis had 'rich peeces of plate presented him as well as great ffees'.

Several of Willis's pupils attained to high distinction, and in addition to Wren and Lower and others to be mentioned we must add JOHN LOCKE, who took a medical degree at the age of 42, and like Sydenham, continued his studies at Montpellier.

Locke's great reputation as a philosophical writer has made many people forget that he was a doctor. As my friend Dr. Payne has pointed out, he was, however, a regular physician by education and by practice, having taken the degree of M.B. on Feb. 6, 1674–5. Born in 1632, he entered Christ Church at the age of 20, and was therefore eight years junior to Sydenham. After a course at Montpellier he obtained a post as domestic physician to Lord Ashley, the first Earl of Shaftesbury, whose life he saved in 1666 when suffering from empyema.[2] Locke kept the wound open by a silver tube. Several of his prescriptions found among the Shaftesbury papers have been published,[3] and a medical item of even

[1] London, 1665.

[2] The circumstances were described by Sir W. Osler in an article in the *Oxford Magazine*, March 12, 1914.

[3] Withington, *Locke as a Medical Practitioner*, *Janus*, 1899 and 1909. There are manuscript notes on his cases in the British Museum.

greater interest is his 'Extracts of Sydenham's Physick Books, and some good letters on various Subjects' in the Bodleian Library.[1] As an example of a letter from one Oxford doctor to another, the following from Sydenham to Locke may be quoted:

'For Mr Locke,—Your age, ill habit of body, and approach of winter concurring, it comes to pass that the distemper you complaine of yields not so soone to remedies as it would doe under contrary circumstances. However you may not in the least doubt but that a steady persisting in the use of the following directions (grounded not on opinion but uninterrupted experience) will at least effect your desired cure. First therefore in order to the diverting and subduing also the ichorose matter, it will be requisitt to take your pills twice a weeke as for example every Thursday and Sunday about 4 o'clocke in the morning, constantly till you are well. In the next place for as much as there is wanting in bodyes broken with business and dispirited upon the before mentioned accounts, that stock of naturall heat which should bring the matter quickly to digestion 'twill be highly necessary that you cherish yourselfe as much as possibly you can by going to bed very early at night, even at 8 o'clocke, which next to keeping bed, that is unpracticable, will contribute more to your reliefe than can be imagined. As to diett, all meats of easy digestion and that nourish well may be allowed, provided they be not salt, sweet or spiced, and also excepting fruits, roots and such like. For wine a totall forbearance thereof if it could possibly be, and in its stead the use of very mild small beer such as our lesser houses doe afford, would as neare as I can guess be most expedient, for thereby your body would be kept coole and consequently all accidents proceeding from hott and sharpe humors grating upon the part kept off.

'This is all that I have to offer you and I have thought of it, and all circumstances relating to your case, with the same intention of mind as if my life and my son's were concerned therein. 'T. S.'

Presumed date: Autumn of 1674.

[1] MS. Rawlinson, C. 406, printed in 1845 under the title, 'Anecdota Sydenhamiana,' by Dr. Greenhill.

In his practice Locke had more respect for research in pure science, but less respect for tradition than had Sydenham. In a letter to Molyneux he wrote:

'You cannot imagine how far a little observation, carefully made by a man not tied up to *the four humours*[1]; or *sal*, *sulphur*, and *mercury*[2]; or to *acid* and *alcali*,[3] which has of late prevailed, will carry a man in the curing of diseases, though very stubborn and dangerous, and that with very little and common things, and almost no medicine at all.'

In conclusion we feel inclined to ask, Is the world any the better for Locke's Philosophical writings? It is certainly the poorer for his defection from the study of Medicine.

Dr. Richard Lower, who 'was esteemed the most noted Physician in London', had previously a distinguished career in Oxford as an anatomist and physiologist, and owing to his friendship with a patient, we are intimately acquainted with one side of his Oxford life. He was a Christ Church man who was in Anthony Wood's set of tavern companions. Readers of the *Life and Times* will remember that after Wood had 'bought me a perewige of my barber 6*s*' in Michaelmas Term 1656, he consorted with masters of music and dancing and began to spend money on sack and 'at Mr. Ellis'es'; and thereafter such entries as 'at Earles', 'at Elleses', with occasional entries 'for phisick' appear ordinarily in his weekly accounts. By July 1657 he had begun to enter the names of his associates, the first of whom was Arthur Crew, soon to be followed by Cresset of Magdalen, John Curteyne the physician, and Richard Lower of Christ Church. Sept 18, 1658, 'spent at the Taverne with Mr. Lower 1*s*' is the first entry. They rang the changes on the Castle Inn, Joneses, Harper's, Jeanses, Mat. Leeches, Webs, the Crown and others; the Meremaid, where you could get half a pint of sack for $4\frac{1}{2}d.$ was a favourite. The dates given in the footnote[4] and the

[1] The four humours = the dogma of Hippocrates and Galen.

[2] The sal, sulphur, and mercury = the practice of Paracelsus and Van Helmont.

[3] The acid and alcali = the chemical system of Sylvius and Willis.

[4] Lower visited some named tavern or coffee house in Oxford with Wood and other friends on the following dates: 1658 Sept 18;

following notes may appear trivial, but at least they illustrate the relations between an Oxford physician and one of his patients.

On July 26, 1660, Lower is addressed by his christian name of Dick by Wood, and *1s.* is spent on him at the Mermaid. On Jan 8, 1662, he prescribed pills, six of which were made up by John Fulke, apothecary, and taken by Wood, who two days after 'had an issue made in his left legg under his knee, by the advice of Richard Lower, a physitian of Ch. Ch. This he kept open for several yeares after. And tho it did his stomach good, yet by his continual standing at his study, and much walking withall, too much of the humour issued out, which alwaies after made his left legg and thigh cold, especially in the winter-time. And he now thinks that when age comes upon him it will turne to the dead palsie and be his death'.

On April 23, 1663, Lower and Wood began a course of Chemistry with Stahl at Tilliard's the apothecary, and for the next three years were constantly in one another's company. He was the chief guest at a supper given by Wood on Jan 9, 1664: for this two bullock's cheeks were baked and Mary had *6d.* for ordering the cheeks and baking. In April of 1664 'or the mounth of May Mr. R. Lower discovered the healing well at Eastrope in Northamptonshire near King's Sutton. Who shewing it to Dr. Willis afterwards, who commended the water to divers men there, it is now reported that the said Dr. Willis was the first finder therof'. Vide Dr. Lower *inter Scriptores* L. 33.

On Sundays Wood and Curteyn seemed to have made a practice of visiting Lower in his room at Christ Church, and on one occasion, on Sunday night May 15 at seven o'clock the former was detained there by 'a terrible shore of hail—some as larg as walnutes, others

1659 Feb 2, May 16, June 24, Oct 17, 28; 1660 May 1, June 30, July 26, Aug 10; 1661 July 13, Sept 5, 7; 1662 Jan 13, July 9, Aug 8, 15; 1663 Apr 13, 29, May 4, July 11, Aug 11, Sept 14, 22, Oct 9, 16, 19, 31, Nov 6, 11, 21, Dec 4, 24, 26; 1664 Jan 2, 7, 23, Feb 3, 9, 20, 27, March 3, 10, 14, 19, 26, 28, Apr 2, 12, 14, 16, 25, May 12, June 7, 15, 18, 23, Oct 9, 16, 22, 29, Nov 14, 17, 25, 26; 1665 Jan 3, 26, 30, March 12, Apr 1, 7, 10, 18, 20, 21, May 3, 12, 19, 20, 28, June 8, 11, 21, July 9, 15, 28, 29, Aug 4, 7, 8, 15, 29: 1666 Feb 24, March 1, 7, 9, 19, May 2, 27; 1667 Feb 20, 23, 25. Wood's *Life* (edit. Clark).

flat and rough like fritters as broad as half a crowne'.[1] In 1665 in Feb, Lower 'practized the transfusion of blood at Oxford'; on July 18 and August 8 Wood was mixed up in a private affair of L.'s at Garsington, and on Aug 29 the entry is 'at the Castle where we parted with Dr. Lower, 1*s*'. Obviously he went up to London at that time, but was back in Oxford in March 1666, being present on the 9th, 'when we club'd for an entertainment for Dr. L., 3*s* 1*d*.' On May 27 he sold his coat to Wood for 8*s* and thereafter but little more is heard of him in Oxford except in Feb. 1667, when again there was a farewell gathering at the Mermaid 'at Dr. L.'s departure, 1*s*', and his place as doctor to Wood was taken by John Curteyn.

1691. Letter dated Jan 15, Th., the famous Dr. Lower is at the point of death; his physitians have given him over. Jan 17, S., this morning died the famous Dr. Richard Lower (the 15th, saith Mr. Aubrey; fals). Dr. Lower hath bequeathed 1000 *li.* to St. Bartholomew's Hospitall London; 500 *li.* to the French refugees; and 500 *li.* to the Irish protestants.

He was buried in the church of St. Tudy near Bodmin. So great was his reputation as a successful physician that his name was 'impudently affixed to many nostrums sold in the shops. The print of him is suspected to be counterfeit'.[2] His original transfusion experiment (p. 131) has become a recognized operation of very great utility at the present day. He showed dropsy to be an exudation from the blood, producible by ligaturing veins, and the defluxion of a catarrhal cold to be something of the same nature and not an excretion of the brain.

Among the new methods of treatment that were invented by Oxford men in the seventeenth century, we may mention the injection of medicines into veins, due to Sir CHRISTOPHER WREN in 1679, and to the same fertile brain we owe suggestions for the better study of diseases. 'The Physicians of our ⟨Royal⟩ Society should be desir'd to give us a good account of all the epidemical diseases

[1] *An Account of the Rise and Attempts, of a Way to conveigh Liquors immediatly into the Mass of Blood.* Phil. Trans. Dec. 4, 1665.

[2] W. Huddesford quoted in Clark's *Wood*, i, p. 428.

of the year; Histories of any new disease that shall happen; Changes of the old; Difference of operations in medicine according to the weather and seasons, both inwardly, and in wounds: and to this should be added, a due consideration of the weekly and annual Bills of Mortality in *London*.'[1] Dr. LOWDHAM of Exeter, a surgeon living in Oxford in 1679, is said to have been one of the first who amputated limbs by means of flaps instead of by the circular method as was then usual. The operation is thus described by James Yonge in his *Currus Triumphalis e Terebintho*:

> Ligatures and gripe being made as usual, with catling or some long incision knife raise (suppose it the leg) a flap of membraneous flesh, covering the muscles of the calf, beginning below place where incision is to be made and raising it that way, of length enough to cover stump. Then, having done this, turn it back under the hand of the one griping, and as soon as member severed, bring this flap of cutaneous flesh over stump, and fasten it to the edges by 4 or 5 strong stitches. Then put a dossil into inferior part, that one passage may be open, for any blood, or matter may lodg between, but this seldom occurs.[2]

The Clinical Thermometer was first described in England in the Ashmolean School of Natural History at a meeting of the Oxford Philosophical Society held on May 13, 1684. It was only 3 inches long; 4 or 5 lines in diameter; and the tube containing refined mercury, was only half a line in diameter. It had been recently invented by M. du Val of Paris for showing the duration, increase, and diminution of fevers. Other medical observations which were brought to the notice of the Philosophical Society between 1683 and 1697, will be described in full in the fourth volume of this work.

But although the leading spirits of the medical profession were making unprecedented advances, they were still far from achieving unanimity in diagnosis.

In no case was this more clearly shown than in 1685,

[1] Wren, *Parentalia*, p. 223.

[2] A letter on Lowdham's flap operation, signed 'James Young' and dated from Plymouth Aug. 3, 1678, appeared in an article by Dr. W. Blair in the *London Medical Review* v, Feb. 1801. I am indebted to my friend Mr. J. F. Fulton for this reference.

when around the death-bed of Charles II, the founder of the Royal Society, fourteen Doctors consulted and confuted each other. Some, thinking they were dealing with an epilepsy, bled him freely and ordered that he should be left undisturbed, others affirmed his fit to be apoplectic, and tortured him for hours 'like an Indian at a stake', a hot iron was applied to his head and a loathesome volatile salt, extracted from human skulls, was forced into his mouth. Then, since neither treatment was effective, and even the 'arcanum Goddardianum' failed, it was settled that he was in a fever, for which he must take bark.[1] Dr. Thomas Short alone held aloof, and told the Queen that so many physicians would kill the King. But if the doctors could be in such great disagreement in the sick-room, it is not surprising that the wildest stories should have been believed by the world outside. The tales are worth reciting as evidence of the intellectual development of the general public. 'His Majesty's tongue had swelled to the size of a neat's tongue. A cake of deleterious powder had been found in his brain. There were blue spots on his breast. There were black spots on his shoulder. Something had been put into his snuff-box. Something had been put into his broth. Something had been put into his favourite dish of eggs and ambergrease. The Queen had poisoned him in a jar of dried pears.'[2]

Dr. John Radcliffe (1650-1714) was the ideal Oxford man. He came to Oxford to prepare for a professional career, he made a fortune in London in the exercise of his profession, and then left it for the lasting benefit of the University. Entering University College at the early age of 15, he took his Bachelor's degree in 1669: accepting a Fellowship at Lincoln College, he pursued the study of medicine and took the degree of M.A. 'with uncommon applause' in 1672.

While still a student it was his boast that he prepared himself for the practice of the art of healing on the recent

[1] 1695. 29 Nov. Evelyn was told by the Marquis of Normandy that the physician would not prescribe Quinquina for the King. On being asked why, 'Dr. Lover said it would spoil their practice or some such expression, and at last confessed it was a remedy fit only for kings'.

[2] Macaulay, *History of England*, i. chap. 4. See also Dr. Raymond Crawford, *The last days of Charles II*, Oxford 1909.

works of Sydenham and other modern writers to the exclusion of the 'rubbish of antiquity contained in musty volumes'. It was by independence of mind and character, by skill and conversation, rather than by book-learning, that he achieved his rapid success. Indeed the story is told of him that when Dr. Bathurst, the President of Trinity, called at his lodgings and asked to see his library, Radcliffe replied, pointing to a few phials, a skeleton, and a herbal, 'There, sir, is Radcliffe's library'. Yet, so long as exists the noble Physic Library that bears his name he will be held in grateful remembrance in Oxford.

Radcliffe's procedure when he first began to practise in the city of Oxford was so different from that adopted by Dr. Lydal, the most popular doctor in the University, that the leading apothecaries, Foulks and Adams, decried his methods. But nothing succeeds like success, and the apothecaries were soon obliged to make interest with him 'to have his prescriptions on their files'. He did not spare abuse of his antagonists, whom he loaded with opprobrious names, and derided, because of the slops, caudles, and diet drinks with which they drenched their patients. The position was finally won by his adoption of Sydenham's judicious method of treating the small-pox—employing cooling in lieu of the heating and stimulating treatment which was then in vogue. 'Luckily', he observes, 'it occurs occasionally, that from the preposterous application of external heat and inward cordials, the patient becomes delirious, and in a fit of frenzy, escaping from the cruel attentions of his nurse, leaps out of bed, lies exposed for many hours to the cool night air, and thus haply recovers.'

While these pages were passing through the press, we came across a good instance of such a recovery noted in a recipe book containing Forman manuscripts, now in the library of Corpus Christi College. The date of the story seems to have been about 1604, and therefore Radcliffe may have heard of it, or of similar cases.

There was a parson in Oxfordshire that was sick of a hott ague, the physicians charged them that were about him that they should keepe him from cold drinke, he lying very hot

in his bed, when he sawe that he could gett no drinke, and looking up perceived the woman that attended him was a sleepe, he rose out of his bed in his shirt and ranne into the yard where was a great deepe poole, he lept into it and swame round about it. His friends came running and crying that he had spoyled himself. They gatt him into his bed agayne, where he did sweat exceedingly and so mended very shortly after.[1]

The *new method*, as it was called, had the sanction of the illustrious Locke, but the generality of doctors continued to trudge in the ancient course. An epidemic of small-pox in Oxford[2] gave Radcliffe his opportunity. Instead of stoving up his patients, he employed the 'new method', exposed the sick to the free access of the air, gave them cooling emulsions, and thereby rescued more than one hundred cases from the jaws of death.

His method also proved successful in the case of Lady Spencer at Yarnton, who had been under Dr. Lydal and Mr. Musgrave without benefit. In a short time Radcliffe restored the lady to health, to the great increase of his reputation and of his practice among the county families round Oxford.

After some unpleasantness at Lincoln College he resigned his Fellowship, but continued to reside in Oxford, and in the year 1682 took the degree of Doctor of Medicine, going out Grand Compounder. His openness and straightforwardness with patients not only enhanced the dignity of the profession, but dealt a blow to the empty pretensions of the numerous quacks and impostors who battened on credulous humanity. He specially ridiculed the art of the Uroscopists, a medical legacy of the fourteenth century and still in fashion with quacks who claimed to diagnose and prescribe for any disease from a mere inspection of the patient's urine.

In London, too, his success was immediate. He had not been settled there more than a twelvemonth before he was at the head of the profession, and in 1686 he was appointed by King James II physician to the princess (afterwards Queen) Anne. In the fateful year of the Restoration, 1688, he was sorely beset to change his religion and turn papist. He was attacked both from

[1] MS. C.C.C. 169.

[2] 1675 and 1683 were both small-pox years.

within and without the Court and from his old College at Oxford. The following is the beginning of his reply to a letter from Obadiah Walker, who had written that 'he should be incessant in his prayers to the blessed Virgin' that Radcliffe might be 'enlightened, and see the things that belonged to the peace of his immortal soul'.

Bow Street, Covent Garden,
May 25, 1688.

SIR,

I should be in as unhappy a condition in this life, as you fear I shall be in the next, were I to be treated as a turn-coat; and must tell you, that I can be serious no longer, while you endeavour to make me believe that, I am apt to think, you give no credit to yourself. Fathers, and councils, and antique authorities, may have their influence in their proper places: but should any of them all, though covered with dust 1400 years ago tell me, that the bottle I am now drinking with some of your acquaintance is a wheel-barrow, and the glass in my hand is a salamander, I should ask leave to dissent from them all. . . .

JOHN RADCLIFFE.

After 1688 and the enthronement of King William and Mary, Radcliffe's successes are a matter of history. He restored the king to health sufficiently to enable him to join the army in Ireland and gain the victory of the Boyne. He cured the young Duke of Gloucester of fainting fits, attended the Earl of Albermarle during the campaign before Namur, and was so secure of his position that he could behave with greater rudeness, not to say brutality, to his royal and noble patients than any other physician before or since.

During the last decade of his life Oxford was evidently much in his thoughts. In 1706 he gave a considerable sum of money for public buildings. In 1708 he purchased the advowson of the living of Headborne-Worthy in Hampshire, and bestowed it upon Mr. Bingham, a Fellow of University College.

Towards the end of his life Radcliffe relinquished his practice to his friend Dr. Mead, and, had he been content to live simply in retirement, might have attained old age, but he consented to be elected Member of Parliament for Buckingham in 1713, and doubtless the strain of

politics contributed to bring on the fit of gout that kept him from attending Queen Anne in her last sickness, and hastened his own end. He died on November 1, 1714, falling 'a victim to the ingratitude of a thankless world, and the fury of the gout'.

By his will he left his Yorkshire estate to University College in trust for the foundation of two travelling fellowships; the overplus to be paid to them for the purpose of buying perpetual advowsons for the members of the College. Also £5,000 for new buildings. To St. Bartholomew's Hospital he gave £500 a year for 'mending their diet', and £100 a year for buying of linen. For the building of a library at Oxford he left £40,000 with endowments of £150 and £100 a year for librarian and books respectively. The bulk of the residue of his property he gave to trustees to be applied to such charitable purposes as they, in their discretion, should think best.

The Radcliffe Library was finished and opened in 1749, and the 'faithful and enlightened guardians' of his funds made the following contributions to various institutions selected solely by themselves.

The Radcliffe Observatory.
The Radcliffe Infirmary.
Building the College of Physicians (1825), £2,000.
Building the Oxford Lunatic Asylum (1827), £2,700.

There are three portraits of Radcliffe in Oxford, based on the original by Sir Godfrey Kneller in the Radcliffe Camera which was considered 'extraordinarily well done', and also a full-length statue by Rysbrack. There is also a caricature of him in Mr. Scriblerus 'Map of Diseases'.

Small-pox was so prevalent in Oxford, being spread by *engrafting*, as it was called by Addison's friend, Lady Mary Montagu, when she introduced that eastern practice from Adrianople in 1717, that engrafting or inoculation was forbidden by the Vice-Chancellor in 1753. He thus anticipated the final veto by the law of 1840.

The medical writings of Dr. John Freind (1675–1728), of Westminster School and Christ Church, enjoyed a wide European reputation owing to their being printed in several centres of learning. In his first work he applied the laws of hydraulics and the methods of

statistics to the discussion of menstrual phenomena,[1] and with such success that he was elected to the professorship of chemistry in the following year.

After delivering a course of *Praelectiones chymicae*,[2] he went off to Spain to serve as an army doctor in two campaigns under the Earl of Peterborough. And again, in 1712, in the same year in which he received the honour of the Fellowship of the Royal Society, he took service in the Low Countries under the Duke of Ormond. His varied experiences appear to have resulted in the growth of great independence of spirit, for which he was rewarded by election to Parliament as member for Launceston, followed by a temporary residence in the Tower of London on a charge of high treason, and finally in 1727 by appointment as physician to the Queen of George II. He is best remembered now by his valuable *History of Physick from the time of Galen to the beginning of the sixteenth century*, a work that was compiled during his confinement in the Tower, and was for a few years the subject of several controversial writings.[3] In conjunction with Dr. Broxholme of Oxford he attended Bishop Newton, and witnessed the latter's cure after his self-prescribed draught of four quarts of small beer. The two physicians received five hundred guineas for their journey.

When Radcliffe fell, afflicted Physic cried,
'How vain my powers!' and languished at his side.
When Freind expired, deep struck, her hair she tore,
And, speechless, fainted, and reviv'd no more.
Her flowing grief no further could extend;
She mourns with Radcliffe, but she dies with Freind.

Samuel Wesley.

[1] Freind, *Emmenologia, in qua fluxus muliebris menstrui phenomena, periodi, vitia, cum medendi methodo, ad rationes mechanicas exiguntur*. Oxonii 1703. Editions also appeared at Rotterdam 1711, Amsterdam 1726, Paris 1727, and, translated into French, at Paris in 1730.

[2] Printed in 1709 and reissued from the presses of Amsterdam 1710, Paris 1727, and London 1729 (in English).

[3] Freind's other writings include *Hippocratis de morbis popularibus liber primus et tertius; his accomodavit novem de febribus commentarios J. Freind M.D.* London 1716, Amsterdam 1717. *De purgantibus in secunda variolarum confluentium febre adhibendis.* London and Rotterdam 1720. *De quibusdam variolarum generibus.* London 1723. *History of physick.* Lond. 1725–6, 1751. In Latin,

The Catalogue of Materia Medica drawn up by JOHN POINTER of Merton College is an example of the great interest that was taken in medical matters by many laymen at this time, when the practice of compiling volumes of medical recipes was very prevalent. Pointer's MS. notes on *Waters*, on *Hot and Cold Baths*, and on *Cautions before Bathing* now in the Library of St. John's College, are printed as an Appendix on page 503.

ROBERT JAMES of St. John's College (1705-76) wrote on fevers, and treated his cases with a patent antimonial powder, which was believed to have proved fatal in the case of Goldsmith. (*Morning Post*, 7 April 1774, *D.N.B.*)

FRANCIS WILLIS (1718-1807) of Lincoln College, St. Alban Hall, and Brasenose College, was a pupil of Nathan Alcock. In 1769 he was appointed physician to a hospital in Lincoln, where he treated mental cases with such success that although considered by his enemies as 'not much better than a mountebank' he was called in to attend on George III during his first attack of madness in 1788. His treatment was completely successful, as it was in the difficult case of the Queen of Portugal. Willis was also in orders and was rector of St. John's, Wapping, and vicar of Ashby de la Laund, co. Lincolnshire.

One of the few medical preparations associated with Oxford is due to SAMUEL GLASS, a surgeon, who in 1764 made 'prepared magnesia' in a laboratory he had contrived in St. Bartholomew's Hospital by Cowley Marsh, where it remained until about 1833. His *magnesia alba* was not cheap: it was sold by him in Oxford in Guinea, Half-Guinea, and Six-shilling Boxes.[1]

The uses of calomel were studied by DANIEL LYSONS, commoner at Magdalen 1744, and described by him in two essays, the first *Upon the effects of camphire and calomel in continual fevers*, Lond. 1771, and the second *Upon intermitting Fevers, Dropsies, Diseases of the Liver, the Epilepsy etc. and the operation of calomel*, Bath 1772.

THOMAS HUNT, a Burford surgeon, was a correspondent of John Hunter who communicated an exceptional case

Leyden 1734, Paris 1735. In French, Leyden 1727-8. And his Collected Works in Latin appeared at Naples in 1730, London 1733, Venice 1733, Paris 1735.

[1] *Early Science in Oxford*, vol. i, p. 60.

which was described in the first of the latter's *Observations on certain parts of the Animal Oeconomy*, 1786.

The temporalities of the Regius Professor of Medicine were somewhat improved under the will of Dr. RICHARD FREWIN, who on September 6, 1757, gave two messuages and tenements in Oxford, which he held by two beneficial leases from Brasenose College, to the Chancellor on trust for Mr. Gilpin for life, then on trust for the Regius Professor of Medicine, on condition that every such Regius Professor should personally occupy the same and not let it, and should keep the buildings in repair and pay £9 yearly to the Chancellor. And on June 12, 1817, the University of Oxford granted to Dr. Kidd, a lease for three years of Dr. Frewin's house.[1]

A more important endowment came in 1780 from the Rt. Hon. George Henry, Earl of Lichfield, Chancellor of the University of Oxford. He appointed by his will the Chancellor, the Bishop of Oxford, and the President of St. John's College as Trustees for a Professorship for the reading of Clinical Lectures in Physic in the Hospital or Infirmary, to the Students in Physic. The following Rules, Orders, and Directions were made by the Trustees in 1780:

1. Professor to reside in the University.
2. In November, December, January, February, March in presence of auditors, to visit and prescribe for Radcliffe Infirmary patients. Treatment to be entered in a book to be kept open for the inspection of students.
3. On 2 days to read a lecture—on cases.
4. To give a month's notice of course of lectures.
5. Auditors to be medical students of University of Oxford; 3 of them to be an audience.
6. Professor may admit anyone who has been sober for 2 years past.
7. Fees: £3. 3. first course, £2. 2. second course.
8. Failure to enter up notice of lectures punishable with loss of year's stipend.
9. For Failure to lecture,—£5 to be forfeited to Radcliffe Infirmary.
10. Deputy allowed in case of illness.

[1] Bodl. Univ. Arch. W.P. y. 2. The house, Frewin Hall, was occupied by King Edward VII, when he was an undergraduate at Oxford, and then by Edward Chapman of Magdalen. Its garden is still *rus in urbe* near the Cornmarket.

11. A grave offence to be punishable by removal from office.
12. Trustees reserve to themselves the power of making further rules.

N.B. A 'Student of Physic' is a person who has completed 2 years at Oxford and shall have signified intention of studying physic by entering his name in the Vice-Chancellor's Book.

Bodl. Archives. W.P.B. 2.

May 30th, 1780.

Matthew Baillie (1761–1823) of Balliol College achieved distinction as a pathologist. 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 he 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 re-translated 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*'.

Another Oxford physician who attained to fame in Court circles was Sir Henry Halford (1766–1844) of Christ Church, the son of Dr. James Vaughan of Leicester. He wrote convincingly on the influence which diseases of the body have on the powers of the mind. *Tic douloureux* was the subject of another essay, and his pamphlets *On the Education and Conduct of a Physician*, and on the *Effects of Cold* were very widely appreciated.

The teaching of Medicine was greatly advanced by the lectures endowed by Dr. George Aldrich under his Will dated April 27, 1795. He founded praelectorships in Medicine, Anatomy, and Chemistry. His three trustees, the Vice-Chancellor, the Dean of Christ Church, and the Warden of Merton, were to pay a third of the interest of moneys at their disposal to the Praelector of Anatomy, on condition that he shall constantly in every winter or spring give or read one entire course of Physiology, accompanied with the completed dissection that may be of a dead human body, explaining at the same time, or in subsequent lectures, the figure, situation, connection, nature, function, and uses of the several parts and organs thereof and illustrating them by such anatomical preparations of the said parts and organs as he may be provided with, or may in future make or become possessed of; and upon this further condition that the said Praelector of Anatomy shall twice in every of the

last eight weeks of that Michaelmas or Lent Term in which he shall not give or read the entire course of Physiology aforesaid, read or deliver it to the students of Medicine, in the School of Anatomy, or other more convenient place, one public lecture on some detached subject of Anatomy or Physiology at his own choice or the request of the majority of the said students. And also upon this further trust that they the trustees are to pay a third of interest to the Professor of Chemistry . . . on condition that at some convenient season of every year when the Univ. is generally fullest, he shall perform or cause to be performed under his inspection, by some well qualified person, whom he shall provide and pay for that purpose, one course of Processes in Medicinal and Philosophical Chemistry in illustration of doctrinal tendency of such series or course of Processes and pointing out the conclusion fairly deducible from the facts they exhibit . . . the remaining third to Regius Prof. of Physic, his allowed deputy or any other Doctor of Physic of the University, in pure regard to his general sufficiency and experience, first duly elected for this purpose, for it is not my intention that the Regius Professor shall claim preference by virtue of his office ; he shall read a complete course of lectures on the Practice of Physic, to be annually begun at the commencement of the latter half of Lent Term, and be uninterruptedly continued till the same be finished. . . . Professors Intermitting shall be liable to docking of salary at discretion of trustees. (Will dated April 27, 1795.)[1]

Profs. Medicine		*Anatomy*		*Chemistry*
1803 Ro. Bourne		Sir Chr. Pegge		J. Kidd
1824 J. A. Ogle	1822	John Kidd	1822	C. Daubeny

In November 182– it was proposed in Convocation that £50 be granted to Professor Ogle for the purpose of forming a small collection of such books, plates, and materials of medicine as may 'efficiently elucidate its modern practice'.

Several of the Oxford doctors and pharmacists of the early nineteenth century who attended Dr. Daubeny's Lectures are mentioned in W. Tuckwell's chapter on

[1] Bodl. Arch., W. P. y. 25.

Aesculapius in Oxford in his *Reminiscences*. Firstly there was JOHN IRELAND, a *chirurgus privilegiatus* and apothecary who lived at Headington, whence he descended with a 'stately stride', according to Lockhart. But Tuckwell described him as a man who, like the elder Pendennis in his lowly days, made up his own medicines, attended ladies at the most interesting period of their lives, sold Epsom salts, blisters, hair powder, across the counter of his shop, which he called his 'surgery'. Some men of this kind remained humble to the end; not so Ireland, who somehow obtained a Scotch degree, discarded the surgery, and set up a brass plate as Dr. Ireland on his house in Pennyfarthing Street. His servant-lad ABRAM ROBERTSON was an example of the way in which many of the humbler citizens of Oxford have and always have had the chance of rising. He became Professor of Astronomy.

On the whole in the early and mid-Victorian periods medical science can hardly be said to have flourished in the 'home for lost causes' till Sir H. ACLAND, who in 1857 found it in a state of suspended animation nigh to death, made it re-live. There were not forty men on the books of all the colleges who could write M.D. or M.B. after their name; candidates for the M.D. were allowed such latitude in the choice of subjects that it was said at one time that that distinction was conferred for knowledge of volcanoes, or of the atomic theory, or of the botany of Virgil. Dr. Edw. Fox of Balliol told the story that when he got his first class in the Oxford Science School, he wrote confidently and lightheartedly to his old head master of Shrewsbury to ask a half for the boys. Kennedy replied that he rejoiced in Classical triumphs, was gratified by mathematical honours, pleased with athletic success, congratulated Fox on achieving such success as he had deliberately limited himself to, but to ask for a half for science was—well, a most unwarranted proposal.

Darwin, too, at Shrewsbury, was chid by Dr. Butler for wasting on Chemistry time that should have been given to Classics.[1]

[1] *Brit. Med. J.* art.

III

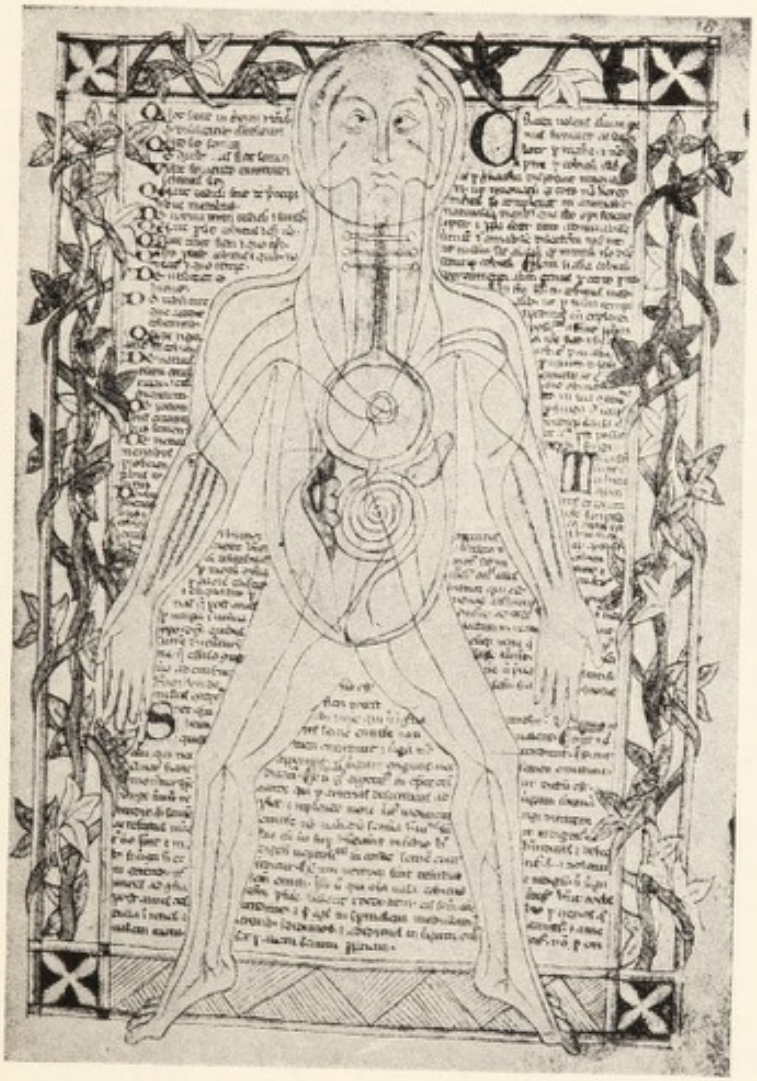
ANATOMY

DURING the Middle Ages the principal sources of advanced anatomical knowledge were copies or Latin translations of the works of Aristotle, Hippocrates, Galen, and Pliny, together with various compilations and extracts based upon those works. In the more attractive manuscripts the meaning of the author was made clearer by the introduction of explanatory pictures or diagrams. An excellent example now on exhibition in a show case in the Bodleian Library, is entitled *De corporis fabrica*[1] with five fine coloured diagrams respectively showing the veins, arteries, nerves, bones, and muscles, but their anatomy does not err on the side of truth to nature.

The study of Anatomy, as a Natural Science in the modern sense, dates from the first half of the sixteenth century. At that time it dawned on active minds that the facts revealed by dissections, which are capable of being demonstrated over and over again by other dissectors, were not always in accordance with a written word whose authority had been unquestioned throughout the Middle Ages. From time to time investigators would have the startling experience that the Book of Nature and the statements of the most learned of the ancient Greeks and Romans were in contradiction. But it was only the greatest of the modern masters who had self-reliance enough to distrust authority, when he found it in conflict with actuality.

[1] This treatise, MS. Ashmole 399, has been variously dated as 'about 1292' and 'about 1298' by Singer, and as 'fourteenth century' by Osler, both of whom have reproduced the diagrams. Singer, *Studies*, 1917; Osler, *Evolution o Mod. Medicine*, 1921.

In Oxford, Roger Bacon had already laid stress on the importance of obtaining knowledge by experiment, but his doctrine was unheeded. It was not until 1523 that another member of our University taught that

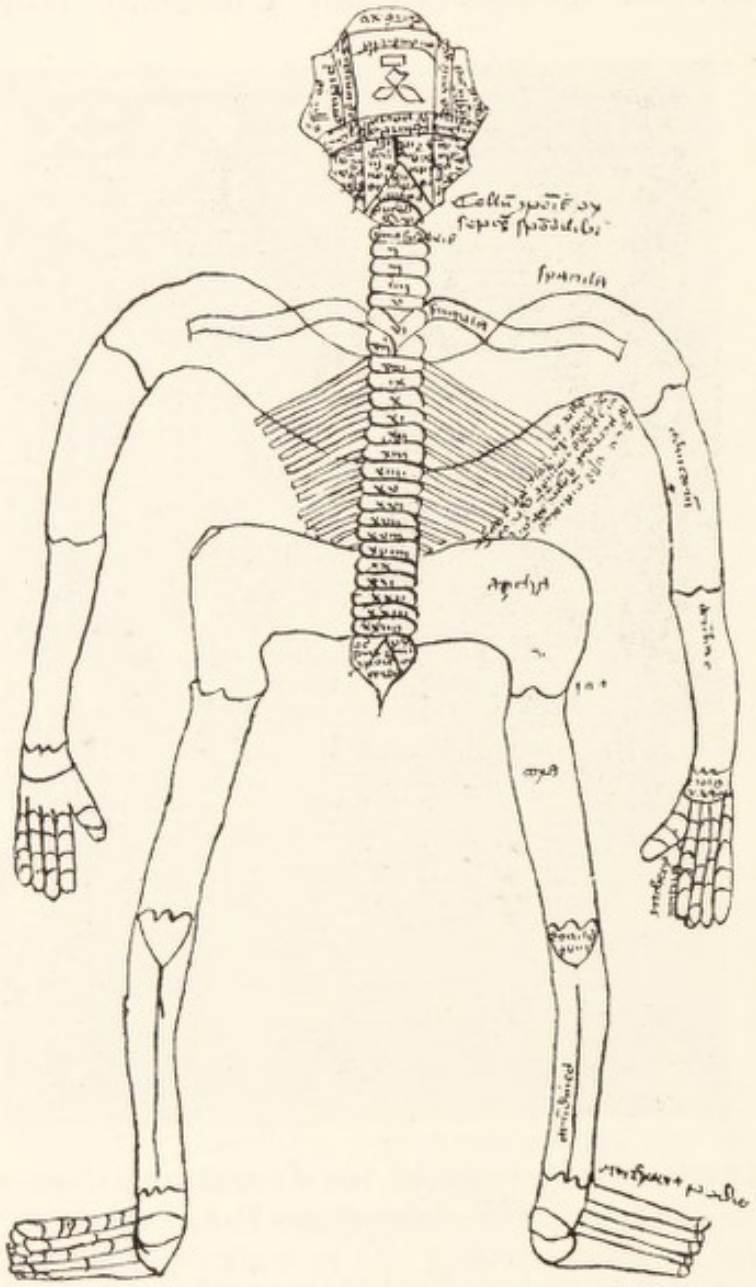


ANATOMICAL DIAGRAM OF THE FOURTEENTH CENTURY.
MS. Ashmole 399, f. 18.

learning, if it is to be of value, must be obtained at first hand. LUDOVICUS VIVES,[1] 1492–1540, a Spaniard who became a Fellow of Corpus Christi College in 1523,

[1] L. Vives, *De Tradendis Disciplinis*, 1523. Vives had been previously lecturing on Pliny's *Natural History* at Louvain. He had a restless southern temperament, and soon retired from Oxford to Bruges with the gout.

advised that a student of science should learn from those persons who have first-hand knowledge, 'for this



THE HUMAN SKELETON AS DRAWN IN THE FOURTEENTH CENTURY.
Cod. lat. Monacensis 13042, after Sudhoff, *Studien*, 1907.

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'.

It was in this spirit that Vesalius (1514–64) became the founder of modern anatomy. As a young student he had followed, though doubtless with some misgivings, the practice of his teacher Sylvius, who is believed to have trusted descriptions as written by Galen 'more than he trusted his own eyesight, but in the end his sight and his reason conquered, and at last he taught only what he himself could see and make his students see'. Dispensing with the aid of unskilled barbers, he dissected the human body with his own hands.[1] The outcome was a great work on 'The Structure of the Human Body', printed at Basle in 1543, before the author had reached his thirtieth year. In England the work of Vesalius was soon followed by a most interesting work by Thomas Vicary which is said to have appeared in 1548, though no copy is now known to exist, and which was republished in 1577 by the Chirurgions of S. Bartholomewe's Hospital. It is entitled *A profitable Treatise of the Anatomie of Man's Body*.[2] Payne and D'Arcy Power have shown that it was a compilation from an earlier anatomical manuscript of the fourteenth or fifteenth century reduced into the form of a text-book likely to be helpful to a student: the eleven editions that appeared before 1651 testify to its popularity. Power suggests that Vicary did not know, or did not think it worth while to incorporate, the work of Vesalius, or even of Geminus, who was one of his own colleagues, as surgeon to King Edward the Sixth. Payne dated the original MS. as 1392.

Chamber of Merton College probably used as a text-book an English translation of the *Surgery* of Lanfrank (*d.* 1306) which he lent to John Halle to help him in the preparation of his 1565 edition of the *Chirurgia parua Lanfranci* 'which was translated out of Frenche into the olde Saxony englishe, about twoo hundred yeres past'.[3] But even before the publication of the

[1] Shipley, *Heritage of Science*, p. 219.

[2] Edited for the Early English Text Society in 1888 but see F. Payne, in the *British Medical Journal*, 1896, vol. i, and D'Arcy Power, *Notes on three sixteenth century English Books connected with London Hospitals* in *The Library*, 1921, vol. ii, p. 82.

[3] D'Arcy Power, *The Library*, 1921, ii, p. 84.

Anatomy of Vesalius, the necessity of dissecting had already made itself felt, and was in fact being met, though the laws in force relating to dead bodies made it impossible for medical students to obtain licitly any practical instruction in anatomy; while on the Continent the difficulty of obtaining bodies was even greater than in England, and even as late as 1723 Haller in Tübingen had to do all his dissection on dogs. Albinus of Leyden only received one body per annum, while in Paris Haller had no other means of procuring bodies than by theft, and, as is well known, had to fly for his life when discovered.

In England, however, dissection as an essential of medical training, was recognized in 1540, when by the statute of 32 Hen. VIII, c. 42, four bodies were given annually to the United Company of Barbers and Surgeons,

> the Maistres or Governours of the misterie or cōminalty of Barbours and Surgeons of London and their successours yerely for ever aftre their sadd discretions at their free libertie and pleasure shall and may have and take without contradiction fower psonnes, condempned adjudged and put to death for felony . . . for anathomyes, . . . and to make incision of the same deade bodies or otherwise to ordre the same aftre their discretions at their pleasures, for their further and better knowledge instruction insight lerning and experience in the said science or facultie of surgery.

So that the would-be students of Oxford had either to go to London, or to have a body sent.[1] But the standard of teaching in the new study had been so much raised before the end of a decade, that the Edwardian Statute of 1549 enacted that a student of medicine was to study for six years and to see two dissections. He had also to make three, or at least two, dissections himself.[2]

Elizabeth in 1565 granted a like number of bodies to the College of Physicians, and Charles II further increased the allowance from four to six.

[1] Sir D'Arcy Power informs us that he believes that the Barbers and Surgeons at Oxford had a right similar to that enjoyed by the London men.

[2] J. de Trokelowe, *Annales Edw. II* (1728), p. 347.

Doubtless it was to such increased facilities for dissection that the most important anatomical discovery of of the century was largely due: viz. the demonstration of the true structure and relations of various parts of the Vascular System, upon which the Circulation of the Blood depends. Harvey's great discovery naturally figures most appropriately in the introduction to the history of Physiology, but it must be remembered that it was as a Lecturer on Anatomy that he introduced his new doctrine to the College of Physicians in 1616, although he waited twelve years before publishing it.[1]

In 1623 a small endowment for the regular teaching of Anatomy in Oxford was provided by Mr. RICHARD TOMLYNS of Westminster. The salary of the praelectorship was at first only £25, but this was augmented in 1639. The post was always to be held by the Regius Professor of Physick.

> The chief office of the Reader is every Springtime immediately after the Assizes are ended, to procure an intire and sound body of one of the Malefactors then condemn'd or hang'd; or, if that cannot be done to get an intire and sound Body of some other Person; which being thus procur'd he is oblig'd to have it prepar'd and cut up by some Skillful Surgeon.[2]

He was to lecture four times on the corpse and have it decently buried 'for which he is to allow fourty shillings'. Every term he must 'read publickly upon the Bones' thrice.[3]

Dr. THOMAS CLAYTON, who had been appointed King's Professor of Physick in 1611, was duly nominated first Tomlyns Reader in Anatomy, and gave an inaugural lecture on March 12, 1624. The lectures were delivered in the Anatomy School,[4] and the students appear to have been helped by a small reprint of Bartholin's *Institutions of Anatomy* which appeared in Oxford apparently for their special use in 1633.

The stipend of the Reader was secured on 26 March 1639, when Tomlins, then of Richmond, Surrey, gave

[1] W. Harvey, *Exercitatio de Motu Cordis*. 1628.
[2] Hearne, ii. 379.
[3] Macleane, *Hist. of Pembroke College*.
[4] After 1683 in the Ashmolean Museum.

£500 for the purchase of land for the perpetual and constant maintenance of an Anatomy Lecture to be hereafter read by his Majesty's Professor of Physick and his successors for ever.[1] And a note in the University Accounts shows that the £500 which had been borrowed from the Bodleian Library Chest 'for the Anotomy (*sic*) purchase' was repaid on July 26.[2]

By an Act of the 2nd of Charles I[3] the Anatomy reader might demand the body of any person executed within twenty-one miles of Oxford.[4] And, as the supply of executed criminals was apt to be precarious, the Professor of Anatomy had to summon his class hastily, when opportunity favoured a demonstration.

So with money and 'subjects' anatomy-teaching should have been booming, but there was a set-back —Dr. THOMAS CLAYTON,[5] who had succeeded his father of the same name in 1647, 'being possest of a timorous and effeminate humour, could never endure the sight of a mangled or bloody body', a fact that was well known among his pupils and was indeed an inspiration to one of them.

Sr Thomas Clayton or a fearfull Anotamie Lecture.

To the Tune of the Spanish Pavion.

Thee 12th day of this month there readd
Uppon a man both hang'd and dead
Sr Tho: Clayton this is hee
That breaks the bond of Unitie
Hee would have rays'd the best of men
His brother.

[1] Bodleian Archives S.E.P., L. II. 16.
[2] Macray, *Annals of the Bodleian Library*, 1890, p. 89.
[3] Gutch, *Collectanea Curiosa*, ii, p. 45.
[4] The Act was similar to that of 9 Geo. IV, cap. 31, by which the Body of a Murderer if executed in the county of Middlesex or City of London. . . . shall be conveyed to the Hall of the Surgeons Company, or to such other place as the said Co. shall direct, . . . for the purpose of being dissected. If executed elsewhere the body shall be delivered to such surgeon as the Court or Judges shall direct, for the same Purpose. Repealed by 24 & 25 Vict., c. 95 (1861).
[5] T. CLAYTON secundus became Warden of Merton and was knighted in 1661. Wood gives an amusing description of the home-coming of the new knight on March 30, 1661.

His wife that made him of the chayre
Had thought to make the sonne and heyre
A proctour (?) by hir husbandes helpe
A prettie and a lovely whelpe
For such a place most fitt to be
A shame to th' universite
His mother.

But what's this to our businesse nowe
I am about to tell you how
He did delate on every part
By peeping on his bookes of art
And Barnard's finger was the tongue
That taught the discontented thronge
Anatamie.

O how he div'd in flesh and blood
It made us all afrayd that stoode
To see this fearce and bloodie Knight
To graspe those gutts like a ravenous Kite
Instructing us both all and some
Untill we sweatt and cri'd each one
How hot am I?

This Knight when he began his speech
. . . . . .
And when as hee was compassd rounde
Hee stoode like a lame Jade in a pounde
Good Lord: how pale and white
As if he had come for the nonst . . .
In foro.

Hee trembled more to reade I hope
Then the fellow did when hee came to the rope
And when we preass'd and throng'd and sweatt
And brought the professour into an heate
Hee sayd all's not so sweete as a nutt
Keepe out the thronge be pleas'd to shut
The doore here.

Behold: quoth the worthie Knight
What I brought for your delight
To entertayne your eyes a while
See an Indian snake and a Crocodile
But some men may object and say
What kinde of reference have they
To a bodie.

And though my speech it doth reflect
Uppon my schoole that is bedeckt
With forrayne beastes. Yet do not say
My speech was taken for a straye (?)
And think mee not because I can
Speake more of those than of the man
A noddie.

[*Four stanzas omitted*]

Well noble Knight our Anotamiste
Take my advice. Bee pleas'd to desist
From reading. And mistake no parte
No not a liver for the hart
As last you did. Trade not in blood
Be advised by your freinds, o good
S^r^ Thomas.

[MS. Tanner 306, f. 273.

Sir Thomas wisely resigned the Anatomy Readership in 1650 to his deputy WILLIAM PETTY. Between 1640 and 1650 Petty, being very poor,

'came to Oxon, and entred himself of Brasen-nose college. Here he studied Physick, cut up doggs and taught anatomy to the young scholars'. Anatomy was then but little understood by the University, and I remember he kept a body that he brought by water from Reding a good while to read on, some way preserv'd or pickled.[1]

Petty was a universal genius. He is the founder of statistical studies on Demography in England. The remarkable group of scientists who founded the Royal Society used frequently to foregather in his rooms in Oxford.

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. On a particular occasion Drs. Willis and Petty had secured for their anatomical demonstration a 'recent subject', the body of a woman who had been hung 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

[1] Aubrey's *Lives* and Hearne's *Diary*.

turned to the means of restoring life, which after much perseverance they succeeded in doing.

> Ann Green was a slippery quean,
> In vain did the jury detect her;—
> She cheated Jack Ketch, and then the vile wretch
> 'Scap'd the knife of the learned dissector.[1]

According to Evelyn she was bled, put to bed to a warm woman, and brought round by spirits and other means. 'The young scholars joined and made a little portion, and married her to a man who had several children by her, she living fifteen years after.'[2]

The succession of Anatomy Lecturers after William Petty, whose deputy was HENRY CLERK, was:

JAMES HYDE 1650/1 C.C.C.
JOHN PARYS 1661 C.C.C.
THOMAS JEAMSON 1669 Wadham.
JOHN LUFFE 1674 Trinity.
ROBERT PITT 1684 Wadham.
STEPHEN FRY 1686 Trinity.
JAMES KEIL c. 1705?

SEVENTEENTH-CENTURY DISCOVERIES.

A first-hand acquaintance with the fabric of the human body and a critical comparison of their own observations with the printed words and plates of the text-books soon led anatomists to the finding of discrepancies and brought about an abundance of discoveries and rediscoveries. For instance, it has been asserted that the Lacteals were known to Erasistratus, but had been forgotten long before our era. Again, they were rediscovered in 1622 in a dog by Aselli of Cremona, and their passage into the thoracic duct was shown by Pecquet in 1651. Similarly the honour of the discovery of the Lymphatics has been claimed for several people.

In Oxford GEORGE JOYLIFF appears to have anticipated Bartholinus and Rudbeck. Rudbeck saw them in a dog in January 1651, and Bartholinus saw them in the following

[1] T. Warton, *Life of President Bathurst*—quoted from Cox, *Recollections*.

[2] *Diary*, 22nd March, 1675, and Wood's *Life and Times*, i. 165, 169-70.

December, and published them in 1653. But Dr. Robert Stapley, who was a contemporary with Joyliff at Pembroke College till Oxford was made a garrison for the King, about the year 1643, told Plot that Joyliff had often demonstrated them to him when they were students

NATHANAEL HIGHMORE OF TRINITY COLLEGE.
From the Frontispiece to his 'Corporis Humani Disquisitio', 1651.

there (1639–43). Evelyn too noted that on 25 Feb. 1649 'Came to visit me Dr. Joyliffe, discoverer of the lymphatic vessels and an excellent anatomist.'[1] Joyliff afterwards, in June 1652 when at Cambridge to take a Doctor's degree, demonstrated them to the famous Dr. Glisson.[2] Dr. Highmore is also believed to have 'noted

[1] In 1657 Evelyn 'Saw at D. Joyliffe's two Virginian rattlesnakes, alive, exceeding a yard in length . . . the Doctor tried their biting on rats and mice, which they immediately killed: . . .'

[2] Professor of Medicine at Cambridge 1636–1677.

something of them, though veiled under a different name and description '.

The same Dr. Highmore treated of Human Anatomy, on the lines suggested by the new Doctrine of the Circulation of the Blood, and appropriately dedicated his book to Harvey.

NATHANAEL HIGHMORE, 1613-84, was a Scholar of Trinity College and was in residence when Harvey came to Oxford after Edgehill. They became friends, and in 1651 Highmore, who had settled in practice at Sherborne, dedicated to Harvey his first work, on Human Anatomy.[1] This treatise was published at The Hague, and, like most of the books on anatomy of its period, gives an account of pathological appearances and of comparative anatomy, as well as of the normal structure of the human body. He was familiar with the anatomy of the dog and of the sheep, and had dissected an ostrich. Though perfectly sound in his views as regards the circulation of the blood, the physiological remarks of Highmore 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 plates are based on those of Vesalius, and he frequently attacks Spigelius. His name is remembered on account of his discovery of a cavity in the superior maxillary bone to which his attention was drawn in a woman patient in whom an abscess of this cavity, ever since known as the *Antrum of Highmore*, was drained by the extraction of the left canine tooth.

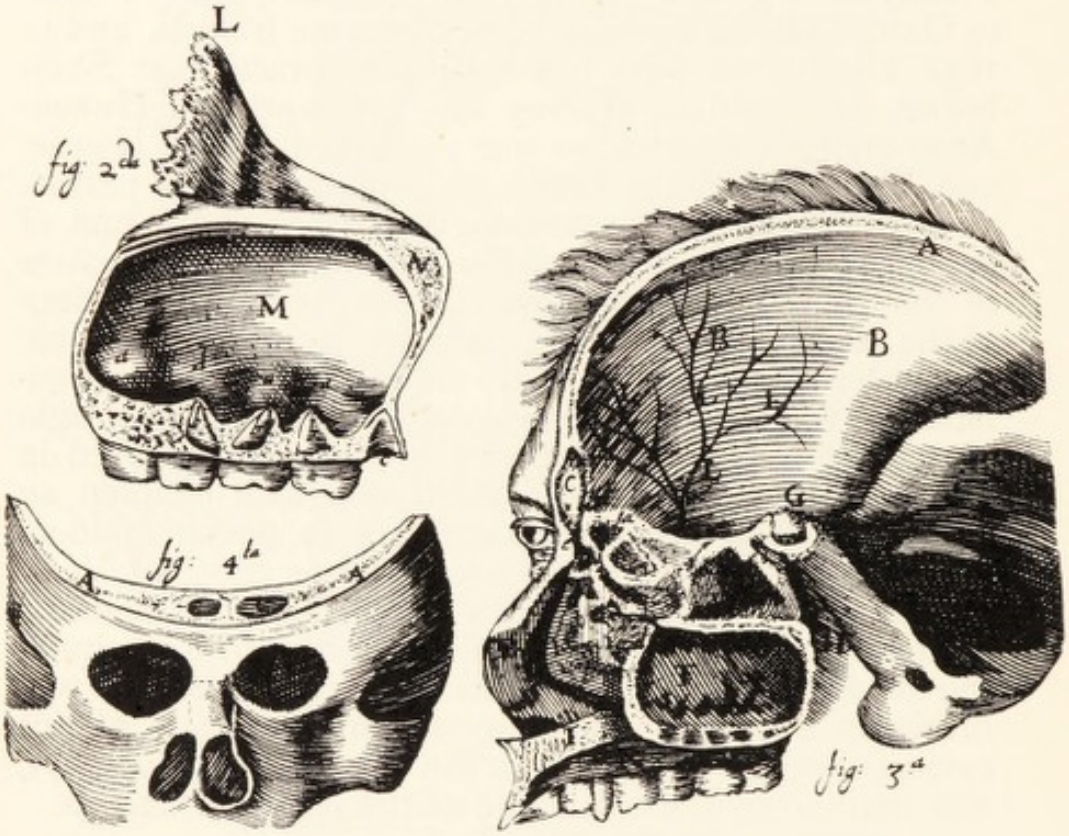
> Concerning *Highmore's* Cave or Cavity, which is internally discover'd in the *Sinus* of each Maxillary Bone, it is observable, Chyrurgeons and unskilful Anatomists are frequently mistaken, who if a Hurt be violent or successive in these Parts, as it commonly happens in the Venereal Disease, take this for a *Caries* or rottenness of the Bone, especially when they can penetrate so deep into it with a Probe, and find this vast Cavity.[2]

He became a magistrate for Dorsetshire, and attained considerable practice as a physician. He never took fees from the clergy. By his will 4 March 1684, he endowed

[1] *Corporis humani disquisitio Anatomica*, pt. I, c. 2.
[2] Erndtel, 1706, p. 68.

an exhibition to Oxford from Sherborne School, and left 21 copper plates of anatomical figures to the Royal Society and his long Tables of the Muscles to the Anatomy School at Oxford.[1]

Plot regarded him as the discover of a 'new ductus for the carriage of the seed from the testes to the parastatae', and author of a new description of the vessels



THE ANTRUM OF HIGHMORE, 1651.

Figs. 2 and 3 show the Antrum (M) in the Maxillary Bone.
Figs. 3 and 4 show the Sinuses (C) in the Frontal Bone.

and fibres of the Spleen, previously considered to be veins, and of 'the intricate plexus of the Parastatae'.[2] His work upon the former organ has been commemorated by the association of his name with the *Corpus Highmorianum* or 'mediastinum testis', which supports the vessels and ducts of the organ in their passage to and from the substance of the gland.

[1] Gunther, *Rolfe Family Records*, 1914, p. 227. Highmore's original MS. of the *Anatomia Restaurata* is in the Sloane collection.
[2] Plot, *Nat. Hist. of Oxfordshire*, 1677, p. 301.

Medical students were greatly assisted in their studies by the anatomical preparations that were being imported from Italy at this time. Such preparations were highly prized by their owners. For instance on April 2, 1649, Moulins, 'the great Chirurgeon', came to see and admire the *Tables of Veins and Arteries*, which JOHN EVELYN had purchased and caused to be drawn out of several human bodies at Padua.[1] Ten days later Moulins in return invited Evelyn to see a private dissection at his own house. In later years, these same Tables were borrowed to illustrate anatomy lectures at the College of Physicians, and after being kept for some time in the museum of the Royal Society, were transferred to the College of Surgeons, where they are still preserved—the oldest anatomical preparations in that great collection. In Oxford students of Anatomy could consult the specimens in the Anatomy School (which are listed on pages 264-77), and in the College Libraries. At St. John's, for instance, on the 12th July 1654, Evelyn visited the Library and saw there the 'two skeletons which are finely cleansed and put together'.

As time went on courses of Anatomy became more and more thorough and better defined, until 'for anatomy the students had in the spring to attend the dissecting of one human body and to hear four lectures, each two hours long, upon it, and in the autumn to hear three lectures on the human skeleton'.[2] Moreover, the study became fashionable, for it was known that even the King, Charles II, was 'fond of seeing dissections'. On the

[1] In 1645 Evelyn attended 'the famous anatomy lecture, celebrated here with extraordinary apparatus, lasting almost a whole month. During this time I saw a woman, a child, and a man dissected with all the manual operations of the chirurgeon on the human body. The one was performed by Cavalier Veslingius and Dr. Jo. Athelsteinus Leonoenas, of whom I purchased those rare tables of veins and nerves, and caused him to prepare a third of the lungs, liver, and nervi *sexti par:* with the gastric veins, which I sent into England and afterwards presented to the Royal Society, being the first of that kind that had been seen there, and, for aught I know, in the world, though afterwards there were others.' Evelyn then departed to Venice and purchased treacle; but his Tables did not arrive in England before the spring of 1649.

1652. Nov. 5. 'Dr. Scarborough was instant with me to give the Tables . . . to the College of Physicians. . . '

[2] Fox Bourne, *Life of John Locke*, 1876.

11th May 1663, Pierce, the surgeon, told Pepys 'that the other day Dr. Clerke and he did dissect two bodies, a man and a woman before the King with which the King was highly pleased'. Pepys also records on 17th February 1662/3 on the authority of Edward Pickering, another story of a dissection in the royal closet by the King's own hands.

We have now arrived at what may be regarded as the heroic age in the history of British Science. It was characteristic of this prolific period that the frontiers between the various natural sciences were readily crossed by men of outstanding genius who made important and simultaneous advances in many directions. There was no narrow 'specialization' in the work of a Wren, a Boyle, or a Hooke. The early Fellows of the Royal Society, universally 'philosophic in mind', would scarcely have recognized the many subdivisions into which the modern biologist classifies his subjects. Yet it was the anatomists of the seventeenth century who laid the foundations of these later subdivisions.

The senior in this group of anatomists was THOMAS WILLIS (1621–75) (see p. 59) whose outstanding work was the publication of the best detailed description of the Nervous System[1] that had yet appeared. Just as the illustrations to the Anatomy of Vesalius had been drawn by Johann Stephan von Calcar, a pupil of Titian, so the success of the work on the Anatomy of the Brain of Willis was in large measure due to the elaborate anatomical drawings of CHRISTOPHER WREN.[2]

Although only twenty-one years of age at the time, Wren was no novice in anatomy. On leaving Westminster School at the early age of fourteen, he had been chosen by Dr. Charles Scarborough as his assistant, demonstrating and making anatomical preparations and various experiments for his patron's lectures at Surgeons

[1] Willis, *Cerebri Anatome cui accessit Nervorumque descriptio et usus*, London. It was printed by Ja. Flesher in 4to and by Tho. Roycroft in 12mo in the year 1664.

[2] After acknowledging help from Tho. Millington, Willis adds: 'Caeterum alter, Vir Insignissimus Dr. Wren, pro singulari qua pollet humanitate, plurimas Cerebri et Calvariae figuras, quo exactiores essent operae, eruditissimis suis manibus delineare non fuit gravatus.'—*Cerebri Anatome.* Imprimatur, Jan. 20, 1663.

Hall.[1] Consequently he came to Willis, a pupil with the training of a scholar.

Among Wren's anatomical researches must be mentioned his Operation to remove the Spleen with safety. The operation is described by Boyle[2] in the following terms:

> Nor is it a small Convenience to the Anatomist, that he may in the Bodies of Brutes make divers instructive Experiments, that he dares not venture on, in those of Men; as for Instance, that late noble, and by many not yet credited Experiment, of taking out the Spleen of a Dog without killing him: For, that this Experiment may be useful, we may elsewhere have Occasion to shew; and that it is possible to be safely made, (tho' many, I confess, have but unprosperously attempted it, and it hath been lately pronounced impossible in Print) ourselves can witness. And because I have not yet met with any Author, that professes himself not to relate this Experiment (of the Exemption of a Dog's Spleen) upon the Credit of others, but as an Eye-witness; I am content to assure you, that that dexterous Dissector, Dr. Jolive, did the last Year, at my Request, take out the Spleen of a young Setting-dog I brought him; and that it might not be pretended, the Experiment was unfaithfully, or favourably made; I did Part of it myself, and held the Spleen (which was the largest in Proportion to his Body I ever saw) in my Hand, whilst he cut asunder the Vessels, reaching to it, that I might be sure there was not the least Part of the Spleen left unextirpated; and yet this Puppy, in less than a Fortnight, grew not only well, but as sportive and as wanton as before, which I need not take Pains to make you believe, since you often saw him at your Mother's House, whence at length he was stol'n. And tho' I remember the famous Emperick Fiorovanti, in one of his Italian Books, mentions his having been prevail'd with by the Importunity of a Lady (whom he calls Marulla Graeca) much afflicted with splenetick Distempers, to rid her of her Spleen; and adds, That she outlived the Loss of it many Years: Yet he that considers the Situation of that Part, and the Considerableness of the Vessels belonging to it, in human Bodies, will probably be apt to think, that tho' his Relation may be credited, his Venturousness ought not to be imitated.

[1] *Parentalia*, p. 187.
[2] *Essays of experimental natural Philosophy*, 1663.

The Operation and Method of Cure, by Dr. WREN.

PRovide a Dog, as big as a Spaniel, and having tied him in a fit Posture on the right Side, with a Cushion under him, that his Belly may turn a little up; first clip away the Hair, and mark with Ink the Place for Section, drawing a Line two Fingers breadth below the Short-ribs; cross the Abdomen at right Angles to the Musculus rectus, beginning short of it a Finger's breadth, and so carry it up the Length of three Finger's breadth towards the Back; then thrust in a sharp Knife, like a Sow-gelder's Knife, till you feel you have just pierced thro' the Muscles and Peritonaeum, having a Care of the Guts; thence rip up freely, carrying on the Point of the Knife to the End of the Line; then put in two Fingers, and while another presses down the Abdomen, draw out the Spleen just without the Wound, having a great Care of pulling it too far out, because of disordering the adhering Vessels within, the Stomach, the Caul, the Arteries, and Veins; then either tie the Veins and Arteries with untwin'd Thread, but strong, and in three or four Places, Caul and all, and so cut them off close to the Parenchyma of the Spleen, and anointing the Ends of the Vessels and Wound of the Caul with Balsam, or Oil of Hypericon, put them in their Places, or else sear off the Vessels, and anoint them with the Juice of Sengreen and Plantain beaten with Whites of Eggs; or else, cum Unguento Diacalcitheos dissolv'd with Vinegar and Oil of Roses, especially the Nerve; then sew up the Wound with the Suture call'd Gastroraphia, leaving at the lower End room enough for Matter to come out, first anointing the Wound with Balsam, then ℞ Olei Mirtini & Rosarum, ℥ ii. Cerae alb. ℥ i. Farinae Hord. ℥ ß. Boli Armeni. & Terrae Sigillatae, ana ℥ vi. make a large Plaister of this to cover the Wound, and all the Muscles about; swath his Belly warm, and lay him upon his left Side in Straw; after six Hours let him Blood in the left hinder Leg, two or three Ounces, more or less, according to the Bigness of the Dog: The next Day if there seem to lye any clotted Blood in the Abdomen; out of a Glister-pipe (one holding the Dog in his Arm, or hanging over the Table, so that the Wound may be downward) inject half a Pint of Decoction of Barley with Honey of Roses and red Sugar, till you have wash'd out the clotted Blood, then tent the remaining Hole with the yellow Salve, and wrap him up in the former Plaister as before till the Wound begins to suppurate.

He compos'd a Treatise of the Motion of the Muscles, explaining the whole Anatomy by Models form'd in Paste-

boards. These were presented to that eminent Physician, and his excellent Friend, Sir Charles Scarborough ; but lost at the Fire of London : there is extant only the first Draught of a Letter from Oxford to Sir Charles, concerning the Bone of the Arm, wherein is a Hint of the Pasteboards.[1]

In a Catalogue of his MSS. this is mentioned as 'No. 42. Of the *Os Brachii*'. No. 43. is on the Anatomy of a freshwater eel, more than 40 inches long, and six inches in girth, with figures. No. 44. is Of the Instruments of Respiration, &c.

A considerable testimony to Wren's skill was that some years afterwards he was specially requested by Charles II to prepare magnified drawings of insects as seen under the microscope.

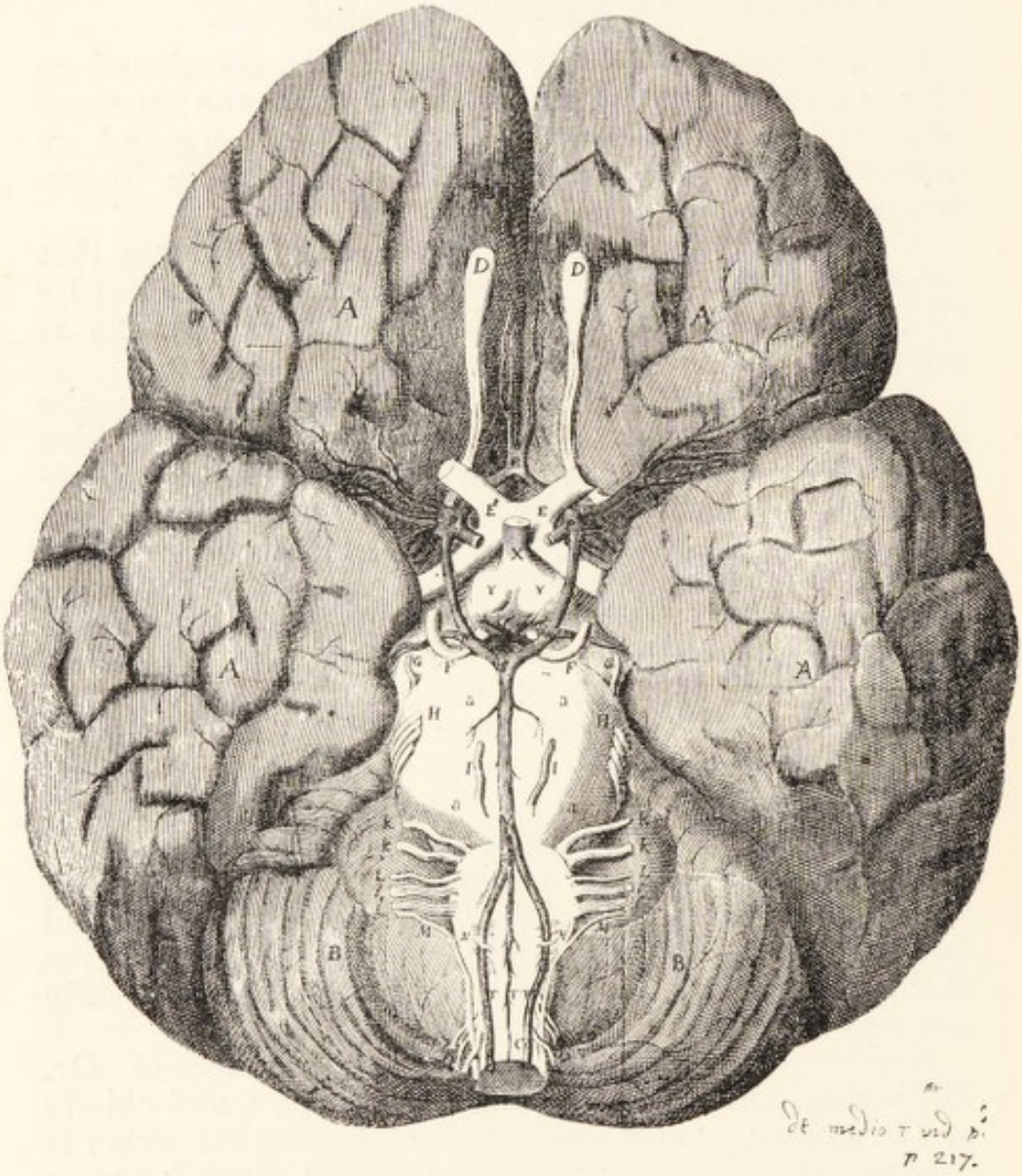
It was doubtless due to this early training in the extreme accuracy of observation and of drawing which the study of animal morphology requires, that the foundations of his success in the architect's profession, which he subsequently adopted, were laid, and indeed may have had much to do with his choice of it. 'Had his philosophical pursuits not been interfered with by the absorbing work of the arduous profession to which he devoted himself in later life, he could not have failed of securing a scientific position higher than was attained by any of his contemporaries, with of course one exception—Newton.'[2] 'Since the time of Archimedes there scarce ever met in one man in so great a perfection such a mechanical hand and so philosophic a mind.'[3] He received credit for his published figures of the Organs of Respiration and for having 'exactly measured and delineated the spheres of the humours of the eye whose proportions were only guessed at before'. (Sprat, *D.N.B.*)

Besides Wren, Willis had the assistance of Dr. Millington, Dr. Edmund King, Dr. Masters, and chiefly of Dr. Lower. 'His method of dissecting the Brain is new and most natural ; and so exact that there is scarce any one part in it, but what has received considerable advancements from him.' We cannot, however, follow him in his attempts at localizing the functions of the brain. With Lower he worked out the curious plexus of the

[1] Wren, *Parentalia*, pp. 237–8.
[2] F. C. Penrose in *D.N.B.*
[3] Hooke, Preface to *Micrographia.*

cerebral and spinal veins and arteries for the first time, whence the anastomosis at the base of the brain between

Figura I[a]

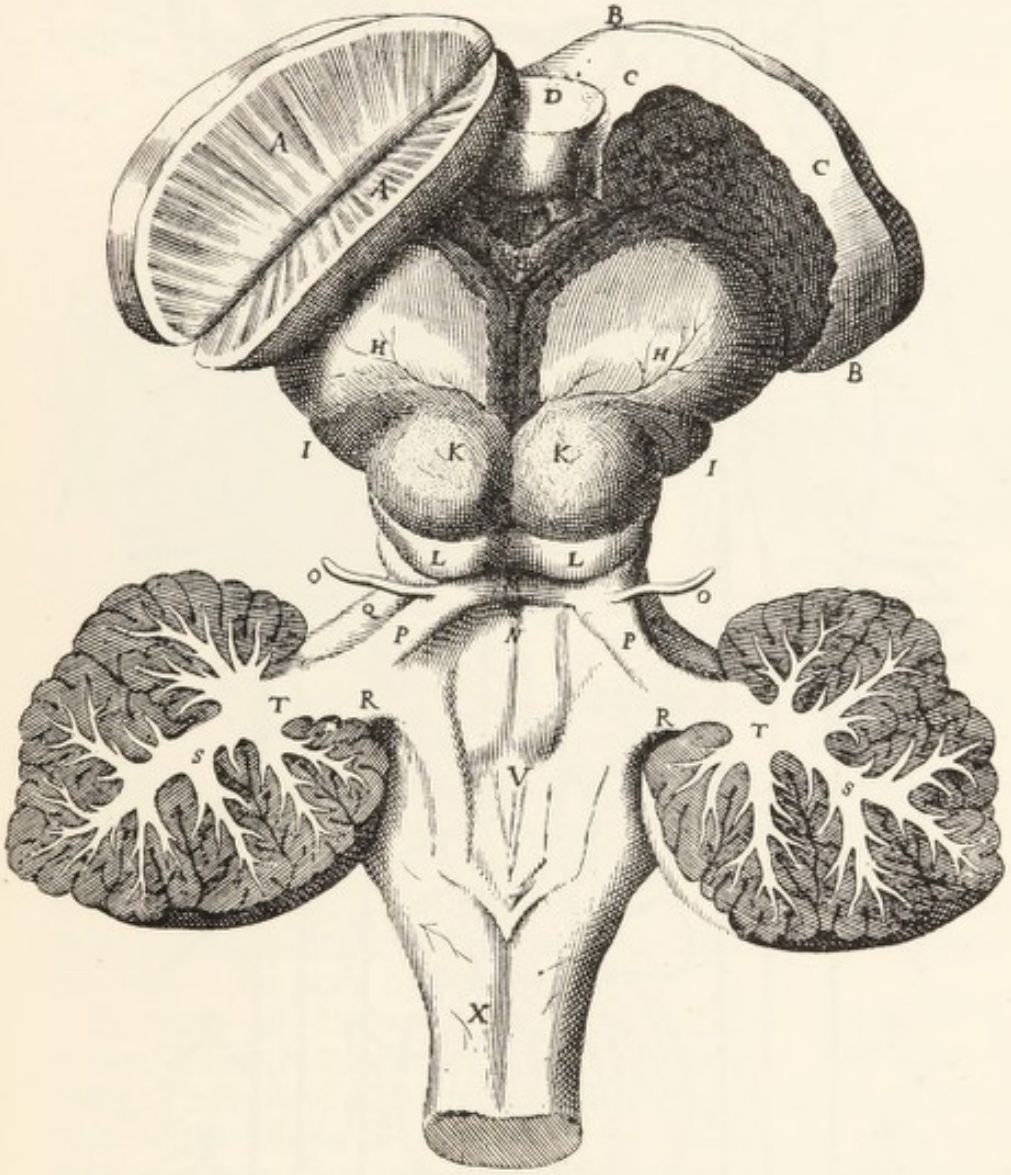


WREN'S DISSECTION OF THE BRAIN, 1664.
From Willis, Cerebri anatome.

the branches of the vertebral and internal carotid arteries is known as the Circle of Willis. By this arrangement the brain is supplied with blood by four arteries, and the 'Circle' connexions ensure a continuous flow of blood

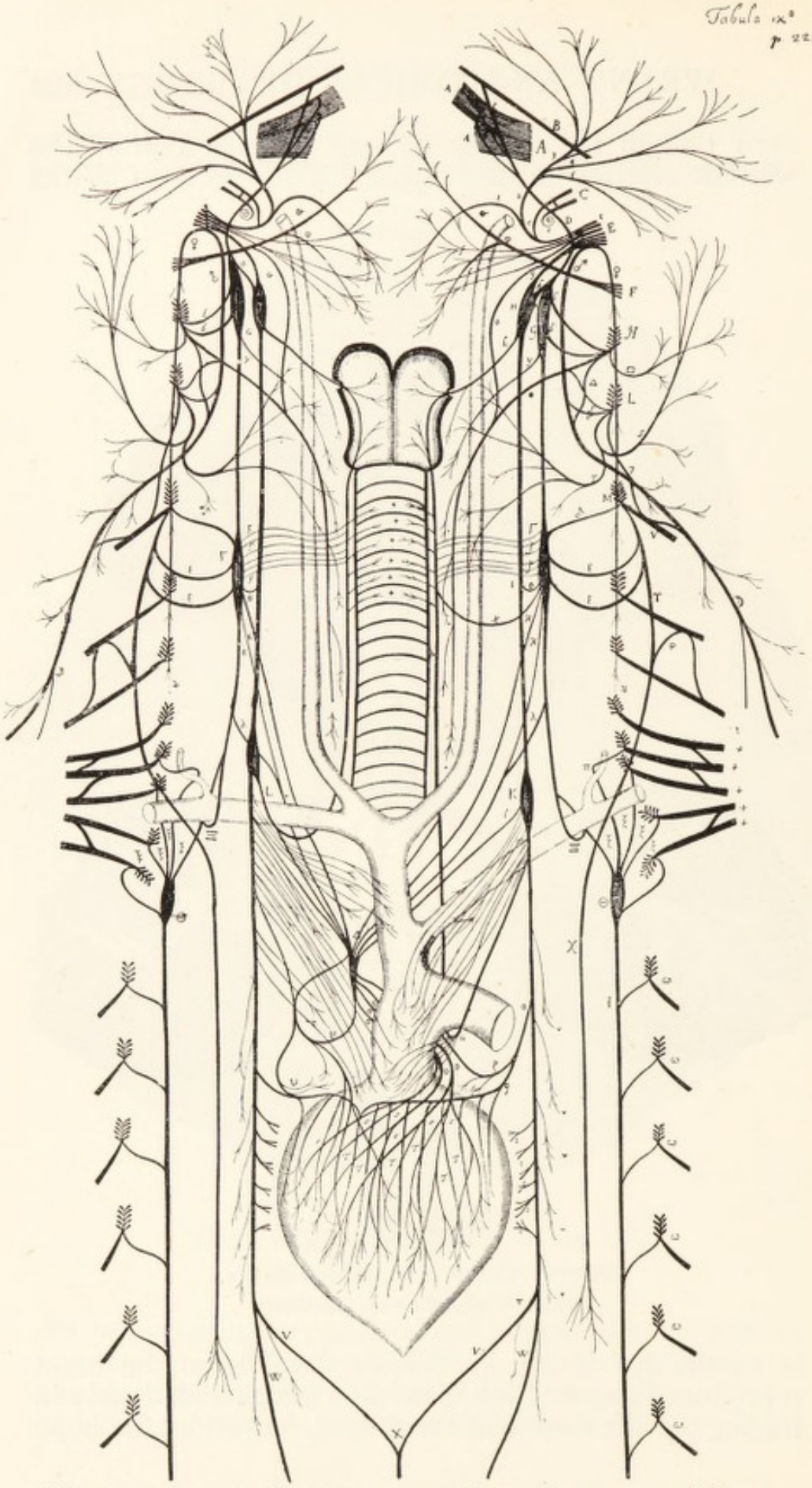
even though the supply by one or even two of the afferent arteries be interrupted. The Circle of Willis

Fig: VIII.ª



WREN'S DISSECTION OF THE BRAIN.
After Willis, Cerebri anatome.

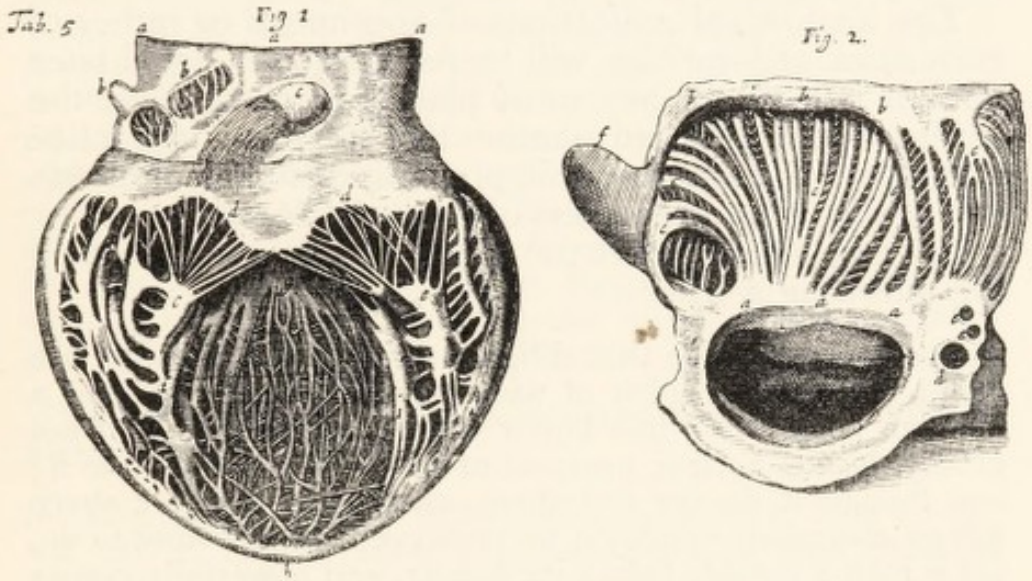
is admirably shown in Wren's drawing of the brain reproduced above. Both dissectors were indefatigable in tracing out the course of the nerves, led on by the hope



DISSECTION OF THE NERVES OF THE NECK. PERHAPS BY WREN.
One of the thirteen plates in Willis's Cerebri anatome, 1664.
Photographed from Sir W. Osler's copy.

of discovering the secret sympathies of the parts. Dr. RICHARD LOWER,[1] who helped, or rather instructed Willis in his book *De Cerebro*, eventually went to London where he 'was esteemed the most noted Physician'. He died in 1691.

Many important anatomical observations are contained in Lower's *Tractatus de Corde*. In addition to his physiological experiments, he therein describes the anatomy of



LOWER'S DISSECTIONS OF THE HEART, 1669.

the thoracic duct, through which the chyle reaching the blood 'serveth for the nourishment of the several parts of the body', and he infers that both arteries and veins must end in fine hair-like branching tubes which must freely communicate by innumerable branching capillaries too fine to be seen by the eye.

Several of Lower's observations are recorded by JOHN WARD, his intimate friend and pupil. On Nov. 16, 1664, Thursday, Lower and John Warde made a dissection 'first of ye Testicles, of ye spleen yn of a bitch wherein wee saw many excellent things; ye parastate; vasa deferentia, prostate and so ye common passages'.[2] He also continued Wren's work on the eye, and we have Pepys's evidence of his skill in the dissection of that organ:

[1] See pp. 66 and 130.
[2] *Medical Society's Transactions*, 1920, vol. 43, p. 276.

on 3 July 1668. 'To an alehouse: met Mr. Pierce, the surgeon and Dr. Clerke, Waldron,[1] Turberville[2] my physician for the eyes, and Lowre 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.'

The anatomical collections of specimens or rather of curiosities and rarities will be referred to in detail later on, but it may not be out of place before we leave the seventeenth century to mention that the present practice of preserving moist organic preparations in alcohol was one of the many inventions of ROBERT BOYLE.

In 1663 he recorded the result of his experience in the following words:

> Nor were it amiss that diligent tryal were made what use might be made of spirit of wine, for the preservation of a humane body: For this liquor being very limpid, and not greasy, leaves a clear prospect of the bodies immers'd in it; and though it do not fret them, as brine, and other sharp things commonly employ'd to preserve flesh are wont to do, yet it hath a notable balsamick faculty, and powerfully resists putrefaction, not onely in living bodies, but also in dead ones. And I remember that I have sometimes preserv'd in it some very soft parts of a body for many moneths (and perhaps I might had done it for divers years, had I had opportunity) without finding that the consistence or shape was lost, much less, that they were either putrifi'd or dry'd up . . . Nay, we have for curiosity sake, with this spirit, preserv'd from further stinking, a portion of fish, so stale, that it shin'd very vividly in the dark.

This observation was printed in 1663, just ten years after Boyle had settled in Crosse's lodgings in Oxford. We may therefore claim as an Oxford discovery Boyle's method for the preservation of moist preparations—a method which perhaps more than any other has helped to forward the progress of biological science. Three years later, when referring to the embryo of a chick that he had preserved or embalmed by this method, he noted

[1] Th. Waldron M.D. of Balliol.
[2] Daubigny Turberville of Oriel College. M.D. 1660.

that he sometimes added a little sal armoniack, observing that it never coagulated the spirit of wine.[1]

At least two of Boyle's spirit preparations were preserved for many years in the Museum of the Royal Society in London, where they were duly described by Nehemiah Grew in 1681. The oldest was one of

a young linet, which being first embowel'd, hath been preserved sound and entire, in rectified spirit of wine, for the space of 17 years. Given by the Honourable Mr. Boyl. Who, so far as I know, was the first that made trial of preserving animals this way. An experiment of much use. As for the preserving of all sorts of worms, caterpillars and other soft insects in their natural bulk and shape, which otherwise shrink up, so as nothing can be observed of their parts after they are dead. So also to keep the guts, or other soft parts of animals, fit for often repeated inspections. And had the Kings or physitians of Egypt thought on't, in my opinion, it had been a much better way of making an everlasting mummy.

The other spirit preparation was of a 'male humane foetus', of which:

the skin hath been kept white and smooth for so long a time, *scil.* above fifteen years, by being included with rectified spirit of wine in a cylindrical glass; to the middle of which the foetus is poised, by means of a glass bubble of an inch diametre, the neck whereof is fastned to the anus of the foetus by a wyer.

The use of spirit of wine as a preservative for all manner of natural objects was strongly advocated about 1689 by William Courten *alias* Charleton, 1642–1702, in his directions to his collectors:

Take Brandy, that of grain is as good as the other, to every quart take ½ a ^{tt} of Turpentine, a handful of sage and about ye bigness of a small nut of camphire, put these into a glass and distil them.[2]

Further he counsels:

That when ever the spirit becomes yellow you must distill it again and then put into it half ye quantity of a small nut of camphire.

[1] *Phil. Trans.*, 1666. [2] British Museum MS. Add. 3962.

The manner of stopping the bottles.

Boyle yor cork with bees wax and coñon oile using a moiety of each, rub the bladder with coñon oil puting ye innermost part of it into ye bottle first, then ye cork over it which you must cover with coñon wax and then cover it with another piece (?) of bladder then take *minion* and colour it round about.

Dried preparations were the rule at that time. John Evelyn's Tables of the Veins, already mentioned, are amongst the oldest now in existence. The preservation of animals in balsam came under discussion by the Oxford Philosophical Society in 1685, when Dr. Herman's collection of curiosities, preserved in that medium, was being described to the Royal Society on April 1.

The history of anatomical injections has recently been reviewed with scholarly care by Prof. F. J. Cole of Reading.[1]

Wren first suggested to Boyle at Oxford not later than 1656[2] to ligature the veins of a living animal, open them on the side of the ligature nearest the heart, and inject with 'slender syringes or quills fastened to bladders'. He recommended as the subject 'pretty big and lean dogs'. This operation appears to have been frequently practised in Oxford, and also in London before the Royal Society. 'And they hope likewise, that beside the *medical* uses, that may be made of this *invention*, it may also serve for *anatomical* purposes, by filling, after this way, the vessels of an animal as full as they can hold, and by exceedingly distending them, discover *new* vessels.' 'To Oxford, and in it, to Dr. CHRISTOPHER WREN, this invention is due.'

Wren, then a youth of twenty-four, injected wine and ale into the blood of a living dog by one of the veins, and noted that the animal became extremely drunk. The experiment he takes 'to be of great concernment and what will give great light to the theory and practice of physic', and Sprat refers to it as that 'noble anatomical experiment of injecting liquors into the veins of animals'.

[1] Cole, *Hist. of anatomical injections* in Singer's *Studies in the History of Science II.* Oxford 1921.

[2] 1659 is the date given in the *Phil. Trans.* for 1665, but Cole has pointed out the error.

Injections have been stated to have been a Dutch invention, but they were constantly employed by the early Oxford anatomists. Thus, Richard Lower in a letter to Boyle on June 24, 1664, writes: 'We took a little branch of the mesenterical artery, and syringed it with milk, and it ran into all the arteries of the mesentery, which was the pleasantest sight I have lately seen in anatomy. One thing more I tried, that the arteria hepatica goes into all parts of the liver; for if it be syringed, it (the milk) will come out of all the lobes of the liver, if you cut off the edge of them'. . . 'Without syringes, anatomy is as much deficient as physick would be without laudanum.'

The same anatomist in 1666 was the first to undertake transfusion of blood from an artery of one animal into the vein of another, and in the following year Jean Denys performed the same operation on a man—'a circumstance of great exultation to the French'. A few years earlier Boyle also, in discoursing *Of the Usefulnesse of Naturall Philosophy*,[1] suggested a medium for injections that solidified. 'Perhaps there may be some way to keep the arteries and the veins too, when they are empty'd of blood, plump, and unapt to shrink overmuch, by filling them betimes with some such substance, as, though fluid enough when it is injected to run into the branches of the vessels, will afterwards quickly grow hard. Such may be the liquid plaister of burnt Alabaster, formerly mention'd, or ising-glass steeped two days in water, and then boild up, till a drop of it in the cold will readily turn into a still gelly. Or else Saccarum Saturni,[2] which, if it be dissolv'd often enough in spirit of vinegar, and the liquor be each time drawn off again, we have observ'd to be apt to melt with the least heat, and afterwards to grow quickly into a somewhat brittle consistence again.'

This, Grew[3] believed to be the first unequivocal mention of the use of injection media which solidify like wax. Whether Boyle did actually use wax is uncertain. He was always very reticent about his achievements. Willis at any rate found an immediate

[1] Published in Oxford 1663.
[2] Lead acetate, or Sugar of Lead.
[3] Grew, *Musaeum Regalis Societatis*, 1681, p. 8.

use for the new method. He had previously injected the carotid artery with liquor 'tincted' with saffron, but used ink for demonstrating the *rete mirabile* of ruminants and, in 1672, the vascular system of a lobster. The media which yielded the best results were 'quicksilver, hot and flowing gypsum, wax mingled and made liquid with oyl of turpentine, or some such matter'.[1]

By the use of these and kindred media new powers of preserving were in the hands of curators of anatomical museums, but it was not in Britain that the highest results were obtained. Frederik Ruysch, 1638–1731, of Amsterdam brought the art of preserving to far greater perfection. 'All the bodies which he injected had the tone, the lustre, and the freshness of youth. One would have taken them for living persons in profound repose, their limbs in the natural paralysis of sleep. It might almost be said that Ruysch had discovered the secret of resuscitating the dead. His mummies were a revelation of life, compared with which those of the Egyptians presented only the vision of death.'[2] Erndtel, one of the foreign visitors to Oxford, visited him in 1706 and saw at his house 'an incredible quantity of Anatomical preparations and a wonderful treasury of natural curiosities, excellently preserved as if fresh'—better, in fact, than if preserved by the secret methods of Bilsius. Unfortunately Ruysch never published his methods, and in 1717 his museum, containing over 1,300 anatomical preparations in liquid, was purchased by Peter the Great and removed to St. Petersburg. But Ruysch's notable success in the application of the methods discovered by earlier Oxford experimentalists, became an undoubted incentive to the curators of other anatomical collections.

The state of anatomical studies of the time in Oxford was summed up by Dr. Wallis in a letter dated Nov. 1700.[3] Dr. Wallis wrote that

> Dr. Musgrave while he was Fellow of New College (upon request of some persons agreeing for that end) did with them go through a course of Anatomy; and the like hath been

[1] T. Willis, *Pharmaceutice Rationalis*, Oxford 1675.
[2] Cole, *Anatomical Museums*.
[3] Dr. Wallis, *Letter*, Nov. 1700. Reprinted in *Collectanea*, Oxf. Hist. Soc. 1885.

done (more or less) by Dr. Willis, Dr. Lower, Dr. Hannes and others, for their own satisfaction, and for the information of such others as have desired it. And now of late Dr. Keil,[1] sometime at Oxford and sometime at Cambridge alternately, hath with divers companies (successively) gone through a course of Anatomy.

And there seldome happens a publike execution of condemned persons but that one or more bodies are privately dissected for that end. And, at other times, the like is oft performed on the bodies of other animals; whereby many usefull discoveries, in anatomy, have been here made, which were not before observed.

But Doctors trained solely on anatomy did not impress every one, and there may have been a modicum of truth in the criticisms and caricatures made of such men as Lower, Wharton, and Willis. 'They flay Dogs and Cats; take livers, lungs, calves-brains, or other entrails, dry, roast, parboil them, steep them in vinegar, etc., and afterwards gaze on little particles of them through a microscope:—then obtrude to the world in print whatever false appearances gleamed into their eyes; and all this to no other end, than to beget a belief in people that they who have so profoundly dived into the bottomless pores of the parts, must undeniably be skilled in curing their distempers.'[2] After the foundation of the Oxford Philosophical Society, the most active anatomists in Oxford appear to have been Drs. Pitt of Wadham College and W. Musgrave of New College, both of whom were greatly interested in physiological questions.

The former informed the Royal Society on April 8, 1685, when he was admitted a Fellow, that the coecum was full of glands.

Instruction does not seem to have been conducted in a very regular manner, and we are indebted to one of our foreign visitors for an interesting note on an Anatomy Lecture in August 1710.

[1] James Keill, of Northampton (1673-1719), author of *The Anatomy of the human body abridged*, 1698, was the younger brother of John Keill the Newtonian, translated Lemery's *Course of Chemistry* in 1698, thereby introducing English chemists to the current theory of the relation of acids and alkalies. He spent eight years in confirming the experiments of Sanctorius and was amongst the first to measure the velocity of the blood flow.

[2] G. Harvey, *The Conclave of Physicians*, 1686.

'In the afternoon [of August 28] the Messrs. Grassy took us to their countryman, D. Lavater of Zurich, a grandson of the well-known theologian and son of the Professor of Medicine at Zurich, to hear the beginning of a *Cursus Anatomicus*. As he had only recently obtained a license to lecture, and had no corpses to dissect, (which he was hoping to obtain from London), he began with Osteology. He certainly gave an excellent account of the production, nutrition and classification of the bones, and he is said to have uncommon knowledge and skill in Anatomy. Among other things he showed the production of bones on the skull of an embryo very clearly, how the fibres are quite soft at first and only in time acquire hardness and a bony nature *per accretionem*; and further how the fibres for greater consistency and firmness, all run from the centre to the periphery. He lectured in English, which he speaks fairly fluently. Englishmen would not have understood his Latin very well, partly because of his pronunciation, partly from their ignorance of the language. I was surprised at the ignorance of the people, how everything is so strange to them, and yet there are some old *socii* among them. About twelve people attend the lecture regularly. The place devoted to this *Cursus Anatomicus* is a small vaulted room under the Ashmolean and behind the Laboratory, and well adapted to Anatomy on account of the coolness.'

For the supply of subjects for dissection Oxford anatomists were still dependent upon the gallows of Oxford and Abingdon. By the before-mentioned Act of Charles I

the Tomlins lecturer is impower'd every spring, to demand the dead body of any condemn'd Malefactor, suffering Death within one and twenty miles round *Oxford*, before it is interr'd by directing his Precept or Warrant to the Sherriff, Under-Sheriff, or his Bailiffs, etc for procuring and delivering up the same; which Body shall be dissected by a skillful Chirurgeon in the presence of this Professor, who is publickly to read thereon, and to shew and describe the Situation, Use, Nature and Office of all the parts of the Body, at four distinct Lectures, as prescrib'd in the Statute made for this purpose. This Lecturer is also every *Michaelmas* term to read three distinct Lectures on a Skeleton, and to give an account of the Bones and their Office, Situation etc. And to this Lecturer there is yearly paid by way of Pension 25*l.* viz. 12*l.* 10*s* at *Lady Day*, and the same at *Michaelmas* out of which Pension the Lecturer pays three pounds to the Chirurgeon for pre-

paring the Body, and 40*s* for burying it. All Students in *Physick*, and Chirurgeons, in the University, are oblig'd to hear this Professor read his said Lectures, under the Pain of 2*s* Mulct *toties quoties* absent. The Chirurgeon is in the Nomination of the Professor.[1]

The dissection usually took place in the Lent Term, when a body was procurable, but in 1714, according to the author[2] of an *Essay towards the improvement of Physic*, it was not easy for students to get a body to dissect at Oxford, 'the mob being so mutinous'. In 1719 private lectures on Anatomy were advertised in the newspapers[3] to be delivered by CHRISTOPHER FURNEAUX, Fellow of Exeter College, assisted by THOMAS BLATHWAIT, surgeon.

Subscriptions are 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 provision of bodies was regarded by students as one of their rights under the statutes, so much so that on one occasion when the body of a criminal was not forthcoming in 1721 they seized upon the child of its unfortunate parents who were conveying it in a coffin to be buried, and carried it into Exeter College, where it was dissected.[4] The anatomy lecturers at about this time were CHARLES TADLOW of St. Johns, 1716, and PHILIP CODE of All Souls.

The next reader in Anatomy, Dr. FRANCIS NICHOLLS,[5] of Exeter College, was the most distinguished anatomical teacher of 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. Corroded anatomical preparations

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

[2] J. Bellers, the quaker, quoted by G. C. Peachey, *A Memoir of William and John Hunter*, 1924.

[3] *Daily Courant* 2 March 1719, quoted by Peachey, *l. c.*

[4] Hearne, *Collections*, and another instance in vol. 91 under date March 31, 1721.

[5] For a recent account of Nicholls see the sketch of the early teaching of anatomy in England to 1746 in Peachey, *W. and J. Hunter*, 1924.

were first made in Oxford by him,[1] and with such success that he has been widely credited with their invention, but the idea was probably borrowed from the Dutchman, Govard Bidloo,[2] 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. Nicholls's art in the making of injections was known to and commended by Cuvier and, doubtless, in 1741 he transmitted the technique to his pupil WILLIAM HUNTER, who may therefore also be regarded as a scion of the Oxford school.

In a manuscript copy of Hunter's lectures, now in the possession of Professor Cole, four lectures out of eighty-two are devoted to injection methods. 'He states that nothing has contributed more to the promotion of anatomical discovery, and that "there is no making a good practical anatomist without it". His watery injections are made from glue, isinglass, or gum arabic, and for the finest injections he used turpentine thickened with a little resin.' He also made lead casts of the vascular and other body cavities.

Before 1738 Dr. Nicholls had deserted the anatomy school, and about that year NATHAN ALCOCK, M.D. of Leyden, began lectures on his own account. He taught Physic also, as the aged Regius Professor, Woodford of New College (1730-59) made a sinecure of his office. The University was shamed into appointing a Chemistry Reader, T. Hughes, M.D., Trinity, and summoning Dr. THOMAS LAWRENCE from London to lecture in Anatomy.[3] Alcock was allowed a room by his own college, Jesus. This was crowded, while the authorized readers addressed the walls of the empty museum, which at last they resigned to their rival. Alcock received his degree of M.A. in 1741 by decree of Convocation after some opposition, and proceeded M.B. in 1744.[4]

[1] Frank Nicholls (1699-1778), *Compendium Anatomico-Oeconomicum*, London 1736. He was also the author of *De Anima Medica* 1750 and *De motu Cordis et Sanguinis* 1775.

[2] Bidloo's *Anatomia* was printed in 1685.

[3] Lawrence advertised lectures 'At the corner of Lincoln's Inn fields near Clare Market'. *London Evening Post* 27 Sept. 1743, 7 Jan. 1746, 12 Jan. 1748.

[4] Wordsworth, *Schol. Acad.* The succession of Anatomy Lectures during the Regius Professorship of W. Woodford was

An advertisement that appeared in Jackson's *Oxford Journal* for August 18, 1753, seems to indicate that medical students were not less reticent about appearing in public than now. It is obviously intended to refer to Dr. Alcock.

This is to inform the Publick

That on the first Day of *Michaelmas* Term next, there will begin at the *Laboratory* under the *Museum*,

A Course of Anatomy

By RICHARD LUMMY, *formerly Bone-scraper to several eminent* Anatomists, *and now Retailer of Scandal to the* Old Interest.

AT the Time when the most unexceptionable Characters are exposed to Defamation, to obviate Reflections it cannot be thought impertinent to declare, that although the Lecturer has taken no degree in Physick, nor ever studied the Science of Anatomy in the vulgar mechanical Way, yet he humbly conceives that by the Advantage of a retentive Faculty in appropriating to his own use the System of an excellent Preceptor, whom he served for many years in an inferior Capacity, he is properly qualified for the Province he proposeth to engage in. His Lectures being fairly transcribed, any Person who has a bad Ear or a short Memory, shall be at Liberty to enrich his Common Place Book from the Original.—That the work he intends to communicate is not his own composition, he apprehends will be no Disparagement, but the greater Recommendation of it. On this Occasion he will outshine himself by a borrowed light.

After describing

Vices (great as his Imperfections are) which the Operator in Anatomy holds in Detestation.

the writer concludes:

Should it be recollected that he was discarded by Dr. A——k for ill Behaviour, let it be remember'd, that within the memory of man a Lecturer of higher Rank was turn'd out of his Station with Ignominy for Insolence and Ingratitude to his Constituents. For further Anecdotes the Anatomist

Nicholls 1729; Lawrence 1745; Alcock, unofficial; J. Smith *c.* 1757. The London Anatomy Lecturer of 1744–5, John Freeman, may have been the son of J. Freeman, vintner of Oxford. He was apprenticed to T. Bigg, the surgeon, for 7 years for a premium of £367 10*s*.

appeals to his Life, which is near finish'd, and will be offered to the Publick with all convenient Expedition.

In his enumeration of great men of Science Sir A. Shipley alludes to the fact that one who was perhaps the greatest of all British anatomists JOHN HUNTER (1728–93) had resided for some terms at Oxford, where, fortunately for science, his training did not materially detract from his after success in his life's work. 'They wanted to make an old woman of me, or that I should stuff Latin and Greek at the University, but', he added significantly, pressing his thumb on the table, 'these schemes I cracked like so many vermin as they came before me'. In view of this, his own criticism of his studies in Oxford, an account of his anatomical work can hardly be incorporated in this volume, but it may be noted that in 1783, exactly one hundred years after the opening of the Ashmolean Museum of Natural History in Oxford and one hundred years before the opening of the Natural History Museum at South Kensington, John Hunter built his large Anatomical Museum in Leicester Square. However, the inadequacy in the Oxford equipment was soon to be made good.

Dr. Lee's Readerships and the Anatomy School at Christ Church.

In 1750 Dr. MATTHEW LEE of Christ Church founded a Readership for anatomy in connexion with his own college, and provided the funds for a building, the Anatomy School, for dissections, the delivery of lectures, and for a museum. Lee was a Westminster Student of Christ Church, who held one of the Studentships given to the Faculties of Law and Medicine. He had practised as a doctor, first in Oxford, then in London, and dying in 1755 left his estate to trustees, to pay certain sums to (1) his wife and (2) to Mrs. Knapp, who died in 1759 and 1761 respectively. And then there were to be seven benefactions, including (5) £100 yearly 'for the maintenance of a Lecturer of Anatomy', to be appointed under very stringent conditions. He was to be a Westminster Student of Christ Church and an M.A., studying Physic in the University of Oxford; he was to

be a layman, and if he took Orders was *ipso facto* disqualified; he was 'to take, teach and instruct no Gentleman Pupil or Pupils in any Art or Science except Anatomy, Physick or Botany', and was to go through two 'regular and compleat courses of Anatomy each year, in each of which he shall dissect at least one adult human body and distinctly explain and regularly demonstrate all the bones, viscera, blood vessels, muscles, nerves and all other parts of the human body with their respective uses'. Four students and two commoners selected by the Dean might attend his lectures free, the others were to be charged a fee.

(6) Dr. Lee provided that £40 per annum should be paid towards the expenses of making proper anatomical preparations, and procuring at least two adult human bodies. There was a penalty for failure in performance of this duty.

(7) £30 yearly was to go to instruction of four Westminster Students in Mathematics and Experimental Philosophy in all its branches. Their course was to last three years. Thus £140 per annum was to go to Anatomy and the main object was the advancement of Westminster Students. The Court of Chancery sanctioned the arrangements in 1765.

The Lee's Anatomy School was built in 1765 on the south side of Christ Church under the direction of JOHN PARSONS, 1742–85, of Christ Church,[1] who was nominated first Lee's Reader in Anatomy in the year he took his M.A. and three years before his M.B. He provided excellent preparations, and read two courses of lectures in anatomy every year. Francis Nicholls's *Compendium Anatomico-Oeconomicum*, an illustrated syllabus of 39 lectures first delivered in 1746, was still being used as a text-book at Christ Church thirty years later. F. H. EGERTON, 1756–1829, of Christ Church and All Souls, as a medical student in February 1777 used an interleaved copy of the Compendium as a note-book.[2] Egerton has one or two notes of local interest, as for instance, that 'A stone of a considerable size was found

[1] Cf. *A select account of the late Dr. J. Parsons, Professor of Anatomy in Oxford*, 1786.

[2] Presented by Richard Walker, with other scarce books, to Magdalen College Library.

on dissecting the pelvis of Strap, executed for murder in March 1775 at Oxford' (p. 28).

In 1780 Parsons was elected first Lichfield clinical professor of the Radcliffe Infirmary. By this ample provision of an Anatomy School at Christ Church the need for the old Anatomy School near the Bodleian was superseded, and being found to be admirably adapted for an extension of the growing library, was emptied of contents, which the librarian was pleased to describe as heterogeneous and gruesome, and was finally in 1789 fitted up for Greek and Biblical manuscripts. In 1794 it was called the 'Auctarium'.

The Anatomy School at Christ Church.
From Ingram, *Memorials of Oxford.*

The new Anatomy building was adorned by two skeletons which were said to be the bones of criminals hanged at Oxford,[1] and so it was almost a foregone conclusion that that quarter of the House should have gone by the name of *Skeleton Corner.* Ingram[2] describes the lecture room as affording space enough for an interesting collection of preparations illustrative of human and comparative anatomy, which were ranged round the walls in neat glass cases. There were also several beautiful wax models of the human body, executed at Florence, which had from time to time been purchased by the Dean and Chapter of Christ Church, in pursuance of the intentions and views of the founder of the Anatomy School. Below the lecture room were spacious apartments for carrying on dissections.

[1] Cox, 1790, *Recollections.* [2] *Memorials,* 1837.

Sir Christopher Pegge, Fellow of Oriel, as Regius Professor of Medicine 1801-22, and Lee's Lecturer in Anatomy, at first attracted a numerous class. 'It was then thought not *to be the thing* to leave Oxford without attending one course of these lectures, and the propensity to hard reading *for the Schools* had not yet set in so strong as to leave no spare time for other pursuits.'[1] But later on Sir Christopher, who had been one of the lights of the medical school in the last decade of the eighteenth century, is described as a 'desultory' lecturer, so much so 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'.[2]

A visitor, Dr. Gibbes, Physician to the Bath City Infirmary (1801–22), has the following note:

> By the indulgence of Dr. Pegge, the anatomical Professor at Oxford, I was permitted to examine the receptacle in which the bodies are deposited, after he has finished lecturing on them. This place is a hole dug in the ground to the depth of about 13 or 14 feet; and to remove all offensive smell, a little stream is turned through it.

In 1818, at the same time that the *Kaleidoscope* found its way even into the drawing-rooms of our gravest dignitaries, *Craniology*, afterwards called *Phrenology*, 'with a good deal to say for itself, but not enough to establish its claim and justify its pretensions, demanded to be admitted among the sciences'.[3]

[1] Cox, *Recollections of Oxford*, 1870, p. 141. At the age of 25 he assumed wig, large turned-up hat and gold-headed cane. He and his contemporaries were described in

The Oxford Medical trio.

I would not call in any one of them all,
For only 'the weakest will go to the *Wall*';
The second, like Death, that scythe-armed mower,
Will speedily make you a *peg* or two lower;
While the third with the fees he so silently earns,
Is 'the *bourn* whence no traveller ever returns'.

Circe, alias Sir C[hristopher]

'Like Circe, Sir C. can prescribe a mixt cup,
But mixtures Circeian beware to drink up.'

[2] Lord Holland, *Further Memoirs of the Whig Party*, 1807–1821.
[3] Cox, *Recollections*, p. 93.

In 1822 Dr. KIDD succeeded to the Anatomy Readership, but he abandoned the cocked hat, wig, and gold-headed cane of his predecessor. According to Tuckwell[1] he was 'a little man, trotting' about the streets in a 'spencer', a tailless great-coat then becoming obsolete, and worn only by himself and Dr. Macbride. Although spoken of by Henry Acland, with all the reverence of a grateful pupil, as 'an admirable man gifted with a real scientific insight', he appears to have let down the study of anatomy in Oxford. On the resigning of his Lee's Readership, his class consisted of one or two members of Christ Church, and one from another College, with an occasional medical apprentice from the town.

Important administrative changes occurred during Kidd's tenure of the Readership. The history of the Lee Trust is somewhat intricate, but it may be summarized as follows. The Lee estate realized a capital sum of about £30,000. This was expended in the purchase of two estates, one in Bucks, the other in Warwickshire. From the date of purchase in 1775 the income increased, and in 1825 the Dean and Chapter asked for an improved scheme which was granted by the Court of Chancery in 1827. Dr. Lee's Reader in Anatomy was to have £200 instead of £100 per annum. There was added a charge for the increase of the living of Butler's Marston (the parish in which the estate lay), and the living was limited to Westminster Students. In 1832 the Dean and Chapter again went to the Court of Chancery owing to difficulties that had arisen through the passing of an Act of Parliament restricting the use of bodies for dissection. Dr. Kidd obtained leave to lecture on models and preparations instead of on actual bodies: but the Act was repealed, or became inoperative before the Court of Chancery had adopted any conclusion. (*Report of 1852 Commission*, Part ii, p. 282.)

The arrangements at Christ Church were not such as commended themselves to any one of international experience, and Dr. Carl Gustav Carus, physician to the Court of Saxony, reported adversely.[2]

[1] *Reminiscences of Oxford*, 1901, p. 61.

[2] Carus, *The King of Saxony's journey through England and Scotland in 1844*.

We have also visited the *theatrum anatomicum*, the whole arrangements of which brought back the arrangements of Vesalius to my mind. Above the Professor's table, hung a human skeleton, and a figure showing the muscular conformation of the human subject, so that they could be let down and drawn up again by cords: the latter was that sort of preparation which Albinus was celebrated for, and is such as to cause a feeling of disgust in an uninitiated spectator. All round the theatre, behind the amphitheatrical seats of the audience, were skulls and anatomical preparations, everything quite in the antique style. Professor Kidd, a good-natured old gentleman, quite corresponded with these ancient treasures. He may, probably, formerly have had some talents, or at least some liking for personal activity and inquiry. But, at a later period, without any excitement from without in a University devoted almost entirely to philology and theology (which is indeed no *Universitas*) and without sufficient inward power and excitement, the stagnation of all philosophical study, of natural history, soon put a stop to his activity.[1]

Dr. Kidd made frequent gifts of zoological specimens to the Ashmolean Museum and evidently approved of the extension of the anthropological and anatomical series there. To the 'tatooed head of a New Zealand Chief killed in battle and dried by the natives' presented by Justly Hill of New College in 1822, Kidd added plaster casts of the crania of natives of Nookta Sound and Otaheite, and was doubtless consulted in 1824 when two examples of the anatomical craftsmanship of J. Paxton of Oxford and of the Royal College of Surgeons were presented to the Museum by the maker. They were:

A model in wax representing the distribution of the nerves of the face; consisting of the Pes anserinus, the frontal nerve, and the infra orbitary nerve, their ramifications, and their union with each other.

and

A model of a recently dissected foot, showing, 1st, the cellular and compact structure of the bones; 2nd, the muscles

[1] Atlay, *Acland*, 1903.

and their tendons; 3rd, the arteries, injected red; 4th, the veins, injected blue, and the upper portion opened to show the valves; 5th, the white nervous cords and filaments; 6th, the absorbent vessels injected with quicksilver.

To these J. S. Duncan added 'An injected foot'.

Kidd resigned in 1845. HENRY WENTWORTH ACLAND was appointed in his place, and delivered his inaugural lecture on Oct. 22, 1845, in the Lecture Theatre at Christ Church. He introduced Histology into Oxford. We have the description by an original member of his class, W. Tuckwell. 'The lectures were delivered in the downstairs theatre, whence we ascended to the room above to sit at tables furnished with little railroads on which ran microscopes charged with illustrations of the lecture, alternately with trays of coffee. A few senior men came from time to time, but could not force their minds into the new groove. Dr. Ogle, applying his eye to the microscope, screwed a quarter inch right through the object, and Dr. Kidd, after examining some delicate morphological preparation, while his young colleague explained the meaning, made answer first, that he did not believe in it, and, secondly that if it were true, he did not think God meant us to know it. So we were mostly undergraduates; and greatly we enjoyed lectures, microscopes, and the discussions which Dr. Acland encouraged.'[1]

After 1850 the University took increased interest in Science. Dr. Acland, who was made Lee's Reader in 1845 and Regius Professor in 1857, was strongly of opinion that it was the business of the University to establish a vigorous school of Natural Science, but not to attempt the special training required by Medical men.[2] It would appear that in consequence of this view of Dr. Acland's (as the income of the Lee trust was still improving), the Lee's Readership in Chemistry was founded in 1857.

The Ordinance of 1858 legislated for two Lee's Readerships in Anatomy and Chemistry. In 1860 the Dean and Chapter went to Court for a further scheme, and a serious departure was made from Dr. Lee's original scheme. The

[1] Tuckwell, *Reminiscences of Oxford*, p. 45.
[2] Evidence to Commissions of 1852 and 1877.

Court sanctioned the application of a part of the revenue for Lectures in Law and Modern History, and for exhibitions to persons studying Law, Modern History, Physiology, and Mathematics; and Mr. Sidney Owen became Lee's Reader in Law and Modern History. In 1866 the Court increased the payment of the Lee's Reader in Modern History, abolished the Exhibitioners, and substituted Lecturers with permission to teach any Sciences or subjects recognized in the University Examinations. This arrangement terminated about 1869.[1] Acland's view was that the Lee Trust was available for the general purposes of Natural Science in Oxford: and this also appears to have been the view of Rolleston. This principle governed the loaning of the Collections, which were originally kept in Christ Church, and are now in the Museum on loan from the Governing Body. 'When Acland became Reader there were no Collections or preparations of any kind.'[2] The Collections were made on the Hunterian principle in order that Students who went to pursue their studies in London might find themselves at home in the Collections there (p. 283). Dr. Rolleston continued this policy, and was supported by grants from Christ Church.[3]

Lee's Reader in Anatomy was originally to reside for six months in each year: later he seems to have combined his functions in Oxford with work in London. His stipend was £200 a year. After 1858 Lee's Readers were required to reside and teach, and their income was raised from time to time till it reached the limit which the present Statute prescribes. This increase, with a decrease in proceeds from the Lee estate, has made it necessary to supplement Lee income from the corporate revenues.

It was found in 1912 that only a small fraction of the annual income devoted to Lee Professors and Readers came from the Lee estate. The Governing Body was anxious to associate the name of Lee with its contributions to Natural Science, but in view of the small proportion which the proceeds of the Lee estate bore to the complete charges upon the House, Christ Church

[1] Minutes of Governing Body of Christ Church.
[2] Report of Royal Commission of 1852, pp. 282 foll.
[3] Evidence to Royal Commission, 1877, pp. 270 foll.

thought themselves justified in making any arrangements which the needs of the University might require.

Some details of the expenditure of the Lee income from 1796 to 1860 are printed at the end of the section on Zoology since they refer principally to the study of Zoology and of *Comparative* rather than to that of *Human* Anatomy.

Note to p. 63.

EDMUND DICKENSON 'was one of those very great men whose merits are better known abroad than at home'. *Hermippus Redivivus*, 1771, p. 160.

Note to p. 92.

NATHANAEL HIGHMORE

Dr. Petty to the Hon. Mr. Boyle. Dublin, April 15, 1563.

'My cousin Highmore's curious hand hath shewn you so much of the fabric of man's body, that you cannot think but that so complete a piece as yourself will be always at some little fault or other.'

THOMAS SYDENHAM

MEDICUS IN OMNE AEVUM NOBILIS

Memorial in St. James's, Piccadilly.

IV

PHYSIOLOGY

The composite Science of Physiology had its birth in that short but prolific period when the Natural Sciences were studied as though there were no barriers between them, with the result that great and simultaneous advances were made by a band of researchers that was remarkably small. Physiology came into being when the methods of experimental Physics and Chemistry were sufficiently well based to admit of their being applied to the living organism; and in both departments the Oxford leaders of science in the seventeenth century played a conspicuous part. By showing that the by-paths of physics and chemistry could be brought into the service of humanity, they stimulated a progress which is comparable to that of the rapid exploration of the physiological properties of radium and X-rays in modern times.

Since the first names that will be mentioned are those connected with fundamental discoveries relating to the circulation and to respiration, it will not be out of place to consider the state of knowledge on these subjects before the advent of our own pioneers in the seventeenth century.

Apparently before the middle of the sixteenth century no progress was made on the teaching of Galen, and it does not seem to have occurred to any one that it was possible to advance beyond his views. Oxford students would have been taught that there were two bloods, the natural and the vital, in two practically closed systems, the veins and the arteries. The liver was the central organ of the venous system, the 'shop', as Burton of Christ Church calls it, in which the chylus was converted

into blood and from which it was distributed by the veins to all parts of the body for nourishment. The veins were rather vessels containing the blood than tubes for its transmission, 'irrigating canals', as Galen called them. Galen knew the structure of the heart, the arrangement of its valves, and the direction in which blood passed, but its chief function to him was not, as it is to us, a mechanical one: the heart was the seat of life, in the left ventricle were the vital spirits generated by a mixture of inspired air and blood. By an alternate dilatation and collapse of the arteries blood and vital spirits were kept in constant motion. Galen had demonstrated that the arteries and the veins communicated at the periphery. A small quantity of the blood went, he believed, from the right side of the heart to the lungs, for their nourishment, and in this way passed to the left side of the heart; but the chief communication between the two systems was muscular through *pores in the ventricular septum*, the thick wall separating the two chief chambers of the heart.

Even after the new views of Harvey had been expounded, an author as responsible as Robert Burton of Christ Church, when summarizing the medical knowledge of his day, was still able to write that 'The left creek (i.e. ventricle) has the form of a cone, and is the seat of life, which, as a torch doth oil, draws blood unto it begetting of it spirits and fire, and as a fire in a torch so are spirits in the blood; and by that great artery called aorta, it sends vital spirits over the body, and takes air from the lungs'.[1]

Such was the darkness the pioneer physiologists broke through. The honour of the first step forward is due to a Spaniard, Michael Servetus,[2] of Villanueva da Sigena, physician and martyr to science, burnt on the field of Champel at Geneva, an offering to the Moloch of theology. Sir William Osler has noted that Servetus had the advantage of the most stimulating education in anatomy to be had then in Europe. He had studied in Paris with Sylvius, and had been prosector to Guinther, two of the most ardent of the revivers of the Galenic

[1] *Anatomy of Melancholy*, p. 175, quoted in Osler, *Servetus*. 8vo, Lond. 1909.

[2] Servetus lived from 1509? to 1553.

anatomy; he was fellow-student and prosector with Vesalius, and by his genius he proved a worthy colleague. He found out that the *venous blood on the right side of the heart passes to the left through the lungs*, i.e. he discovered the pulmonary or lesser circulation. But so little did he appreciate the significance of his discovery that, instead of making it the theme of a treatise, he merely used it as an illustration in a discussion on the nature of the Holy Spirit in the fifth book of his *Christianismi Restitutio*. There he circumstantially narrates how the blood is transmitted from the right ventricle, not through the septum or mid wall of the heart, but 'from the pulmonary artery to the pulmonary vein, by a lengthened passage through the lungs, in the course of which it is elaborated and becomes of a crimson[1] colour. Mingled with the inspired air in this passage, and freed from fuliginous vapours by the act of expiration, the mixture being now complete in every respect, and the blood become fit dwelling-place of the vital spirit, it is finally attracted by the diastole, and reaches the left ventricle of the heart.'[2]

The discovery was soon 'in the air'. Realdus Colombus in 1559 and Caesalpinus in 1569 have each been held to have first discerned the fact of the lesser circulation; but neither they nor any one else can be regarded as having forestalled Harvey as the first to discover the general circulation and to demonstrate the complete circulation of the blood by experimental methods.

But, on the whole, physiology at the time of Harvey was as Galen had left it; and the anatomy of man, as taught in the schools, was based on the anatomy of monkeys. Meanwhile the practice of exact observation was rapidly gaining ground in all Sciences. Although in Medicine the great name of the illustrious Harvey, 'the greatest physiologist the world has seen' (Munk), will at once rise up in the mind of any one who may be assessing

[1] Dr. Singer has pointed out that Servetus wrote *flavus*, which can hardly be translated crimson.

[2] R. Willis's (*Servetus and Calvin*, 1877, pp 207–8) translation of the passage in the *Christianismi Restitutio* (1553, pp. 170–1) dealing with the pulmonary circulation. See also his *William Harvey*, 1878, pp. 70–86.

the contributions of our University to the science of Physiology, yet Oxford can hardly lay claim to Harvey, because his views on the Circulation of the Blood were expounded, long before he came up to Oxford, in the Lumleian lectures delivered before the College of Physicians from 1616 onwards, and they were published in his *Exercitatio Anatomica de Motu Cordis et Sanguinis* in 1628, just seventeen years before a Royal mandate elected him Warden of Merton College.

But if Cambridge trained the man who discovered the Circulation, it was Oxford that produced the virtual discoverer of oxygen, JOHN MAYOW, of All Souls College, on whose groundwork rests all our later knowledge of Respiration. In his own language, 'Respiration consists in the separation from the air by the lungs, and the intermixture with the blood-mass, of certain particles absolutely necessary to animal life, and the loss by the inspired air of some of its elasticity. The particles of the air, absorbed during respiration, are designed to convert the black or venous blood into the red or arterial.' Mayow also declared the placenta to be the lungs of the foetus, and knew that stimulation of the third nerve contracts the pupil.

Oxford was, however, connected with Harvey's later work, on Generation, 'a golden fleece, a vast treasure ... of admirable observations' (Sir George Ent[1]); it is entitled *Exercitationes de Generatione Animalium, quibus accedunt quaedam de Partu, de Membranis ac Humoribus Uteri: & de Conceptione*, 4to, 1651. Its immediate success may be gauged by the fact that four editions appeared in 1651. We know that in the preliminary studies for this work GEORGE BATHURST of Trinity College assisted Harvey. He kept a sitting hen in his chamber at Trinity to incubate the eggs which they opened daily in order to ascertain the progress and way of generation. It is possibly at this time that another scientific Fellow of the College, the ingenious FRANCIS POTTER, B.D. (1594–1678), whose name has been mentioned several times already in connexion with his mechanical and horological contrivances, may have

[1] Geo. Ent, of Sidney Sussex College, incorporated at Oxford in 1638. His Anatomy Lectures are contained in MS. Ashmole 1476.

made the acquaintance of Harvey and have learnt from the master's own lips of the physiology of Circulation. And having thus acquired first-hand knowledge of experiments, his active mechanical mind may have been led to imagine the possibility of the transfusion of blood from one animal to another. John Aubrey[1] records the circumstances as follows:

[At] the Epiphanie, 1649, when I was at his house, he then told me his notion of curing diseases, etc. by transfusion of bloud out of one man into another, and that the hint came into his head reflecting on Ovid's story of Medea and Jason, and that this was a matter of ten yeares before that time. About a yeare after he and I went to trye the experiment, but 'twas on a hen, and the creature to little, and our tooles not good: I then sent him a surgeon's lancet. Anno... I received a letter from him concerning this subject, which many yeares since I shewed, and was read and entred in the bookes of the Royall Societie, for Dr. Lower would have arrogated the invention to himself and now one (Richard Griffith) Dr. of Physique, of Richmond is publishing a booke of the transfusion of bloud,[2] and disires to insert Mr. Potter's letter: which I here annex *in perpetuam rei memoriam*.

Worthy Sir,

I am sorrie that I can as yet give you no better account of that experiment of which you desire to heare. I am as yet frustrated *in ipso limine* (but it is by my owne unexpertnes, who never attempted any such thing upon any creature before); for I cannot, although I have tried divers times, strike the veine so as to make him bleed in any considerable quantity.

I have prepared a little cleare transparent vessel (like unto a bladder), made of the craw of a pullet; and I have fastened an ivory pipe to one of the neckes of it, and I have put it into a veine which is most conspicuous about the lowest joint of the hinder legges; and yet I cannot procure above 2 or 3 drops of blood to come into the pipe or the bladder.

I would have sent this bladder and pipe in my letter unto you but that I feare it might be an occasion that my letter might not come into your hands.—This is the rude figure of

[1] Aubrey's *Brief Lives*, ed. A. Clark, 1898, ii, pp. 166–7.

[2] This page is annotated in another hand (not Potter's). 'Hanc designationem Dr. Harveus frivolam et impossibilem omnino esse asseruit; sed tamen quaere. Consult Dr. Glisson.'

it which I do here set down because I thinke it the most convenient for the purpose :—

a = the necke of the craw which goeth to the mouth.

b = the other necke which goeth from the craw to the gissar. Another pipe may be tied to this end and put into the veine of another living creature at the same time.

d = a little crooked ivory pipe, fastened (as a clister pipe is) to a bladder.

e = the capacity of the craw or bladder.

A general treatise on physiology, entitled *Oeconomia animalis*, first appeared in London in 1659 from the pen of Dr. Walter Charleton of Magdalen Hall, who is mentioned on p. 35 in connexion with his theories as to the cause of disease and on p. 100 as a zoologist. His work on the Animal oeconomy was afterwards reprinted with alterations as *Exercitationes Physico-anatomicae*. In 1683 he published *Three Anatomie Lectures* which dealt with the physiology of the heart and the circulation. He had been appointed to a post in London in 1664 'to have the care of dissecting bodies for one year'.

The Physiology of Speech was considered by Professor Wallis (1616–1703) in his *de Loquela*,[1] and further in a letter to Robert Boyle dated Oxford, March 14, 1661/2, and printed in the *Philosophical Transactions* for July 18, 1670. Wallis had been educated at Emmanuel College, and was the first pupil of the Regius Professor, Francis Glisson, to maintain Harvey's doctrine of the Circulation of the Blood. He incorporated as an M.A. of Exeter College in 1649, and connected himself with the County by marrying on February 1, 1682, Miss Elizabeth Harris, of Sounden House. Being financially in easy circumstances, he was able to cultivate a variety of interests. In several cases he was successful in restoring speech to the dumb,[2] a matter in which Dr. William Holder, the brother-in-law of Sir Christopher Wren, was also interested.[3] In these studies both workers may have

[1] An appendix to his *Grammatica Linguae Anglicanae*, Oxford, 1653.

[2] *Phil. Trans.*, July 18, 1670.

[3] *Phil. Trans.* 1669; *Elements of Speech*, 8vo, Lond. 1669.

profited by the pioneer work of WILKINS, who long before 1669 had showed how the epiglottis, larynx, aspera arteria, and oesophagus help in the production of the various speech sounds or phonetics. Wallis rose superior to the troubled times in which he lived, for in his own words he declares that by 'a moderate compliance with the powers in being, I have been able to live easy and useful, though not great'.

THOMAS WILLIS, like Sylvius, made a reputation by research on the structure and blood-supply of the brain, but his work is superior in many ways to that of his Flemish contemporary. Withington, indeed, goes so far as to estimate Willis's observations on the action of drugs as second only (in that age) to those of Sydenham, while 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 views *De Urinis* were communicated in the form of a letter to Dr. Ralph Bathurst of Trinity whom he addressed as 'Ornatissime Domine'. Doubtless the letter was in the hands of Boyle when he formulated his own views upon the same subject.

Willis's pupils included WREN, LOWER, MAYOW, and LOCKE.

Anatomical and Medical subjects seem always to have engaged much of Wren's attention. He may have been first led to them by sympathy with his sister, Mrs. Holder's, pursuits. She was very skilful in healing, and is said to have cured Charles II of a hurt in his hand (Phillimore, p. 224). His cousin, Thomas Wren, in his early days had been a practising physician, and Wren himself had experience as demonstrating assistant to Dr. Scarborough. We also read of his being busied with an invention for purifying and fumigating sick rooms by nitrous fumes.[1]

At the time when Wren was studying anatomy as well as astronomy at All Souls College, the fundamental discoveries in the physiology of respiration and circulation were still recent. And although Harvey was dead, he had successors worthy of him amongst the band of workers living in the prolific years that followed the

[1] *Parentalia*, p. 213. Twelve pages of the *Parentalia* are devoted to Wren's anatomical and medical pursuits.

Restoration. Before Wren left Oxford to take up the duties of the Gresham professorship he made experiments which led to the invention of a method for the transfusion of blood from one animal to another. This appears from a letter of Boyle dated 1665, in which he speaks of the experiments 'started by Wren at Oxford about six years agone, long before others, as we know, thought of such a thing' (*D. N. B.*). Wren was especially interested in the possibility of injecting fluids containing remedial agents directly into the veins of animals, but whether he had heard of Potter's earlier experiments of transfusing blood is not known. The account as given by Plot[1] is as follows:

> The learned and ingenious Sir Christopher Wren . . . was the first author of that noble experiment of injecting liquors into the veins of animals, first exhibited to the meetings at Oxford, about the year 1656,[2] and then carried by some Germans and published abroad; by which operation divers animals were at once purged, vomited, intoxicated, kill'd or revived, according to the quality of the liquor injected (*Hist. R. Soc.*), whereof we have several instances in our *Phil. Trans.* of 4 Dec. 1665. From whence arose many other new experiments.
>
> Particularly that of transfusing of blood out of one animal into another, first performed here at Oxford about the latter end of February 1665 by that most exquisite Anatomist and eminent Physician Dr. Richard Lower (1631–91), Student of Christ Church.[3]

By means of long tubes the blood from the vertebral artery of one dog was made to pass into the jugular vein of another, and it appeared proved that there was no reason to fear any mischief, for the character or nature of one animal was not likely to be changed by injecting into its veins the blood of another. These experiments of 1665 are reported on by John Ward,[4] who, perhaps, rode over to Oxford from Stratford-on-Avon to witness them.

With the enthusiasm of a true experimentalist Lower

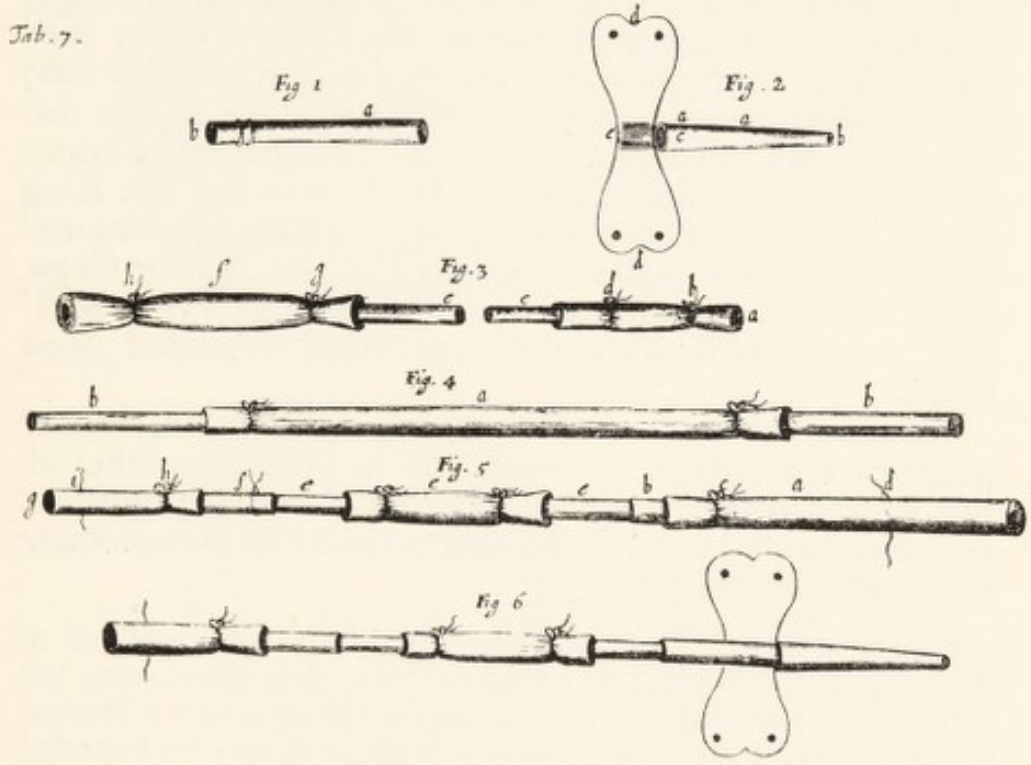
[1] Plot, *Nat. History of Oxfordshire*, 1677, p. 304.

[2] Timothy Clarck, *Letter* in *Phil. Trans*, No. 35.

[3] Lower, *The success of the experiment of transfusing the blood of one animal into another. Phil. Trans.* 1666, p. 352. The experiment was performed in the presence of Dr. Wallis and Dr. Millington and others.

[4] *Med. Soc. Trans.*, vol. 43, p. 277.

'intended the experiment to be prosecuted to the utmost variety the subject will beare; as by exchanging the blood of Old and Young, Sick and Healthy, Hot and Cold, Fierce and Fearful, Tame and Wild, animals'. He also considered it proved that 'those animals that want blood or have corrupt blood may be supplied from others with a sufficient quantity and of such as is good'.



LOWER'S TRANSFUSION TUBES, 1666.

Fig. 1. A silver tube *a*, ending in a nozzle *b*, with two raised rings to prevent the ligatured vessels from slipping off.

Fig. 2. Silver tube for passing blood into a man's arm. The end *b* is inserted into the brachial vein and the tube is kept in place by a thread passed through the holes in the lugs *d d*.

Fig. 3. To the tubes *c c* are tied a cervical artery *a* and a jugular vein *f* by ligatures *d* and *g* respectively. Knots that can be easily tightened or loosened at *b* and *h* regulate the blood flow.

Fig. 4. As india-rubber tubing for connexions was not available, Lower used a length of cervical artery (*a*) to connect tubes *b b*.

Fig. 5. The complete apparatus for transfusing from one animal into another. *a*. Jugular vein into which blood from artery *g* of another animal is to be passed. Both vein and artery are tied to silver tubes *b* and *f*, at *c* and *h*. Tubes *b* and *f* are then joined by *e e e*, the connecting tube described in fig. 4.

Fig. 6. A similar apparatus for passing blood from an animal into a man.

So sensational an operation and one of such obvious utility could not fail to find many imitators. In 1667 Dr. King transfused from a vein instead of an artery, and he experimented with a sheep. In France, Denis and Gayant repeated the process, and with such success that it was alleged that a sheep 'almost blind with age', that could hardly stir before, had two hours after a transfusion leapt and frisked. And the French savants unwittingly did Lower the greatest honour they could when they claimed for themselves the priority, but in October 1667 the Royal Society published 'a Vindication of this discovery from Usurpers'. In the following month a transfusion was practised on a man. Dr. Lower and Dr. King in the presence of 'considerable and intelligent persons' transfused the blood of a sheep into one Arthur Coga. After the operation the subject 'found himself very well' and 'urgeth us to have the experiment repeated upon him'.

In 1669, three years after going to London, Lower published the work by which he is best remembered, the *Tractatus de Corde item de Motu et Colore Sanguinis*. It was dedicated to Dr. T. Millington and found immediate acceptance at the time.

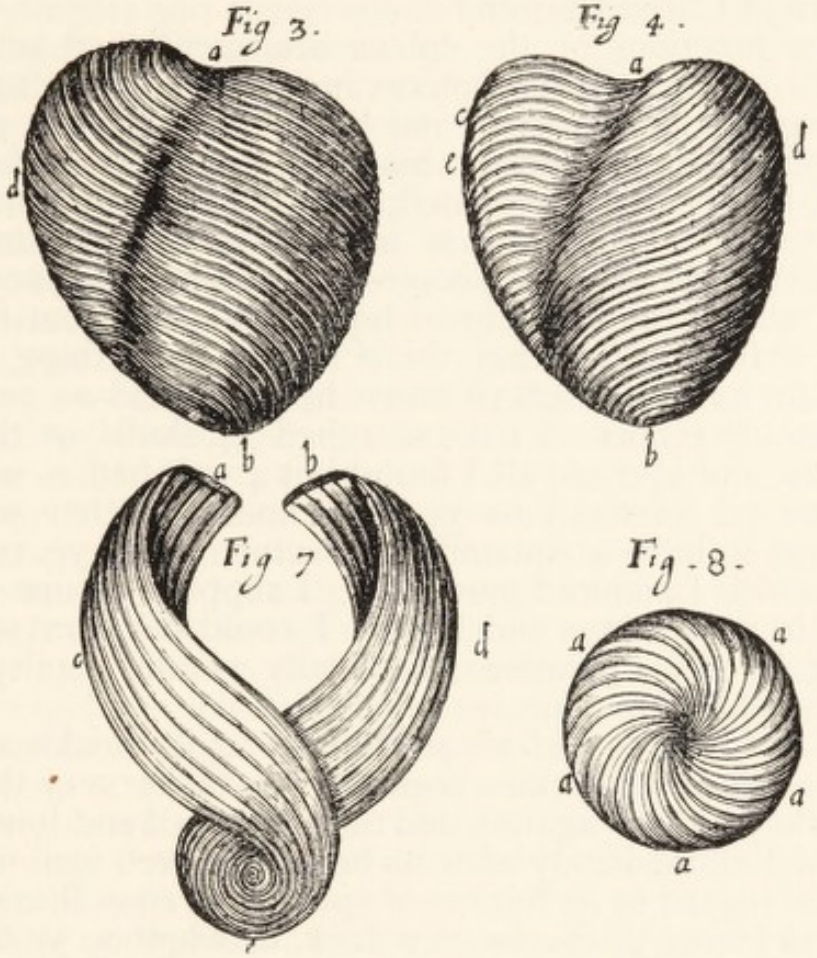
> Lower was the first that published the true method of dividing it [the heart] into its several Muscles, illustrating the same with most elegant cuts; and by attributing to it a Muscular motion, and showing several ways how it may be impeded or disturbed, has done a good piece of service towards the advancement of the Pathological part of Physick.[1]

He proved, in addition, that the beating of the heart is influenced by nerves going to the heart muscle, by ligaturing the vagus nerve, whereby the heart-beats became irregular and feeble. His experiment was repeated by the Webers in 1845; but with the advance of physiological knowledge they showed that such ligatures stimulated the nerves, exciting a nervous impulse that inhibited the heart's motion. The recognition of the real significance of respiration was due in no small measure to Lower's experiments and explanation of the difference in colour between arterial and venous blood, a matter which will be mentioned again later.

[1] Plot, *loc. cit.*, p. 304.

His computation of the frequency of the Blood's circulation through the heart is very ingenious, and the cause he assigns of the florid colour of it when emitted, I think is new, and believe generally received.[1]

Lower's last contribution to physiology was his



LOWER'S DIAGRAMS SHOWING THE SPIRAL ARRANGEMENT OF THE HEART MUSCLES. 1669.

Dissertatio de Origine Catarrhi, 1672, wherein he denies the old doctrine that catarrhal defluxions come from the brain.

Having discovered the channels that carry away the serum that is separated by the glandules of the brain, to be those two foramina in the os cuneiforme, which empty it into the jugular veins, he has sufficiently detected how far the Ancients were mistaken, in making the causes of several distempers to

[1] Plot, *loc. cit.*, p. 305.

be defluxions or humours falling from the brain. Willis mentions this passage, but it is believed to be Lower's invention.[1]

The stimulating effect of Lower's researches is very clearly shown in the Diary of one of his pupils, JOHN WARD of Christ Church.[2]

The functions of the spleen are mentioned several times. 'The recurrent nerves in a dog's neck being cut ye dog afterwards could not bark.' 'Mr. Lower cut a dogges windpipe and let him run about. Hee had a week so hee could not smell, but would eat anything as I am told.' 'When one would discover ye ductus chyliferus of Pecquet presse ye Mesenterie somewhat hard and a thinne pellucid liquor will come out at ye top.' 'Inquire whether there is any such thing as a woman having a suture down her forehead as people commonly report. I have searched 34 skulls or thereabouts, and of these all I found but 4 wch had a suture downe ye forehead to ye very nose: another which seemed to have a squamiferous suture upon ye vertex and which I admired much att. I suppose nature does vary in such things and I wish I could discover something of her operations, especially whether epileptick persons have any sutures.'

'View ye blood of all animals as to its thickness or thinness; yt of Turkies seems to me to be very thick.' 'Turkey's blood again a 2nd time observed and found to be thick immediately after its being out, wch well might bee in regard to its fulness of spirits wch soon flies away and so leaves ye masse very thick, or whether ye blood naturally is thicker yn that of other animals. Remember to kill a turkey and another fowl together and observe wch blood soonest coagulates.'

The activity of the Oxford physiologists attracted several members of the sister University, among whom was WALTER NEEDHAM. He came to Oxford in 1660 and attended the lectures of Willis and of his old Westminster schoolfellow Lower, his senior by a year. In 1664 Dr. Needham related to the Royal Society how in

[1] Plot, *loc. cit.*, p. 305.

[2] *John Ward and his Diary. Medical Society's Transactions*, 1917, vol. 40, pp. 16 and 17.

Oxford they had by blowing into the receptaculum chyli continued the pulse of the heart, without the exercise of the lungs. No wonder that when writing to Boyle on November 17, 1664, Oldenburg rejoiced to find anatomical experiments and observations so well pursued at Oxford. And undoubtedly the most important of these experiments and observations were those relating to the physiology of Respiration.

The fundamental experiment in respiration was due to Robert Boyle, who showed in 1660 that if even a part of the air were removed from a receiver by his new pneumatic engine or air-pump, any animal that might be shut up in it would die, and that in this there is some similarity between the breathing of an animal and the burning of a candle. Air is necessary for both. At the early meetings of the Royal Society these experiments were shown over and over again to delighted spectators.[1] But it was not conclusively proved that the movements of the chest wall had not as much to do with respiration as the air, until 1667 when at the meeting of the Society on October 24, Hooke showed that an animal could be kept alive merely by blowing air through its lungs by bellows, and that therefore breathing movements of the lungs were an accessory, but not essential to respiration, as some had previously believed.

The next step was the explanation of the difference between arterial and venous blood. From remote antiquity anatomists had believed that there was a profound difference between the dark blood in the veins and the bright blood in the arteries, and that if one ever changed into the other, it did so in the heart. To Richard Lower is due the discovery that the blood in the arteries is the same as that in the veins, and that the difference in colour is due simply to exposure to air in the lungs. His observations on the blood-flow[2] caused him to doubt 'whether there could be that great difference between

[1] Boyle's *Pneumatical Experiments* on animals in 1662–3 included experiments on ducks, vipers, grass snakes, frogs, kitlings, oysters, crawfish, gudgeon, greenfinch, sparrow, mouse, linnet, tadpoles, and various insects, &c. He also began investigating the phenomena of phosphorescence with his pneumatic engine, and came to the conclusion that air had a good deal to do with it.

[2] Lower, *Tractatus de corde*, 1669.

venous and arterial blood which the vulgar think', but he was unable to satisfy himself of the correctness of the view, until he availed himself of the method of artificial respiration devised by Hooke. He then noticed that the blood in the pulmonary veins of an animal kept alive by artificial respiration was bright red in colour. He further saw that when the artificial respiration was stopped, when no fresh air was driven into the lungs, when the animal was suffocated, the blood in the pulmonary veins and in the left side of the heart became dark and venous. He took dark venous blood from the vena cava, and injected it artificially through the lungs. He found that so long as insufflation of the lungs was kept up the blood ran out of the pulmonary veins florid in colour, but ran out dark and unchanged if no fresh air was driven into the lungs.[1] Having thus assured himself that air in the lungs caused the blood to change colour, he confirmed his conclusion by observing that a clot of dark venous blood soon becomes florid when exposed to the air, and finally he inferred that the change of colour was due to air being actually taken into the blood, i.e. that arterial blood = venous blood + air, and that the same fresh air is as essential to efficient breathing as it is to a flame, 'in fact where a fire burns readily, there can we easily breathe'.

It will be noticed that at this stage 'pure air' was believed to be an elementary substance and not a mixture, although it might have other things mixed with it that would thereby render it foul or at any rate less pure.

The crowning discovery of the secret of respiration was made by Mayow, a chemist who had had the advantage of assisting Lower with his dissections and experiments. He was almost certainly present at one of Lower's transfusion experiments, for he has placed on record his surprise that an animal when transfused with bright blood 'scarcely found it necessary to draw his breath at all, although before he had been breathing deeply and panting'.

John Mayow (1640–79) of Wadham College, was, like Lower, a Cornishman by descent, although he was born in the London parish of St. Dunstan in the West.

[1] M. Foster, *History of Physiology*.

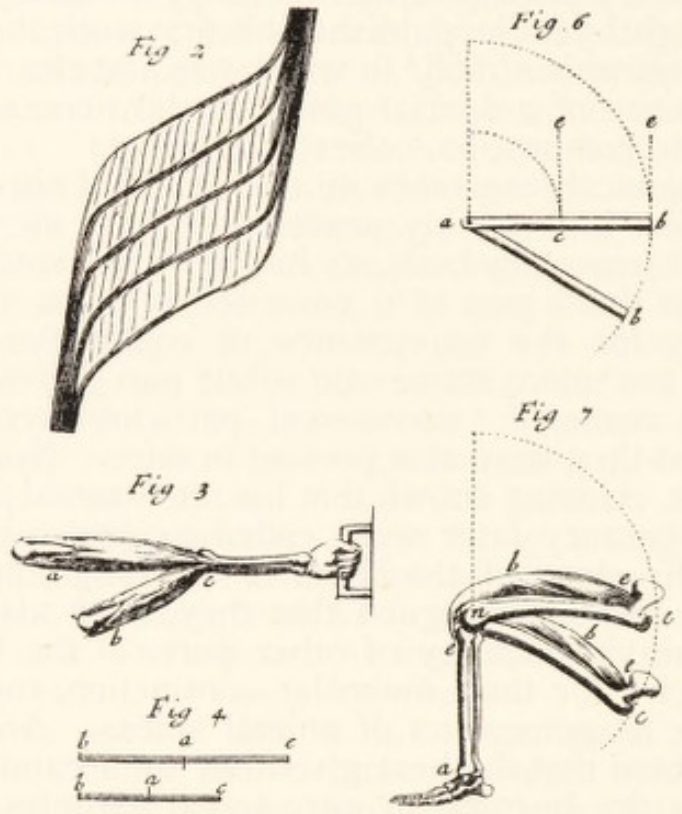
Gifted with extraordinary talents, the discoverer of oxygen became a Fellow of All Souls College at the age of seventeen. There he studied law and, fortunately for science, medicine. In a short time he had not only mastered the outlines of anatomy and chemistry, as they were then taught, but had attempted to get at the general or elementary principles that underlay the facts. In his twenty-eighth year he published his first work, the *Tractatus de Respiratione*, 1668,[1] in which was first clearly stated the existence of a special gas in the air necessary both for life and combustion. (See vol. i, p. 31.)

His chemical researches on the nature of nitre and on combustion indisputably proved that pure air was not a simple elementary body, as had been previously supposed, but that a part of it consisted of a gas that was necessary for the maintenance of combustion. This part was the 'more active and subtle part', to which he gave the name of 'nitro-aereal particles' because he found that they were also present in nitre. Nor did he stop here. Having shown that his nitro-aereal particles, which a century later were called *oxygen*, caused the change of colour of the blood in the lungs, and were essential to life, he argued that they were also essential to the vital activity of other parts of the body, to the muscles for their muscular contraction, and to the brain for its generation of animal spirits. And lastly, having noted that the heat given out by a candle flame is due to the burning in nitro-aereal particles, he also inferred that animal heat must be due to a similar cause, and that the greater heat which is the result of violent exercise must be due to the greater supply of nitro-aereal particles caused by increased respiration.

His idea that the source of body heat is situated in the muscles then lay dormant for two centuries, when Helmholtz once more called it into life.

[1] Mr. J. Fulton informs me that there are copies of the *Tractatus Duo* in Bodley and at the R. College of Physicians: the title of the two tracts (*de Respiratione* and *de Rachitide*) is dated 1669, and the second title-page, that of the *de Rachitide*, is dated 1668. The Leiden edition 1671 is in Brit. Mus. and Surgeon-General's Library. English transl. by Jury with Greek title Ραχιτιδη, 1685, is in B. M. and Bodley. A 1687 edit. Oxford with the title *Mothers Family Physician* is under Mayow in the Surgeon-General's Library. The *Tractatus Duo* also appeared in 1708 (B. M., Bodley, and S.-G. L.).

Owing to his early death, and partly, too, to the misrepresentation of his views in the unintelligent abstracts, hurriedly drafted by Hooke for the Philosophical Transactions, the transcendent merit of Mayow's work was not recognized in Britain until it was rediscovered by Drs. Beddoes and Yeats at the end of the eighteenth century.



MAYOW'S DIAGRAMS TO EXPLAIN MUSCULAR ACTION. 1674.

Fig. 2. Arrangement of Muscular Fibrillae.
Figs. 3 and 4. Muscular Contraction.
Figs. 6 and 7. Action of Muscles used in Jumping.

Of the tens of thousands who have breathed Sheldonian air at the last two hundred and fifty Encaenias, we wonder how many have known that either in the Arena or in the cellar beneath it, was printed in 1674 the work of the first man in the world who was able correctly to explain their Respiration, the *Tractatus Quinque* of the discoverer of Oxygen, John Mayow.[1]

[1] Joh. Mayow, *Tractatus Quinque Medico-physici. Quorum primus agit de Sal-nitro et Spiritu nitro-aereo. Secundus de Respiratione. Tertius de Respiratione Foetus in Utero et Ovo. Quartus de Motu*

'I flatter myself that henceforward Mayow will share the glory of Verulam and Newton, and be named with due respect by all.'[1]

In the fourth Tract he taught that the contraction of the heart was more likely to be due to the Fibrillae,

Fig 8

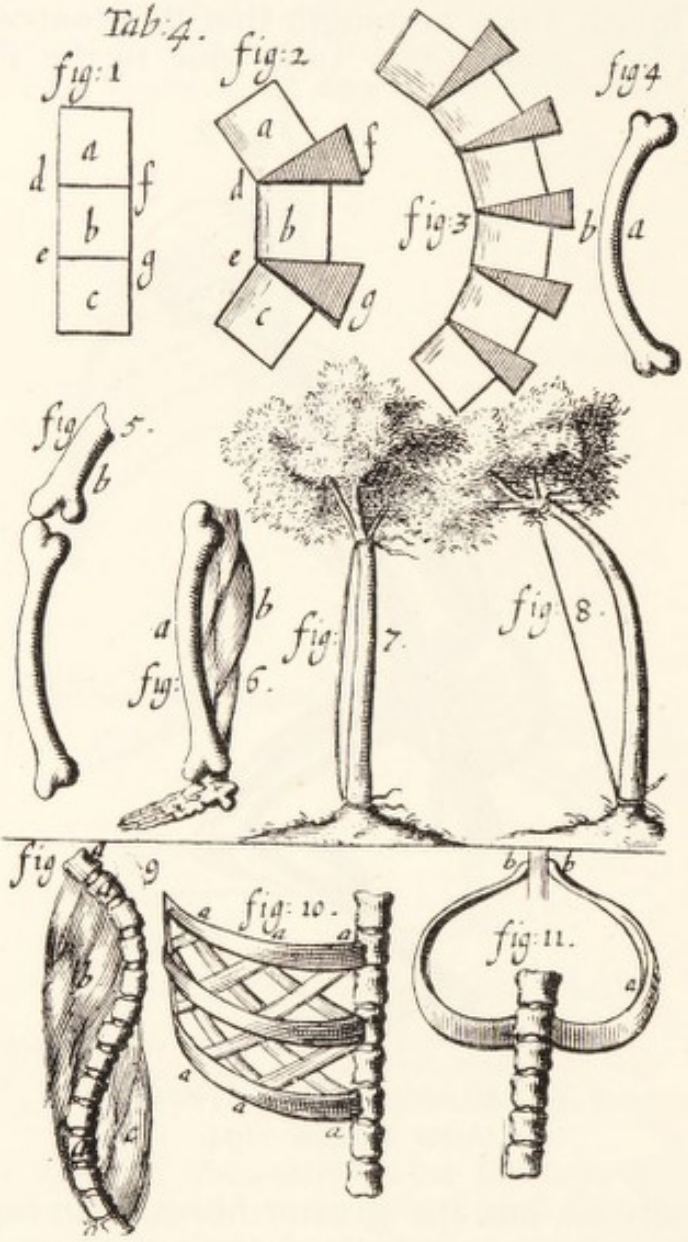
THE MUSCLES USED IN JUMPING.
After Mayow, 1674.

transversely set into the greater fibres, than to the carneous fibres, by reason both of their position and size and number. The fifth Tract gives by far the best of

Musculari, et spiritibus Animalibus. Ultimus de Rhachitide. Oxonii, e Theatro Sheldoniano. 1674. It also appeared at the Hague in 1681 and in foreign edits. Dutch 1684, German 1799, French 1810. There is an excellent account of Richard Lower and John Mayow by Francis Gotch. Oxford, 1908.

[1] Beddoes' *Chemical Experiments and Opinions, extracted from a work published in the last century.* Oxford, 1790.

the earlier writers' accounts we have, of the reason for the incurvation of the leg-bones and spine in Rickets.



MAYOW'S DIAGRAMS TO EXPLAIN THE CURVATURE OF THE SPINAL COLUMN, TIBIA, AND RIBS.
Mayow, *De Rachitide.*

Some really remarkable *Memoirs for the Natural History of Humane Blood, especially The Spirit of that Liquor* appeared in 1683/4 from the fertile pen of ROBERT

BOYLE. Although, as he acknowledged in the preface addressed to the Ingenious and Learned Doctor J. L. [John Locke], he 'being no profess'd Physician, . . . had not the Opportunities of examining that [the blood] of Sick Persons molested with particular Diseases', yet he set out thirty heads under which observations ought to be made in order to complete a first survey of the subject.

His headings or 'titles' were:

1. Of the Colours of Humane Blood Arterial and Venal.
2. Of the Taste ,,
3. Of the Odours ,,
4. Of the Heat ,,
5. Of the Inflammability ,,
6. Of the Aerial Particles naturally mixed with it.
7. Of the Specifick Gravity of blood entire.
8. Of the Specifick Gravity of the two obvious parts, the Red (and Fibrous) and the Serous.
9. Of the Consistence of entire blood.
10. Of the Disposition of blood to Concretion, and the time wherein it is performed.
11. Of the Liquors and Salts that coagulate blood.
12. Of the Liquors and Salts that impede or dissolve its coagulation.
13. Of the Liquors and Salts that preserve it.
14. Of the Mixtures that Humane blood may admit from Aliments.
15. Of the Spontaneous or natural Analysis of blood into a Serous and a Fibrous part.
16. Of the respective Quantities of the Serous and Fibrous parts.
17. Of the Differences between the Serous and Fibrous parts.
18. Of the Artificial or Chymical Analysis of blood, and first of its Spirit.
19. Of the Vol. salt of blood and its Figures.
20. Of the Phlegm of Distill'd Humane Blood.
21. Of the two Oyls of Humane Blood.
22. Of the Fixt Salt of ,, ,,
23. Of the *Terra Damnata* of Humane Blood.
24. Of the Proportion of the differing Substances chymically obtained from Humane Blood.
25. Of the Fermentation or Putrefaction of Humane Blood, and its Phaenomena.

26. Of the Mechanical uses of Humane Blood, as in Husbandry, etc.
27. Of the Chymical uses of Humane Blood.
28. Of the Medicinal uses of Humane Blood.
29. Of the Difference between Humane Blood as 'tis found in sound Persons differingly constituted and circumstantiated, as men, women (when menstruous, and when not), Children, Moors, Negro's, etc.
30. Of the Affinity and Difference between the Blood of Men, and that of divers other Animals, as Quadrupeds, Birds, Fishes, and Sanguineous Insects.

After this amazingly exhaustive treatment of his subject, Boyle goes on to say

I do not think it unlikely that some of the Titles of our intended History of the Blood and a greater number of the particulars that you will meet with in it, may seem frivolous to you at the first perusal. But perhaps in process of time, these very things will not appear impertinent, nor be found useless.

After suggesting that other liquors, such as Gall, *Lympha*, *Succus Pancreaticus*, Spittle, and Milk might be advantageously treated of in the same manner, he subjoins a 'set of Titles for the History of Urine'. 'I think Urine to be a Liquor which, as much despis'd as it is by others deserves to be solicitously enquir'd into by Physicians, Naturalists and upon special Accounts by Chymists; who will perhaps be excited to seek and hope for great matters, both for Medicine and Alchymy, from this Liquor skilfully handled, when they consider that the *Phosphorus*, of which I have elsewhere related so many new, and some of them surprizing, *Phaenomena*, is made, at least according to my way of Meer Urine by a simple Distillation.'

Boyle's Titles for the Natural History of Humane Urine emitted by Healthy men are thirty-one in number and they correspond so closely with the Titles for the history of the Blood, that we need not reprint them at length. The following titles are adapted to the special nature of urine.

9. Of the Differences between fresh and stale Humane Urine.
11. Of the Spontaneous Separation of Parts in Humane Urine.

12. Of the vulgar Analysis of Humane Urine by Distillation.
15. Of the Spirits of Humane Urine.
16. Of the Phlegm of ,, ,,
17. Of the Volatile Salt of Humane Urine.
18. Of the Fixt Salt of ,, ,,
19. Of the compounded Salt of ,, ,,
20. Of the shining Substances obtainable from Humane Urine.
21. Of the Salt that is predominant in Humane Urine.
22. Of the Empyreumatical Oyl, or Oyls of Humane Urine.
23. Of the *Mellago*, or Rob of Humane Urine, and its uses.
25. Of some accidental Differences of Humane Urine, as 'tis emitted in the morning, or at certain Distances from meat, or after the use of certain Aliments, or Medicaments, as Sparagus, Turpentine etc. Or at differing Seasons of the year as Winter, Summer etc.
28. Of the Affinity and Difference between Urine, Blood, Gaul, Milk etc. and divers other Liquors, or Juices belonging to the Animal Kingdom particularly of the comparison between Humane Urine and that of Beasts.

Boyle certainly discovered that blood serum and urine behave differently when acted on by acids, for from the former he separated 'some white Concretions that quickly subsided to the bottom and there appear'd like a very light and tender Cheese-Curd'[1]: an observation of first-class importance.

Several of the meetings of the Oxford Philosophical Society, 1683-90, were taken up with discussions of physiological subjects.—Lee of Brasenose College read a discourse on Digestion in Aug. 1684, which was further expanded by Dr. W. Musgrave of New College at subsequent meetings.[2] The latter experimentalist carried out several experiments on dogs with a view to settling certain questions connected with the Circulation, and the chemical members of the Society were constantly engaged on the investigation of organic substances.

An early attempt at estimating the values of certain constants relating to the physiology of Circulation was made by James Keill (1673–1719) by a method of calcu-

[1] Boyle, *Nat. Hist. of Humane Blood*, 1683, p. 72.
[2] To be printed in vol. iv of this work.

lation.[1] Having imbibed some mathematical notions from his elder brother John, he proceeded to discuss by mathematical methods the physiology of secretion, the amount of blood in the body, and the muscular motion and force of the heart. He computed the velocity of the blood current to be 156 ft. per minute (too low); the force of the heart's systole to be 5 oz. (now 3·6 foot-lb.); the quantity of blood expelled by the heart at each beat at 2 oz. (now 6 oz.). The results were adversely criticized by Dr. Jurin, a most skilled controversialist.

For a brief period in 1708 elementary instruction in Physiology was given by Dr. JOHN KEILL, the mathematician, at Christ Church, in his course of lectures on Experimental Philosophy. Keill is reported to have taught that there was air in the Thorax, outside the lungs, though some people opposed that opinion. Desaguliers, another physicist, used regularly to demonstrate the 'Air' in the blood by showing how it frothed when put into a receiver exhausted by an air-pump.[2]

About the middle of the century the science was sufficiently advanced to encourage the hope that regular courses of lectures might be given in it; and Dr. Malcolm Flemyng (*d.* 1764), a pupil of Monro at Edinburgh and of Boerhaave at Leyden, wrote in Feb. 1753 to Haller, to suggest the possibility of teaching physiology at Oxford. Flemyng is remembered for his realization that motor and sensory nerves are anatomically distinct.[3]

Meanwhile researches of a more practical order were not uncommon. We gather from the diary of the Rev. JAMES WOODFORDE of New College that he and his friends anticipated a recent research of Dr. H. M. Vernon on *The influence of dilution on the Toxic action of alcoholic liquids*.[4] But whereas Vernon tested the result of drinking alcohol by typewriting, Woodforde's friend

[1] Keill went into practice in Northampton in 1703. His principal works were *The Anatomy of the Human Body*, 1698 (15th edit. 1771); *An Account of the Animal Secretion, the Quantity of Blood in the Humane Body and Muscular Motion*, 1708, of which the 4th edit. contained 'A Dissertation concerning the Force of the Heart', by James Jurin, M.D., with Dr. Keill's Answer and Dr. Jurin's Reply.

[2] Desaguliers, p. 404.

[3] *Dict. Nat. Biog.*

[4] Vernon, *Brit. Journal of Inebriety*, Oct. 1920.

attempted to test it by writing out a chapter of the Bible by hand.

1761. Nov. 4. Dyer laid Williams 2*s.* 6*d.* that he drank 3 Pints of Wine in 3 Hours, and that he wrote 5 verses out of the Bible right, but he lost. He did it in the B. C. R., he drank all the Wine, but could not write right for his Life. He was immensely drunk about 5 Minutes afterwards.[1]

Dr. Thomas Beddoes, who had acted as reader in Chemistry from 1788 to 1793, had a medical training that enabled him to turn his chemical knowledge to good account. In university teaching in the eighteenth century the two sciences were very closely associated. At Glasgow Black professed both Anatomy and Chemistry, and at Edinburgh Medicine and Chemistry were one. Humphrey Davy began as apprentice to an apothecary and surgeon. It was the golden age of pneumatic chemistry. What more natural than that Dr. Beddoes, hearing of the fact, recently discovered, that every newly-isolated gas had physiological effects of its own, should foresee important therapeutical applications. He thereupon abandoned the study of pure, for that of applied science, and founded a 'Pneumatic Institution' at Bristol, perhaps hoping for a satisfactory return from the new venture. Davy was put in charge of the laboratory, and the result, his discovery of the valuable anaesthetic nitrous oxide or laughing gas, is far famed. The effects of the new gas were soon made known by a sister-in-law of Dr. Beddoes, Maria Edgeworth.

'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 oblivious 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

[1] *The Diary of a Country Parson: The Reverend James Woodforde* 1758–1781. Oxford, 1924.

vain for satisfaction in the bag of " Gaseous Oxyd ", and found nothing but a sick stomach and a giddy head.'

In another contemporary it is reported that

> Dr. Beddoes astonished all green and philosophical amateurs, with his account of his having turned a *black man, white*! with oxygenated muriatic acid; but the philosophical bubble burst in less than a month!—the epidermis had been slightly affected, without injuring the *rete mucosum*.—The whole affair ended, by all the town considering the chemist, not as a philosopher, but a conjuror.[1]

[1] *Flim-Flams*, ii. 188, 1806.

V

ZOOLOGY

In the early days of the University, students had perforce to be 'content with the landmarks of science fixed by their fathers'. By the end of the fourth century the Church had settled that there is only one way to deal with those who think for themselves, and this is set out by De Foe in his *Shortest way with Dissenters*: if a man insist on having an opinion of his own, that is pernicious and jeopardizes his eternal salvation, it is much safer to burn him than to allow his doctrines to spread. It was only after ecclesiastics had been shorn of extreme powers of repression that advance in biological studies became possible.

Pliny, Aristotle, and the Bible were the chief 'original' sources of zoological knowledge throughout the Middle Ages. While for those who craved more sensational reading there were the pages of Aelian's seventeen books *de Natura Animalium*, brightened regardless of truth with marvels and traveller's tales. From these several sources arose a popular text-book known as the *Physiologus*. For many centuries it was widely read and repeatedly copied and altered.[1] It is believed to have been compiled in Alexandria in early Christian times, to have taken account of the Natural History of the Bible and of that of the various animals or monsters known to the compilers. Certainly almost all the animals mentioned in it were familiar to Egypto-Hellenic civilization. The stories are usually introduced with a text from Scripture and conclude with a moral.

In course of time the Church looked with suspicion on

[1] MS. Bodley 2393, xiith cent.; MS. Ashmole 511, xiiith cent.; MS. Bodley 764.

a work in which passages of holy writ were closely allied with others, which might provoke some souls to scoffing and some to heresy. So Pope Gelasius in 496 passed censure and declared the *Liber Physiologus*, 'which was written by heretics', to be *apocryphus*. But the stories made too successful an appeal to human nature. People of all nations continued to transcribe and rearrange the chapters as seemed best, alphabetically or in zoological order; and many of the tales found their way into the popular literature of the day, and even helped the fancy of the artists employed on the decoration of medieval churches. In Oxford the Pelican of Corpus Christi College recalling its young to life by its own blood is but one of the emblems of the *Physiologus*, and the Phoenix of the well-known Fire Insurance Company is another. A versified extract from it was made by a bishop Theobald in the eleventh century which was eventually printed at Delft in 1487. It only dealt with twelve selected animals.[1]

The first English writer on zoological subjects who has claim to our attention is ALEXANDER NECKAM, 1157–1217, the foster-brother of Richard I. Of his work *De Naturis Rerum* there are MSS. in the Libraries of Magdalen, No. 139, Corpus Christi College, No. 245, and St. John's, No. 51. It is chiefly remembered by reason of an account which he gives of certain medieval inventions such as mirrors of glass and the mariner's compass. This natural history was partly derived from Solinus, Isidore, and Cassiodorus, but to his extracts from them the author added much that was derived from his own observation. His merit lay in the eagerness he displays for a better groundwork than mere authority. In his choice of animals Neckam selected such as were neither too commonly known to the vulgar, nor totally unknown. Beginning with the crocodile, serpent, rhinoceros, viper, toad, weasel, fox, ape, bear, wolf, deer, camel, elephant, dragon, lion, onager, and hyena, he reaches the 'noble animal' man, with an interesting disquisition on sight, and refraction and reflection of light by *glass* mirrors. He explains that since man withdrew his obedience from his Creator, the obedience of the greater number of wild animals has been with-

[1] *Physiologus Theobaldi Episcopi de naturis duodecim animalium.*

drawn from him; but to reprove and abate his pride, the power of tormenting him has been given to some of the most insignificant of animated beings. Gnats attack him in the eyes . . .; fleas disturb his sleep at night and his contemplations by day; flies intrude into the liquors he drinks and into the food he eats. Moreover, if man had not sinned, there would have been no venomous or poisonous thing on the earth. After this

NECKAM'S LICE THAT TORMENT SINNERS, 1491.[1]

discourse on Man, he proceeds to treat of domestic animals, including bees and silkworms, given to man after the Fall out of compassion for the human race.[2]

To Neckam, too, has been ascribed a much later compilation of which there is also a manuscript at

[1] Familiarity, however, bred other views as to the utility of lice. A seventeenth-century Student of Christ Church, ROBERT LOVELL, after stating that the place of their occurrence is 'sufficiently known to every one', adds that 'If breeding in the heads of those that have been long sick, they prognosticate health', and that 'They are eaten by rusticks to help the jaundise'. Even so exalted a personage as Edward Gibbon, when a Lord Commissioner of Trade and Plantations, slept in a bed that occasionally required to be 'thoroughly cleaned from buggs'. *Notes and Queries*, Sept. 8, 1923.

[2] The *De Naturis Rerum*, edited by T. Wright, appeared in the Rolls Series for 1863.

Corpus Christi College, No. 274, which once belonged to George Nycholl. It is an encyclopaedic work in which some two hundred and fifty animals are described. They are grouped in classes in alphabetical order.

The first book *De animalibus quadrupedibus*, beginning *Canes ut dicit Jacobus* (*i.e. Acconensis*) *docibiles bestie sunt ad omnem ludum*, discusses 24 mammals ending with the *Vulpis*. Book 2 *De Avibus* enumerates 42 species from *Aquila* to *Upupa*. Book 3 *De Monstris marinis*, 52 in number, from *Aludes* to *Zephius*, including the Ipopotamus. Book 4 *De Piscibus marinis*, 83 in number, *Anguilla* to *Virgales*. Book 5 *De Serpentibus*, 51 *Aspis* to *Vipera*. Book 6 *De Vermibus*, 46 *Apis* to *Vermis*. The compiler then proceeds to treat of Trees, Herbs, Precious Stones, Metals, the Regions of the Air, and other matters.

In the thirteenth century the intellectual stimulus following on the rediscovery of Greek and Arabian literature reached us through the intercourse of our student travellers with the south and east of Europe. Chief among the discoverers of the Greek learning must be ranked MICHAEL SCOT of Oxford, subsequently 'Astrologer to the Lord Frederick, Emperor of Rome'.[1] At a time when serious study would have been impossible in England, a more favourable entourage at Toledo in 1210 enabled Scot to learn Arabic and to translate the work of Avicenna on animals.[2] But he is better known through the translation by which he made Aristotle's History of Animals available to the student world. It was rendered from an unidentified Arabic text, and the date 1221 is inscribed in the manuscript copy belonging to Caius College.[3] By such labours as these did our travelling scholars make known the great literature of antiquity, and lead their fellow-countrymen to realize the necessity by the foundation of Colleges, of increasing the efficiency of their two Universities.

The translations of Michael Scot ensure him a name in literature, but he should also have been mentioned in

[1] Colophon to Scot's *Astronomia*. MS. Canonici misc. 555.

[2] The Vatican copy of his *Abbrevatio Avicennae* has a colophon 'explicit an. dom. MCCX'.

[3] MS. 109, ff. 102 v–103 z: 'Et juro ego michael Scotus qui dedi hunc librum latinitati quod in anno 1221 xii kal. novembr. die mercurii.' . . .

our volume on Astronomy, for it was by Astrology and Necromancy that he was famous in the Middle Ages.

Dante, Villani, Boccacio, and Sir Walter Scott have immortalized his traffic with the devil, his marvellous invisible rides on a demon horse with magical powers, and the like, stories that gripped the popular imagination far more securely than the real facts of his life. But it appears fairly certain that he was born before 1180, and having begun his studies at Oxford and Paris, continued them in Bologna, Palermo, and Toledo. In drawing attention to the fact that Scot dedicated this translation to Frederick, Mr. Wood Brown emphasizes the interest displayed by the Emperor in zoological matters. Not only did he keep an elephant, a camelopard, camels, dromedaries, lions, leopards, panthers, a white cockatoo and other rare birds, and a white bear, but, when desiring to study the process of digestion, he caused the surgeon's knife to be used on living men. He also experimented on the artificial incubation of hen's eggs and got an Egyptian over to teach him how to incubate ostriches' eggs by the heat of the Apulian sun.

Scot was sent by Frederick II on a mission to the universities of Europe to make known to them his rendering of Aristotle; and in 1230, according to Roger Bacon, who belittled Scot's labours as a translator, 'Michael Scot appeared [at Oxford], bringing with him the works of Aristotle on Natural History and mathematics, with wise exposition, so that the philosophy of Aristotle was magnified among those who spoke Latin'.

Nevertheless it was by Scot's translation that Medieval Oxford was introduced to the surpassing interest of Aristotle's Zoology, and thereby was begun the domination of Aristotle over Oxford that was to last for seven centuries. Scot's work reached a still wider public in 1496 when a Latin Aristotle was printed in Venice. The version was 'partim è Greco, partim ex Arabico', made by learned men by order of Emperor Frederick II.

Clearly Oxford owes much to Michael Scot, but he is probably less well remembered amongst us for his Aristotle, than as a Scotsman whom Dante put into hell.[1]

[1] *Inferno*, c. xx. The following works by Michael Scot are in Oxford: *Astronomia* or *Liber Particularis*, MS. Canon. Misc. 555. *Liber Introductorius*, MS. Bodl. 266. *Liber in quo continetur Magisterium Speciale*, MS. Bodl. 44. *De Alchemia*, MS. C.C.C. CXXV.

Another transmitter of Aristotelian zoology was Albertus Magnus who died in 1282 and whose manuscripts may have been widely read even before they were printed in 1478. And the work of Albertus Magnus, with interpolations from Isidore of Seville (VII cent.) added to the *Physiologus*, gave rise to the *Hortus Sanitatis* of Johannes de Cuba.

Such were the materials from which subsequent zoological works were constructed. One that passed through many editions was the *Liber de Proprietatibus Rerum*, a voluminous and encyclopaedic work by a Franciscan, Bartholomaeus Anglicus, written in Latin about 1250 and translated into English in 1397. It was first printed in 1494 by Wynkyn de Worde, and again in a 'newly corrected, enlarged and amended' form under the editorship of Dr. Stephen Bateman in 1582. The book was entitled 'Bateman uppon Bartholome: His Booke *De Proprietatibus Rerum* . . . with such Additions as are requisite, unto every severall Booke. Taken foorth of the most approved Authors, the like heretofore not translated in English. Profitable for all Estates, as well for the benefite of the Mind of the Bodie.'

We have cited these works and editions to show how slow were the steps by which ancient learning was made available for the medieval Englishman, and how, even when it had been brought within his ken, the slavish adhesion to authority caused him to be supplied with zoological learning gleaned from the observation of the fauna of the Mediterranean countries and beyond, which had never been checked by modern observation and was quite ill-adapted for students of English zoology. It is from a source such as Bartholomew that Shakespeare derived much of his knowledge of natural history: for the rest he would have gone straight to Nature, and following the pregnant advice of Ludovicus Vives of Corpus Christi College, would have had 'recourse to gardeners, husbandmen, shepherds, and hunters', and have observed the nature of things 'in the heavens, in clouds and in sunshine, in the plains, on the mountains, in the woods'.

Vives was probably well acquainted with the old works from the twelfth and thirteenth centuries on

falconry and the care of horses, some of which were derived from Arabian sources. Of such there is still an example in the library of his College, a copy, made in 1448, of a Latin translation by Theodore, the philosopher of Moamyn Falconarii *De scientia venandi per aves et quadrupedibus ut solatium habeatur*[1] which follows after a copy of the *Doctrina circa regimen equorum* by Laurentius dicto Bugus de Urbe.

At the same time the Founders of Colleges at Oxford, as at Cambridge, harshly interdicted the study of live animals, either in captivity or in natural surroundings. At Magdalen none of the Demies or Fellows was permitted to keep 'a Harrier, or other Hound of any kind, or Ferrets, or a Sparrow-hawk, or any other Fowling Bird, or a Mavis or any other Song Bird'. And monkeys, bears, wolves, and stags in addition to ferrets and hawks were banned by Henry VI when he drew up statutes for King's College. We are, however, glad to think that at any rate some of the early Fellows were sufficiently human to break their statutes, and that in quite early times not only were dogs kept, but also swans, a she-bear, and marmosets and other live stock.

In the fifteenth century zoology showed signs of moving within the pupa case in which it had been so long enveloped. JOHN FREE, a Fellow of Balliol 1449 († 1465, see p. 24), wrote excerpts from Pliny's Natural History which may still be read in MS. Balliol 124, a manuscript presented to the College by WILLIAM WORCESTER or BOTONER (1415–82?), himself a scholar of Great Hart Hall, then attached to Balliol. Worcester, like Free, had read medicine and was a traveller with wide interests. He has left an antiquarian or topographical account of a journey in 1478 in which he describes the country between Bristol and St. Michael's Mount, with a few brief observations on animals which are still of value.

The Rabbits and Puffins of the Scilly Islands are noted for the first time.

> Insula Rascow (= Trescoe) pertinet Abbati Tavystock, continet in longitudine 3 miliaria, et in latitudine 3 miliaria, inculta, cum cuniculis et avibus vocatis *pophyns*.

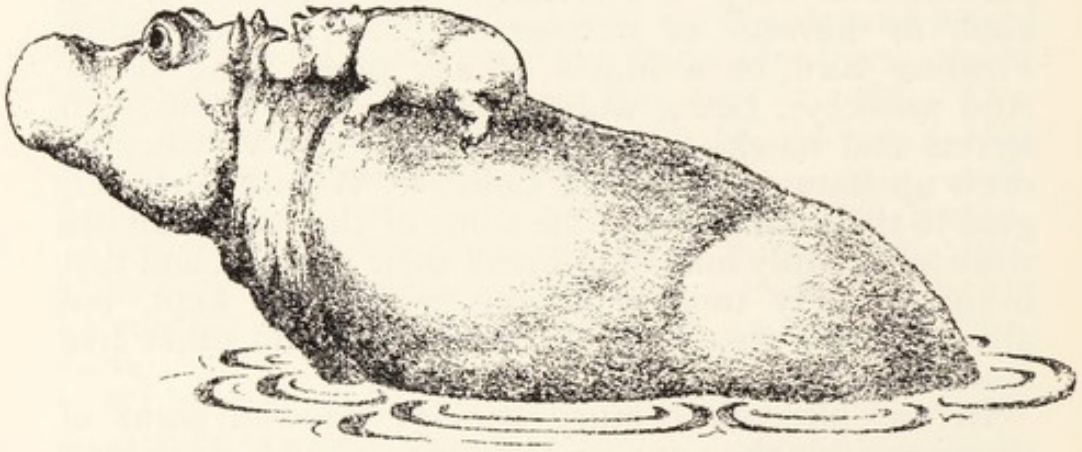
[1] MS. C.C.C. No. 287.

And another island

non est populata, nisi silvestres herbas, aves vocat mewys [sea-mews] kermererertes [cormorants] et Katones et muscae, idest mowses.[1]

A similar Scillonian population is noted in Leland's MS. of 1533, now in the Bodleian.

Another instance of the renewed interest that was being taken in Natural History, is supplied by the four volumes of manuscript *Notes and Observations on the Natural History of Pliny* written by JOHN CLAYMOND Demy of Magdalen 1483, and afterwards the first Presi-



THE HIPPOPOTAMUS CARRYING ITS YOUNG.
After Dr. Chalmers Mitchell, Childhood of Animals.

dent of Corpus Christi College.[2] As a Demy Claymond was one year junior to Richard Wotton, afterwards bedel in Oxford, to whom in 1492 was born a son, EDWARD WOTTON, our first great Zoologist, a man of European reputation. He was educated at Magdalen College School, and having been a chorister 1503, and Demy 1506, was elected to a Fellowship at Magdalen College in 1516.

While Wotton was a Demy of the College, the curious hieroglyphic statues were erected round the quadrangle. Several animals figure among them, but the most remarkable of all is the River Horse on the North side.

[1] Wm. Botoner, Itinerarium sive Liber Rerum Memorabilium Ex cod. autographo autoris in bibl. C. C. C. Cant. No. 210. Edited by J. Nasmith, 1778.

[2] Gunther, *Daubeny Laboratory Register*, iii, p. 349.

As will be seen from the sketches, the statue is true to nature in so far as it represents the way in which the

THE RIVER HORSE AND YOUNG IN MAGDALEN COLLEGE. *c.* 1506.

old hippopotamus carries her young one. The problem as to how the carver-naturalist got his information is still unsolved.

At Merton College, too, over the entrance gate is a delightfully realistic representation of rabbits, posing

FOWLS OF THE AIR LODGING IN BRANCHES IN AN ORCHARD WITH PLEASANT FRUITS.

ANIMAL SCULPTURE OVER MERTON COLLEGE GATE. *c.* 1500.

WOLVES. LAMB. LION. UNICORN. BEAR.

THE ROCKS ARE A REFUGE FOR THE CONIES.

in and out of holes as conies of the Scripture. Behind them are a lion, a lamb, wolves, a bear, and a unicorn, and in the background trees laden with pleasant fruit and birds. It is altogether as unlikely as a 'wilderness'

as that St. John the Baptist and the Founder of Merton College should ever be seen in one together: it probably represents the Holy Mountain described in Isaiah xi. 6–9. The sculpture appears to be of the same date as the Magdalen hieroglyphics, and is far more true to nature than that of the representation of the Scorpion among the zodiac bosses over the vaulted archway under Merton College Hall (1274). According to some accounts it is a carving of the thirteenth century, but this appears to be highly improbable. The drawing of the trees in the background is very like that which may be seen in fifteenth-century manuscript miniatures and even in fifteenth-century printing.

Claymond continued to take an interest in the younger Wotton and introduced him to Fox, the Founder of Corpus, who made him *Sociis compar*, and facilitated his travels abroad. In 1521, or 1523–4, Edward Wotton obtained leave to go to Italy to continue his studies, and chiefly to learn Greek. Like Harvey, he graduated M.D. at Padua. On his return home he was admitted a Fellow of the College of Physicians, becoming president in 1541–3. He was physician to the Duke of Norfolk and to Margaret Pole, the mother of Reginald the Cardinal, with whom Wotton corresponded. But his chief interest lay in the systematic study of zoology. A part of his work entitled *De Differentiis Animalium* appeared in his lifetime. It was a folio, dedicated to Edward VI, printed by Michael Vascosanus in Paris and 'probably unsurpassed in typographical excellence by any contemporary work', it was, moreover, praised by Neander for the eloquence of its language.[1] I was fortunate to recognize a copy of this work in the holograph of his son HENRY WOTTON written in 1547–9 while he was a bachelor at Christ Church.[2] Like his copy of Ruellius in the Goodyer Library at Magdalen and two other books of his in the Physick Garden, it is signed with his initials and motto.

H . *Spes nō cōfundit* . W.

At the end of vol. i he wrote '11 Dec. 1547'; at the end

[1] 'No one had written of animals more learnedly and elegantly than Wotton.' Neander, *Explicatio Orbis Terrae*, 1597, p. 410.

[2] Jesus College MS. 90, 100. Cf. Gunther, *Early British Botanists*, p. 224.

of vol. ii '*τέλος σὺν θεῷ* 1548 ultimo Junii. Non omnia possumus omnes'; and at the end of the table of contents '3 April 1549'. It may be that the son induced the father to get the book printed.

Edward Wotton was the first Fellow of the College of Physicians to bring Zoology into the list of subjects on which a physician should be informed. Like many another savant of his day he was a correspondent of Conrad Gesner (1516-65) of Zurich, who was twenty-three years his junior, and the author of the great *Historia Animalium* of which volume i began to appear in 1551, and volume iv, which came out in 1558, contains a reference to Wotton's work. Wotton certainly appears to have forestalled Gesner in collecting materials for a History of Insects, but he did not live to complete it. The work was continued by two Cambridge men, Thomas Penny and Thomas Moffett, both of Trinity College, neither of whom was to live long enough to publish it. Wotton died in 1555.[1]

Penny, who entered Trinity College in 1550, had probably not heard of Wotton until, in the course of his Continental tour, he worked with Gesner in Switzerland. He is believed to have been with Gesner when he died, and according to Sir A. Shipley certainly helped to arrange the natural history specimens which the great master left. He may have brought back for further study in this country Gesner's drawings of butterflies. Penny undoubtedly seems to have left considerable literary remains. How, when compiling a new edition of his *Phytologia Britannica*,[2] between 1650 and 1656 had access to Penny's botanical papers. His insect notes and Gesner's drawings passed into the possession of Moffett (1553–1604) also of Trinity College in 1569, but later of Caius in 1572. After taking an M.D. degree at Basle, Moffett proceeded in 1579 to Spain and Italy, where he studied the silk-worm and collected further notes for a monograph on Insects. To these notes were added those of Edward Wotton,

[1] Four years after the death of Wotton another fellow of Magdalen, PETER MORWENT, translated Gesner's work on distilling medicines into English, publishing it under the title of *The Treasure of Evonymus*. 1559. It was reprinted in 1565 and 1575.

[2] Gunther, *Early British Botanists*, p. 234.

but it was not until eighty years after Wotton's death, or thirty after Moffett's that the work was printed under the title of *Insectorum sive Minimorum Animalium Theatrum—ad vivum expressis Iconibus super quingentis Illustratum*, 1634. Engraved portraits of Wotton, Moffett, and Penny adorn the frontispiece. One hundred and three years after the death of Wotton, the work, which he was the first to begin, appeared in English as an appendix to Topsell's *History of Serpents* in 1658.

Meanwhile, William Turner, botanist and ornithologist, of Pembroke College, Cambridge, and later proposed as President of Magdalen College, Oxford, had been more successful in getting his books out as he wrote them. He, too, was a friend and correspondent of Conrad Gesner, as also was John Caius (1510–73), himself tutor to Thomas Moffett.[1]

The reviving interest in English Zoology is also shown by occasional notes in general works such as the *Britannia* of WILLIAM CAMDEN, who is evidently reminiscing from Carew's *Survey of Cornwall* when he observes that

> In the rocks underneath [St. Michael's Mount], as also along the shore everywhere breedeth the Pyrrhocorax, a kind of crow, with bill and feet red, and not, as Plinie thought, proper to the Alpes only. This bird the inhabitants have found to be an Incendiarie, and theevish beside: for, often times it secretly conveieth fire sticks setting their houses afire, and as closely filcheth and hideth little pieces of money.

While Sir T. BROWNE, 1605-82, was in residence at Broadgates Hall from 1623 to 1624, he presumably received such preliminary training as was customary among medical students. His wider fame rests on his power of getting outside himself and the narrow sphere of professional experience. He was a scholar-naturalist, singularly gifted with a poetic instinct, yet a sceptical unveiler of fallacies; he was equipped as few have been for his pastime of philosophical research into the fairy world of animal and vegetable life.

His fondness for animals was innate. In the well-

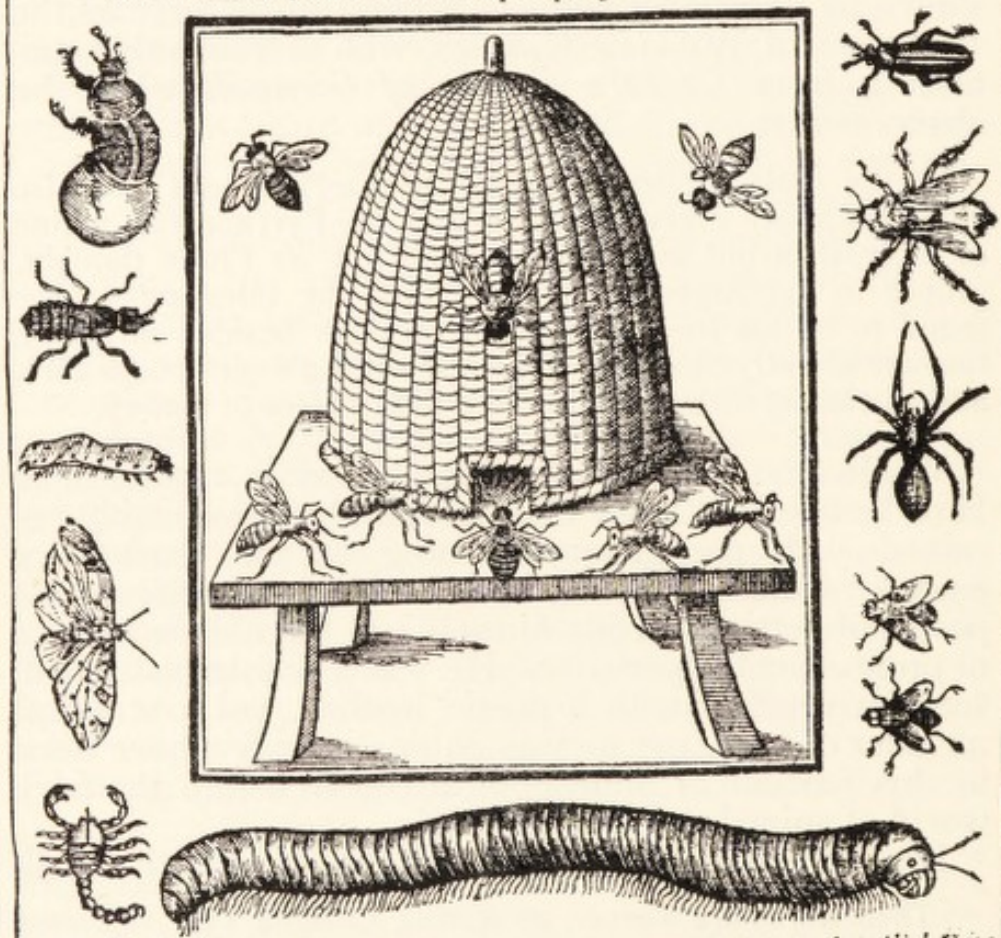
[1] Their works are Turner, *de Avibus*, Cologne, 1544, reprinted Cambridge 1823. Caius, *De rariorum animalium atque stirpium historia*, London, 1570.

INSECTORVM
SIVE
Minimorum Animalium
THEATRVM:

Olim ab

EDOARDO WOTTONO.
CONRADO GESNERO.
THOMAQVE PENNIO
inchoatum

Tandem
THO. MOVFETI Londinâtis operâ ſumptibuſq; maximis concinnatum,
auctum, perfectum:
Et ad vivum expreſſis Iconibus ſuprà quingentis illuſtratum.



Londini ex Officinâ typographicâ *Thom. Cotes*. Et venales extant apud *Guiliel. Hope*,
ad inſigne Chirothecæ, prope regium Excambium. 1634.

known picture of the family group of the Brownes, he is painted a quaint little figure on his mother's knee, in red cap and coat, clasping a black rabbit. The child was the father of the man. After Browne had been established thirty-five years in Norwich, Evelyn found his 'whole house and garden a paradise, and cabinet of rarities, medals, books, plants, and natural things'. Among these was a collection of eggs of such birds as storks, cranes, and water-fowl, gleaned from the broads and marshes of Norfolk. In addition to birds, fishes, and natural curiosities, he had a garden of rare plants. These, which were a great attraction to scientific visitors, may have occasioned Evelyn's earlier correspondence with him.

As a eugenist Browne's theory was not quite in accord with his practice, since in spite of the aspiration expressed in the *Religio Medici* that 'we might procreate like trees', he shortly afterwards followed the ordinary fashion of mankind, and married Dorothy Mileham, a Norfolk woman, 'a lady of such symmetrical proportion to her worthy husband, both in the graces of her body and mind, that they seemed to come together by a kind of natural magnetism'.

Observations on natural history are scattered through his various works. Many, investigated in *Enquiries into Vulgar and Common Errors*, were evidently the result of a methodical hunt of years duration, but without any orderly grouping of the subjects. He explains the 'conceit of the Centaurs', disposes of the solemn stories of combats between toads and spiders which ended in favour of the spider, graphically describes the 'flammeous light' of the glowworm, testifies to the shapely form of bear-cubs, discourses on the alleged uncanny power of wolves to strike men dumb. His *Hydriotaphia* or *Urn Burial*, 1658, is a pattern for a treatise in which anthropological research and historical records are to be combined.

The *Garden of Cyrus* or the *Quincunxial Lozenge*, is a disquisition on groupings in the form of a five in cards ⁘. Incidentally he interspersed in it many interesting observations on the forms of plants and the laws of vegetation, with ideas on growth which to some extent anticipated later works on phyllotaxis.

Among the posthumous writings which deserve notice are several dealing with interesting aspects in natural history: 'Observations upon several Plants mentioned in Scripture'. 'Of Garlands or Garland Plants'. 'A Letter on the Fishes eaten by our Saviour with his Disciples'. 'Answers to certain Queries about Fishes, Birds, and Insects, etc.'. He had a mind that was always on the alert. A Catalogue of Sir T. Browne's Museum was compiled by Dr. Charleton and is contained in his Commonplace Book, now Sloane MS. 3413 in the British Museum.

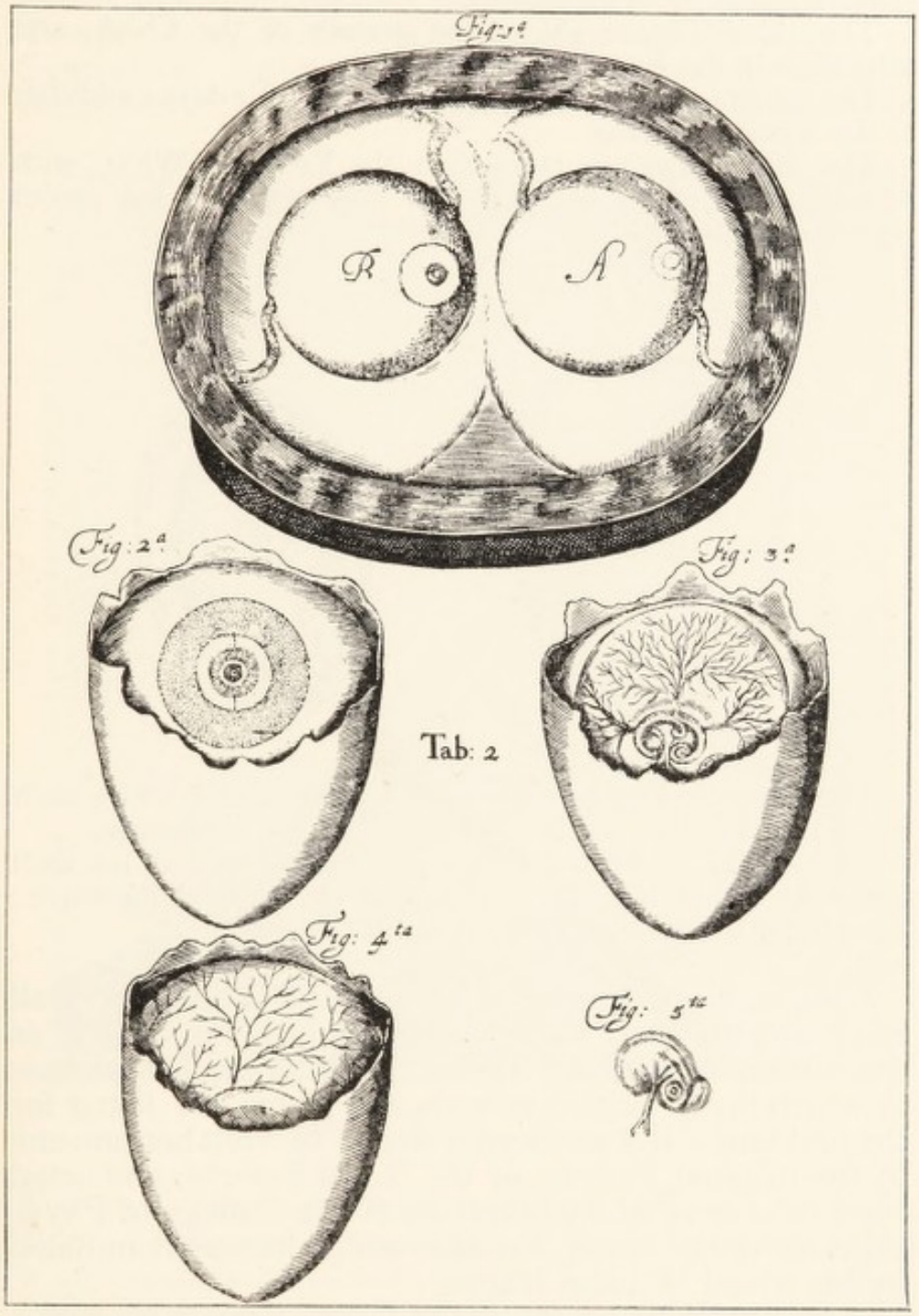
Among contemporary ornithologists we must not forget the name of WILLIAM HARVEY whose interest in birds dated from May 1633, when he visited the Bass Rock on a journey to Scotland with Charles I. The circumstances of the publication in Oxford of his later work on the early stages of the Development of the Chick have already been recounted. The research was prosecuted in the rooms of G. Bathurst in Trinity College, and Highmore was engaged in similar studies there. The extent to which Harvey's views on Generation may have been influenced by his Paduan teacher, Fabricius of Aquapendente, can hardly be defined, but he seems to have gone beyond him in suspecting that mammals were no exception to the rule that animals are produced from eggs. Farther than this, it was hardly possible at that time to go.

The figures we print of the developing chick are from NATHANAEL HIGHMORE'S little work, the *History of Generation*. It appeared in 1651 in the same year as Harvey's *De Generatione*, and Highmore could hardly have been expected to see more than he drew, without a microscope. It was not till quite twenty years later that this instrument helped Malpighi to a further advance.[1]

The first Figure demonstrates the Eggs taken from their shels in a dish, with the Chalazae, and Cicatricula: which in *A* that was never sat on, is but small. In *B* that hath endured the heat of the Hen one whole day, something dilated. In some new layed Eggs, I have seen it no more altered the third day.

The second Figure delineates the second dayes observa-

[1] Malpighi, *De formatione pulli in ovo*, 1673.



HIGHMORE'S DRAWINGS OF CHICKS IN THE FIRST DAYES INCUBATION.
The History of Generation, 1651.

tions and change in the Egg; the large dilation of the Cicatricula, with all its Circles.

The third Figure shews the growth of the Chick, and alteration in the Egg, the fourth day.

The fourth and fifth Figures, shew the fifth dayes addition to the former growths.

The fifth shews him taken from the Yolk and White, with a delineation of all his parts, as they appear lying round together in the Egg.

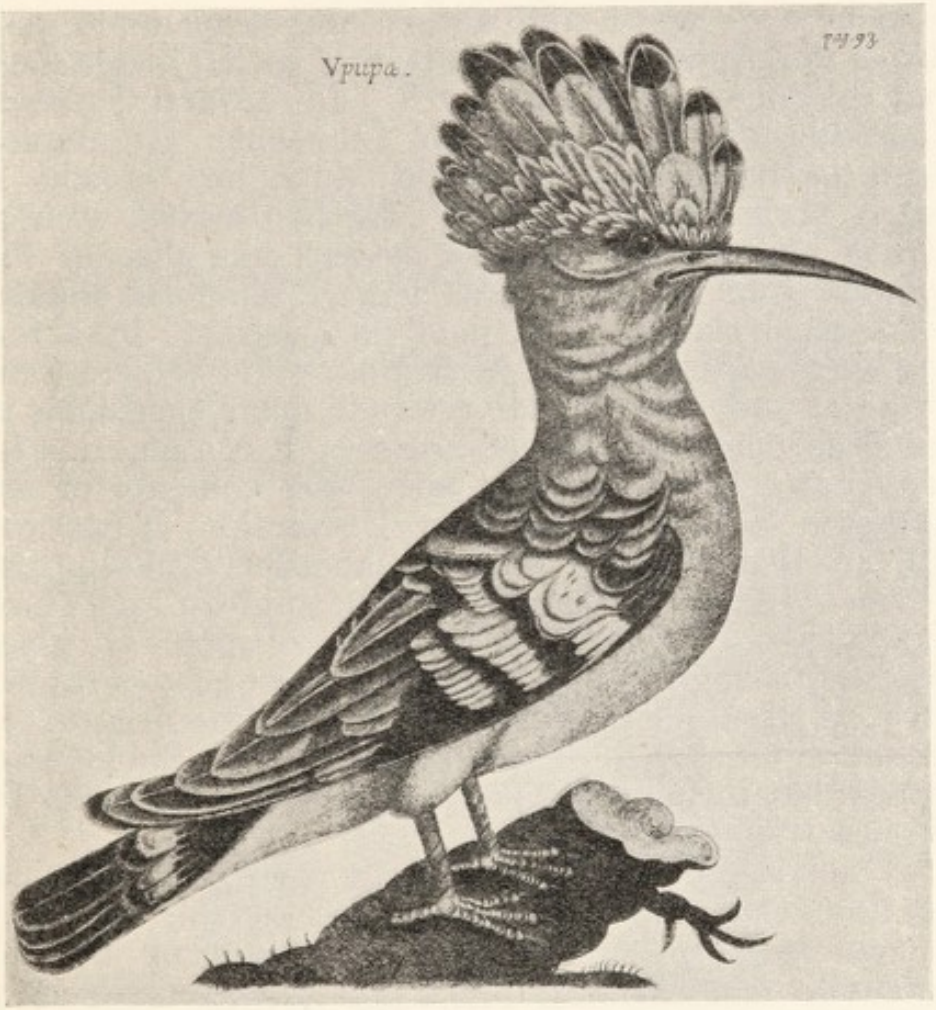
The seventh Figure shews what progress the Chick hath made in his formation, in the third day after incubation.

The eighth shews the Chick perfectly formed in his shell not long before his exclusion; with the Yolk about whole; describing the manner of his lying in the shell.

CHRISTOPHER MERRETT, 1614-95, of Gloucester Hall 1631 and of Oriel College 1633-4, is often quoted as the author of a *Pinax rerum Naturalium Britannicum* in which many British animals and plants are listed for the first time. It was a useful work. Merrett became one of the original Fellows of the Royal Society, and acted for a time as resident Librarian of the College of Physicians in Amen Corner, a post to which he was nominated by his friend William Harvey.

A less valuable book was the *Panzoologicomineralogia*, or a *Compleat History of Animals and Minerals* by a Student of Christ Church, ROBERT LOVELL, 'philotheolog-iatronomus'. It was printed in 1661 at Oxford by Henry Hall, and contained 'the Summe of all

Authors, both Ancient and Modern, Galenicall and Chymicall, touching *Animals*, as to their Place, Meat, Name, Temperature, Vertues, Use in Meat and Medicine, . . . Sympathie, Antipathie, Diseases, Cures, Hurts and Remedies'. It is provided with a *Universall Index* of the



Charleton's London Hoopoe, 1677.

Use and Vertues, and was dedicated to King Charles II. But its very superabundance of medicinal lore makes it an unsatisfactory book.

Dr. Walter Charleton, 1619–1707, of Magdalen Hall achieved the distinction of taking his M.D. Degree at the age of twenty-two and of being appointed Physician-in-Ordinary to the King in the same year. He went to live in Russell St., Covent Garden, and wrote several

medical and physiological treatises (p. 51). His contribution to zoology was a curious work, the *Onomasticon Zoicon, Plerorumque animalium Differentias et Nomina propria pluribus linguis exponens cui accedunt Mantissa Anatomica et quaedam de variis Fossilium generibus.* Lond. 1668. It contains a systematic list of all animals with which the author was acquainted, and also a description of the menagerie in St. James Park that belonged to Charles II. In several respects Charleton was a forerunner of Linnaeus. He emphasized the importance of nomenclature, for 'nomina si nescis, perit cognitio rerum'. He had a clear idea of genera and species, and his system, like that of the botanist John Goodyer, was largely binomial, though not exclusively so. The book is illustrated by a few engraved plates of great perfection. His helpers were Drs. Ent and Merret. He refers to many specimens in the Museum of the Royal Society: it is a pity that he does not tell us anything about the contents of the Anatomy School of his own University. Charleton tells us that he often shot Blackheaded Gulls on the Thames, and that a Hoopoe had been given him which was killed near London in the winter of 1666. He gives good engravings of the Hoopoe and also of the Angler Fish, which he dissected himself. The title page to the second edition of his book, printed in the Sheldonian, shows that in 1677 the Theatre yard was enclosed by Wren's wall.

William Charleton, one of the early benefactors of the Ashmolean Museum, made a considerable collection of zoological specimens, incorporating many that he purchased from Tradescant's widow (see p. 288) in 1667. In his neatly written manuscripts in the British Museum[1] we see that he availed himself of the services of travelling friends and relations to add to his exotic specimens. In 1686 he furnished directions for collecting to his cousin Posthumus Salwey 'who went for ye Streight in ye Smirna yacht', and in Sept. 1689 to James Reed 'who went to ye West Indies', whom he furnished with full instructions as to the things he most desired. He strongly advocated the use of spirit of wine as a preservative. Specimens sent home were to be directed

[1] MS. Add. 3962.

GUALTERI CHARLETONI

EXERCITATIONES

DE

Differentiis & Nominibus ANIMALIUM.

Quibus accedunt

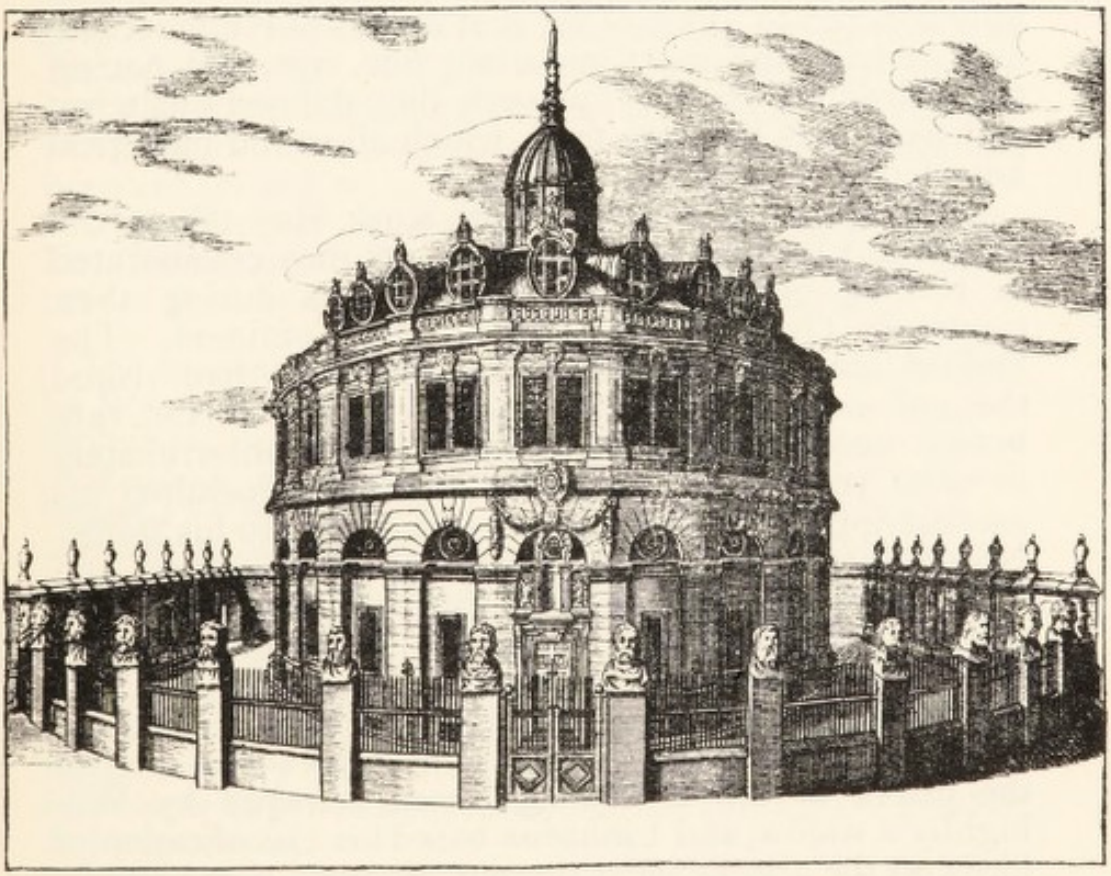
MANTISSA ANATOMICA,

Et quædam

De variis FOSSILIUM generibus,

Deque differentiis & nominibus COLORUM.

Editio secunda, duplo fere auctior priori, novisque iconibus ornata.



OXONIÆ,

E THEATRO SHELDONIANO, An. Dom. 1677.

to 'Mr. W. Charleton at Mr. Wm. Cockram's, merchant, in Swithens Lane in London'.

In the seventeenth century the chief contributions to sound zoological literature were made by two members of Trinity College, Cambridge, John Ray (1628–1705) and Francis Willughby (1635–72) whose labours were so interdependent that they must be mentioned together. They were the first of the moderns to recognize the principles by which the natural affinities of animals should be determined; and to see that a thorough reform in the classification of the vegetable and animal kingdoms had become necessary; that the only way of bringing order into the existing chaos was by arranging the various forms of life according to their structure; that zoological literature must not be burdened with inapplicable passages and quotations from ancient writers, and perpetuate the erroneous or vague notions of predecessors. Speculation must be abandoned, facts only adhered to. One of the first results of their method, and perhaps the most important one, was, that having recognized the 'species' as such, they defined this term, and fixed it as the base from which all sound biological knowledge has to start.

Although they had divided the work, Ray taking the plants, and Willughby the animals, yet they collaborated in making observations and collections during their travels in Great Britain and on the Continent. The Oxford libraries supplied Willughby, who had visited the university in 1660 for the purpose, with the rare books necessary for his studies, but unfortunately he died young without publishing, but bequeathed his manuscripts and an annuity of £60 a year to his friend. No one could have had a more faithful executor: and notwithstanding the pressing nature of his own great work on the Vegetable Kingdom, Ray found time to revise and complete Willughby's three works: his *Ornithologia*, 1678, his *De Historia Piscium*, fol. Oxford, 1686, and his *History of Insects*, in 1710. The cost of the plates in the *Ornithologia* was defrayed by Willughby's widow, and Linnaeus based his classification of birds on the arrangement therein adopted.

The gathering of the first Fellows of the Royal Society in Oxford was not particularly fertile in zoologi-

cal research or discovery. There were no collections, and without specimens for examination and comparison, but little can be accomplished. Two notable advances in method deserve special notice, indeed we can think of none that have been more fruitful in their application. The first is due to Robert Boyle, and had the simplest of beginnings. It was his method of preserving or embalming the embryo of a chick in a glass filled with spirit of wine, to which he sometimes added a little sal armoniack, observing that it never coagulated the spirit of wine. The results of his experiment are described on p. 105. Before that time, dried preparations were usual.

The second advance was the application of the Microscope to biological research.

Among the minor contributions to learning were the researches of Warden Wilkins on bees. And his beehives or Colony hives were still to be seen in Wadham Garden in 1677, having been set up for over twenty years (Plot). He had evidently continued the earlier hobby of Francis Potter of Trinity, who several years earlier had also experimented with bees and had shown Aubrey their thighs under a microscope.[1] Plot's notes on Oxford bees are quoted on p. 179.

Other lines of zoological research were advocated by Dr. Christopher Wren, who was also a zealous advocate of the importance of anatomy. He wrote:

> The Seasons of Fish and Fowl are retarded or accelerated by Weather: foreign Fowl are observ'd to come in great Multitudes, near the Time of their Departure, to some Coasts of *England*, and there to stay for a Wind which when it happens for their turn, in a few hours there is not one to be seen in the whole Country. The Seasons of Fish depend much upon the Seasons of the Water-flies and Insects their Food; in two rivers parted by the same Meadow I have known the difference of ten days or more. The Seasons of the Insects are themselves very considerable. The Multitudes or Paucity of venemous creatures, and of many other the like things are very well worth registring; and all other things found to be either consequences, signs, or presages of weather and seasons.
>
> I could wish we were frequent in Dissections of Animals, of any Sort whatsoever, and that Figures be drawn, where

[1] Aubrey, *Wiltshire*, p. 68.

Nature appears anomalar, as she is most in Fishes and Insects; especially in the parts that serve for Concoction. And with this we may take in the experiments about Generation: The Spring should not be lost, for observing the Progress of hatching Eggs; and likewise the springing of Grain and Seeds; which in a ruder Proportion gives some light to the Generation of Animals. Tame Rabbets may be kept purposely for Dissection, as well because they are frequently pregnant, as because of late, some Observations have been made from them which seem to thwart those of Dr. *Harvey*, how truly, will be worth our Enquiry.[1]

Wren's ideas were admirably carried out by EDWARD TYSON, 1651–1708, of Magdalen Hall, in a series of monographs on the anatomy of a variety of animals including the chimpanzee, musk hog, porpoise, Virginian opossum, rattlesnake, embryo shark, lump fish, tapeworm and roundworm.[2] He observed that many strong-scented animals, besides the *Hyaena odorifera*, and the *Catus zibethicus* or Civet cat, have follicular repositories or bags, near the anus, in which their respective scented humours are contained. He found such bags in Fiber Castor, or Beaver, whence *Castoreum*; *Gazella indica* or *Capra moschi*, whence Musk; and in Sepia, Loligo, and Purpura. His first observation was made on a male Pole-cat dissected at Oxford February 4, 1674, and the observation was confirmed in a female Pole-cat, March 2, 1675. Later on he found similar scent bags in the Fox, Weasel, and Cat. (Plot.) His work on the Porpoise was discussed by the Royal Society on June 3, 1680, when Wren was in the Chair. At the same meeting the Fellows considered certain problems connected with Eugenics, more particularly the cause of monstrous births. The discussion was opened by a case of 'Siamese twins' from Somerset, described by JOHN AUBREY, and Wren surmised that most monstrous births proceeded from twins. Examples of hybrids between different species were mentioned, it being generally observed, 'that all these mixt productions were barren,

[1] Wren, *Parentalia*, p. 222.

[2] Two of Tyson's beautiful paintings in a MS. at the Royal College of Surgeons, of dissections of Lophius and of the Stomach of a Gazelle, have been figured by Singer, *Studies in the History of Science*, ii, pl. 12. Tyson was also a student of finger prints.

and would not go on to propagate their like' [1]—a most important generalization.

Variation among domestic animals was also illustrated by a great number of instances, including a 'pheasant of Surinam', described by Sir Christopher Wren.

Wren, too, played a most important part in the early application of the microscope to the study of small and apparently insignificant things. He thus introduced the naturalist to the new and powerful engine of research that has had so profound an effect upon science and philosophy and indeed on the whole course of civilized life. Already in 1664 ROBERT HOOKE, 1635-1702, of Christ Church, pointed out that 'the Science of Nature has been too long made only a work of the Brain and the Fancy: It is now high time that it should return to the plainness and soundness of Observations on material and obvious things. It is said of great Empires, That the best way to preserve them from decay, is to bring them back to the first principles, and Arts, on which they did begin. The same is undoubtedly true in Philosophy, that by wandring far away into invisible Notions, has almost quite destroy'd itself, and it can never be recovered, or continued, but by returning into the same sensible paths, in which it did at first proceed.'

By the advice of Dr. Wilkins, Hooke proceeded to engage on microscopical observations yet '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 now make one of the Ornaments of that great collection of Rarities in the King's Closet. . . . But at last being assured both by Dr. Wilkins and Dr. Wren himself that he had given over his intentions of prosecuting it, and not finding that there was any else design'd the pursuing of it, I set upon this undertaking, and was not a little incourag'd to proceed in it, by the honour the Royal Society was pleased to favour me with'.

With the aid of the Compound Microscope which has been figured in vol. i, p. 288, Hooke studied a great variety of vegetable and animal forms. He did more to popularize the newly-invented instrument than any other

[1] Birch, *Hist. Royal Society*, iv, p. 41.

Englishman of his time. It supplied him with an inexhaustible fund of 'experiments' to show to the Royal Society. And in 1667, only three years after he had been appointed Curator of Experiments, he was able to produce a remarkable volume of 'Observations made on Minute Bodies of very varied kinds by Magnifying Glasses', under the title *Micrographia*.[1] The book had really been written in 1664, and the engraved plates appear to have been ready before January 20, 1665, when Pepys took home a copy, 'a most excellent piece, of which I am very proud'.

In this work Hooke described and figured plant cells in cork, and in the pith of a number of plants. Among animal structures he made microscopic drawings of the hair of different mammals; of the scales of a sole and other fishes; of the stings of bees; of feathers, pointing out that certain colours, i.e. the blue of the eye of the peacock's feather have no real existence but are due to a texture visible under the microscope; of the feet, eggs, wings, and compound eyes of insects; of the teeth of a snail. He made enlarged drawings of the external features of several flies and the gnats, of the feather-wing'd moth, of a spider and ant, of mites, flea, louse, vinegar eels, sponge, and of the Polyzoan *Flustra*.

Ten years later Hooke investigated the microscopic structure of muscular fibre, describing it as being like a necklace of pearls, and in 1677–8 published observations on Animalculae in pepper-water.

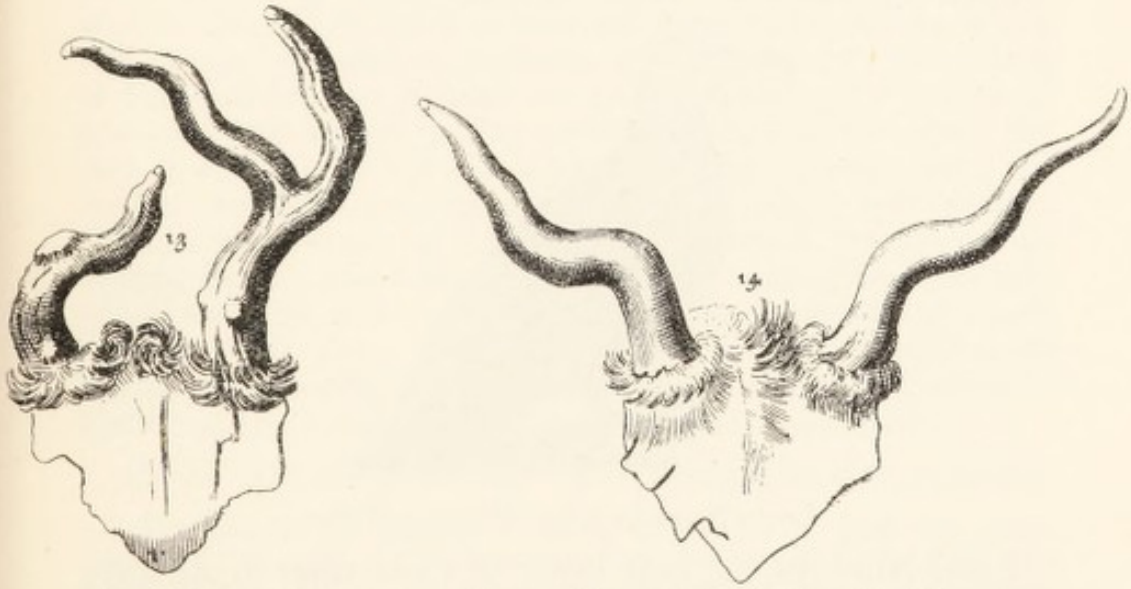
During the last quarter of the seventeenth century a great incitement to the study of all branches of Natural History was due to the action of the Clarendon Press at Oxford in beginning the publication of the Natural Histories of the six English Counties of Oxfordshire, 1677, Staffordshire, 1686, Lancashire, Cheshire, and the Peak, 1700, and Cornwall, 1758. It is a pity that this good work of our printing Press should not have been continued.

In the pioneer volume Robert Plot devotes Chapter VII to his discursive notes *Of Brutes*. Amongst whole-hooft *Quadrupeda* he met with three *Horses* remarkable for their *age*; one at Souldern, another at Sherbourn, and a third at Aston Rowant, each reported to be about

[1] Hooke, *Micrographia*, printed 1667.

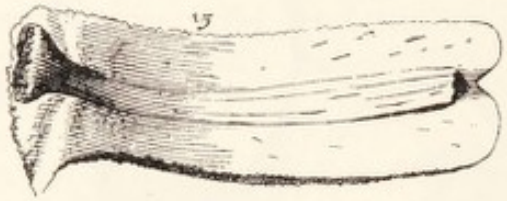
forty years old. Amongst cloven-hooft Beasts a *Hog* at Upper-Tadmarton had been fed to the extravagant greatness of near 13 hands high. Sheep bearing two lambs at a time, *double Ews*, were preserved at Darnford, Newington, and Dorchester. Sheep with four horns and

with one horn resembling a *Unicorn* were bred at Ricot by Lord Norreys (Figs. 10–12). At Newington Mris. *Dunches'* prolific cow produced a calf before



she was eleven months old, and at Hardwick, near Bicester, another cow threw *tergemini*, or three identical triplets. The Deer at Cornbury had irregular dwarfed heads (Figs. 13, 14) so long as the Park was a

Cony-warren, but when the warren was destroyed by the Earl of Clarendon, the deer developed *fair branched-heads* once more. The strange alteration was attributed to the *urin* and *crotizing* of the *Conies*. Amongst *claw-footed Animals* Plot met with nothing so strange as the rib of a Dog, or some such like beast,[1] set



in a bone interceding two other ribs, that the intercostal parts were filled with it (Fig. 15). It was found about Oxford, and given to him by the Right Reverend Father in God, *Thomas* Lord Bishop of *Lincoln*, and its figure was dedicated to the Hon. James Herbert of Tythrop.

Amongst the inhabitants of the lowermost *Heaven* Plot could not find any of the *feathered* Kingdom that had not been noted by the Learned and Industrious *Francis Willoughby*, 'except perchance a *little Bird* sometimes seen, but oftner heard in the *Park* at *Woodstock* . . . commonly called the Wood-cracker'.

LORD NORREY'S ST. HELENA HEN.

Lord Norreys, a great lover of *Curiosities* in all sorts of *Animals*, kept a rapacious, carnivorous '*Hen*' from the *Isle* of St. *Helen*, having her beak near its end, crook'd after the manner of a Vultur, and striking with

[1] Perhaps the rib of a Turtle!

her pounces like a *Hawk*, though her talons indeed are not much more turned than those of the common house Hen. Plot having stated why it cannot be either the *Gypaetos* of Aldrovandus or the *Percnopteros* of Johnston, then proceeds to give a most excellent description, and figure of the Egyptian Vulture, *Neophron percnopterus*, Linn.[1]

He regards as occasional visitors the Hoopoe, seen by him on Otmoor, while another (p. 270) was killed near Cassington; the Cormorant, one killed from St. Mary's steeple (tired with a long flight) in 1675 about harvest time, and another young one taken up in Arncot-field. But he wisely suggests that the *Toucan* of 1644, was an escape from a ship.

Of albinos he noted a white *Linnet*, given him by Lane of Deddington, and the partially white pheasants kept by Lord *Norreys* of Ricot. But when he came to submit the phenomenon of albinism to severe examination his mind was too obfusticated with the fumes of a chemical laboratory to reach any convincing explanation. After suggesting that whiteness often proceeds from a defect of moisture or nourishment he goes on to guess that this Nature

does by giving some certain individuals of each species a skin of finer and more contracted *pores* than others, which will cause *whiteness* in feathers, hair, etc. by not permitting of the *Sulphureous particles* to expire, which give *variety* of colours; thus we see in the *cicatrization* of wounds where the skin is drawn together like a purse, and the pores closed up, the hair comes constantly *white*: thus the subtile *veterinarians* procure white stars, or other desired marks in the fore-heads of their horses, and I have seen the skins of *black* Grey-hounds powdered with white, or made Ermyness, by applying wood-ticks to their skins when young, both which are performed also by *cicatrization* and closing the *pores* of the skin, thereby hindering the exhalation of the *Sulphur* in those parts.

Pyed Birds are produced by crossing common coloured

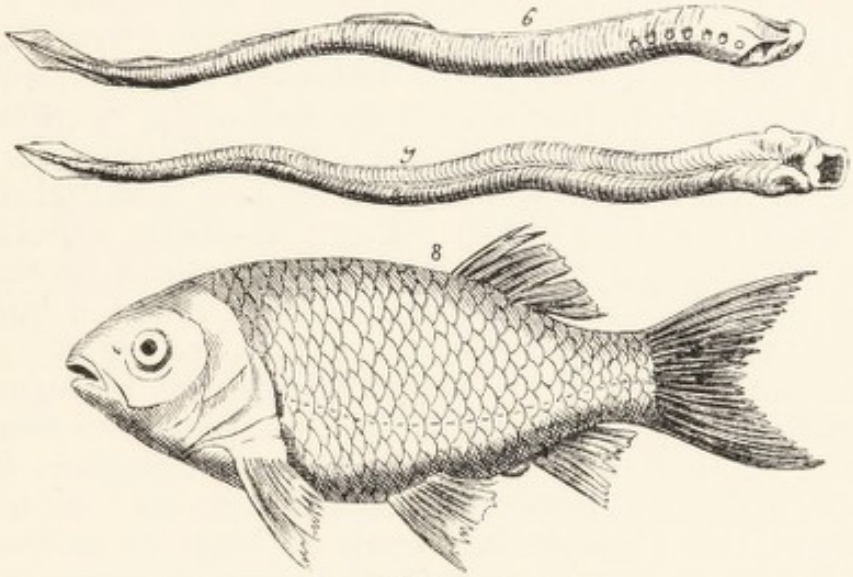
[1] My friend Mr. Regan informs me that this bird has been recorded from Kilve, Bridgwater Bay, Somerset, Oct. 1825, and from Peldon, Essex, on Sept. 28, 1868. The late Lord Lilford informed my father that he had seen Vultures flying high over the south of England, but would not publish his observation for fear of being disbelieved by some other ornithologists who had not seen them.

and white parents. In 1674 the Rev. Mr. Hinton of Witney gave Plot an *Egg* of about the size of a Pigeon's egg with another imperfect one in it, thus illustrating the *Ovum in Ovo* described by Harvey and shown by him to that incomparable Prince *Charles* the *Martyr*; and that other shown by the King of Denmark to Thomas Bartholin, *c.* 1669.

Plot comments on the absence of *Snakes* in the *Northern parts* of *Oxfordshire*. Indeed at Blechington it was believed that an imported snake would instantly die. Plot put the matter to the test by getting leave 'in the absence of the *Family*' to enclose a snake in the court of Lord Anglesey's house to see what time would produce. A gardener was left in trust to observe it strictly. After three weeks' time the snake was found *dead*, and without sensible external hurt. Plot surmised that the death could not be ascribed to the talismanical figure of the snake-stones, Ophiomorphites (= fossil Ammonites) in the rocks, for they and snakes occur happily together elsewhere, and so again the chemical laboratory came to his aid, and he diagnosed death from Saltpetre, Sulphur, and Vitriol, 'but whether by *one*, *two* or *all* these, though we dare not pronounce, yet it is caused by some such *mineral steam* disagreeable to the *Animal*'.

'To the Fishes, whereof we have a sort in the River Isis, that we call here a Pride, of the long cartilagineous smooth kind, concerning which Authors seem so obscure, that I know not whether it be described at all; or if it be, it is done so imperfectly, that perhaps it may be acceptable if I contrive another. The Fish the most like it of any I can find, is the *Lampetra parva fluviatilis* of Rondeletius, rendred by Dr. Charlton and Dr. Merret, the Stone-grig: it having a mouth cut neither perpendicularly downward, nor transversly, but hollowed as it were between two cheeks, without an under jaw, after the manner of Leeches; on the top of its head it has one and on each side seven holes that supply the place of gills; and under the belly a small line, reaching from the mouth to the exit of its excrement; it moves by a winding impulse of its body, without the help of any other fins but the pinnulae at the tail, by which it steers its course; and thus far it agrees with the Lampetra fluviatilis.

'But though they agree in some particulars, they differ in as many, our Pride being streaked from the top of its back down to the afore-mentioned line at the bottom of its belly, with lines of a distinct colour from the rest of its body, like the Pricka marina of Aldrovandus, whereof the Lampetra is not said to have any: Beside the two pinnulae of the Lampetra, whereof one stands on the top of its tail, and the other a little higher on the back, some space interceding; the Pride has another underneath its tail, joyning with the other from above at the tip, making



PLOT'S FISHES.

6, 7. Lamperns, *Lampetra fluviatilis.*
8. Rudd, *Scardinius erythrophthalmus.*[1]

the whole tail to end like the head of a spear. Moreover, the eyes of the Pride are very obscure, and not such plain round ones as are given the Lampetra, not only in the description but Cut of Rondeletius; And though it have a hole in its head, yet it stands not as Rondeletius describes it in the Lampetra, just in the middle between the eyes, but more forward in the extremity of the head, near the upper lip; all which may plainly be seen Tab. 10. Fig. 6, and 7. Whence 'tis easie to conclude, that either this Fish has not been described at all, or so very meanly, that there was almost

[1] Mr. C. Tate Regan, who has kindly identified Plot's animals for me, points out that the description of the eye does not quite fit.

a necessity of giving another, either of which I suppose will excuse this attempt.[1]

29. Beside the Pride which we think undescribed, we have another sort of Fish plentiful in the Cherwell (scarce ever found in Isis but below the place where the Rivers joyn) that is more certainly so ; and that a Fish of the squammous kind, which they call a Finscale, somwhat like a Roach, only the belly fins, and the single one at the exit of the excrement, and those at the tail are much redder then those of a Roach ; it has also a full black eye, incompassed with a yellow iris, whereas that of a Roch is red ; it is also a much deeper and thinner Fish, but yet neither so deep or thin as a Bream ; from which also it differs not only in the redness of its fins, but in that the single fin placed next the exit of its excrement, is not continued to the tail as it is in the Bream : Its fins at the gills are much whiter than the rest, and that upon the back of a dirty bluish colour : its scales, especially near the back, are of a greenish yellow colour, on which from the gills to the tail there runs a crooked line of points, one on each scale, as in Tab. 10. Fig. 8. The fishes most like it of any described, are the Bollerus or Bordeliere, and the Phoxini, Rose or Rosiere of Rondeletius ; but that they cannot be the same is plain from hence, in that the Bordeliere is confest to have no teeth, whereas the Finscale has teeth as large as a Roach ; and the Phoxini never to be found without spawn, or to exceed half a foot in length, whereas I have seen Finscales, even in time of year when one might well have expected it, without any spawn ; and some of them (particularly the described one, Fig. 8) from the mouth to the fork of the tail a foot long, and four inches and a half in depth, beside many other differences that might also be brought.

'The *Evenlode* has a sort of *Chub* peculiar to it, and equalling the perch or tench in goodness. Two *Salmon*, about a yard in length, were taken about 1670 in a small brook near Lillingston-Lovell.'

[1] Ray wrote a letter to Dr. Robinson, dated at Black Notley, Apr. 1, 1685, in which he states his belief that Plot's Lampetra and Finscale are undescribed. A large part of the letter is printed in Birch, *Hist. Royal Society*, iv, p. 389, and the letter itself may be consulted in the Royal Society's Letter-book, x, p. 62.

'Of the feminine monarchy of *Bees*[1] none are more memorable than the Bees of Ludovicus Vives, who, being sent in 1520 by Cardinal Wolsey to Oxford to be Professor of Rhetoric there, and being placed in the *College of Bees* (Corpus Christi being so called by the Founder in his Statutes) was welcomed thither by a swarm of bees, which to signifie the incomparable sweetness of his Eloquence, settled themselves over his head under the leads of his Study (at the west end of the Cloister) where they continued for about 130 years and were known as *Vives his Bees*.'

In the year 1630 the leads over Vives his study being pluckt up, their stall was taken, and with it an incredible mass of hony: but the Bees, as presaging their intended and imminent destruction (whereas they were never known to have swarmed before) did that Spring (to preserve their famous kind) send down a fair swarm into the Presidents garden, which in the year 1633 yielded two swarms; one whereof pitched in the garden for the President; the other they sent up as a new Colony to preserve the memory of this mellifluous Doctor, as the University stiled him in a Letter to the Cardinal. Thus far Mr. Butler.

And there they continued, as I am informed by several ancient members of that Society that knew them, till by the Parliament Visitation, in Anno 1648. for their Loyalty to the King, they were all, but two, turned out of their places, at what time with the rest of the inhabitants of the College, they removed themselves, but no further than the East end of the same Cloyster, where as if the feminine sympathized with the masculine Monarchy, they instantly declined, and came shortly to nothing. After the expiration of which ancient Race, there came, 'tis true, another Colony to the East corner of the Cloyster, where they continued till after the return of his most Sacred Majesty that now is: but it not being certain that they were any of the remains of the ancient Stock (though 'tis said they removed thence to the first place) nor any of them continuing long there, I have chose rather to fix their period in the year 1648. than to give too much credit to uncertainties.

And thus unhappily, after above six score years continuance, ended the famous stock of Vives his Bees.

In Plot's time there was discovered an excellent method of *Bee-houses* and *Colonies*, but none then extant

[1] Butler, *History of Bees*, No. 59.

was comparable to the methods practised by JOHN LAD of Over-Worton and W. Tayler of Warkwork who had *Apifactories* in Oxfordshire. According to the Rev. Mr. Clark of Drayton they profess

> 1. That they can take swarms out of any stock that is able, and neglects to swarm, without any prejudice to the stock. 2. That they can take hony out of a stock without that hazard to the Bees, which (they say) the way proposed by the Author of the Colonies is subject too. 3. That they can secure any stock from the invasion of Robbers. 4. That they can so order an old stock, that the Bees shall gather pure Virgin hony. 5. If a stock be in a low condition, they can preserve and recruit it, so as it shall do well. 6. They can take away a Queen where there is more than one in a hive, and place her in a stock where the Queen is dead, or otherwise wanting, and by that means keep the subjects together, which would else disperse. 7. If a Queen wants subjects, they can draw out of several stocks supplies in what number they please, that shall settle under her government. And these operations they commonly practice, which because profitable to them, they are unwilling should be made too common, which yet they are so ingenious as not to deny to communicate to fit persons upon reasonable terms.

In May 1685 a swarm of bees at University College was the subject of a communication by Dr. Plot to the Royal Society. The bees were reported by Obadiah Walker to have settled on an elm branch that a commoner held in his hand, when he was walking near the hall, and were hived.[1]

Plot described one *Water Fly* as a specimen of what he intended, treating others 'as fast as he could compass the method of their productions'. He called it '*Musca è Phryganio saxatili*, there being a stone, as well as a stick Caddis, or Cad-worm ; in the generation of which, Nature seems to observe the following method. First, there appears on the stone to which many of them stick, as in Tab. 10, Fig. 4. only little bubbles of a glutinous nature, like the spawn of frogs, which by the descent of gravel and sand that stick to them, are formed into stone Caddis houses, including the Animal therefore called the stone Caddis; which after it has continued in its rough-cast stone house its due time, gets off the stone either to the

[1] Birch, *Hist. Royal Soc.* iv, p. 400.

bank of the River, or climes up some reed, where also leaving its house, it becomes a flye, somwhat like in shape to the Muscae διττότριχες, or *bipiles Moufeti*, that

CADDIS FLIES FIGURED BY PLOT.

Fig. 4. Egg cases, probably of *Agapetus fuscipes.*
Fig. 5. ? *Agapetus fuscipes*, magnified.

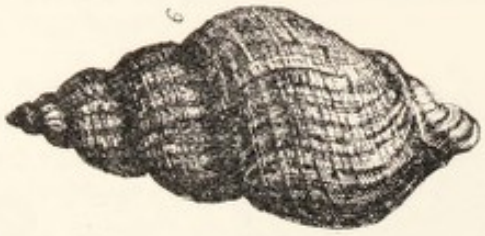
come of the stick Caddis, only it is shorter, and wants both the Antennae and forked bristly tail; but most of all like the Breise, only the Briese is all gray, and this has a black head and dark brown wings.'

The sort of *Gammarus* or *Crey-fish* found in Salford stream do 'not boil to a brisk red colour, but at best of a dirty yellowish red, which I suppose must be attributed to the badness of the water, infected with ill qualities perhaps by the Moor through which it passes, which is very agreeable to one of Cardans signs of good water: "Vbi aqua bona (says he) astaci debent esse valde rubri, cum coquantur": whence 'tis easie to conclude (if the Symbol be truly put) that where they boyl of a different colour, the water must needs be naught.'

Of Mollusca he examined fresh-water Mussels, *Mytilus fluminum maximus subviridis* from ponds at Bradwell, Hanwell, and Shotover Forest in hope of finding pearls, but there were none. Oxfordshire contains all the fresh-water snails mentioned by Lister,[1] and Plot could add nothing to his descriptions save that the *Cochleae fasciatae ore ad amussim rotundo* seem to be all viviparous. Plot thus appears to have discovered the young in *Paludina vivipara*, which he remarked, died in large numbers in the summer of 1676. Of land shells he gives a figure of a common Whelk discovered, by the younger Bobart,

[1] *Philosophical Transactions*, No. 105.

creeping on the grass in Cornbury Park. How it got there was, and still is, a mystery.



Knowledge of insects was extended through the translation of Godartius' *Of Insects* by Martin Lister, who printed 150 copies at his own expense in 1682. And further important work was accomplished in London by Nehemiah Grew, but in Oxford, zoological studies appear to have been afflicted with the somnolence of the eighteenth century.

Dr. William Sherard (1658–1728) of St. John's College, remembered as 'the regent of the botanic world', was our greatest patron of botanical studies. His letters to Richardson and Moyle[1] show him also to have been interested in birds. 'I describ'd about forty sorts at *Smyrna*' (where he was Consul from 1702 to 1718), 'mostly such as I cou'd not make out by Mr. Willughby.'

Sherard's work is an example of the stimulus towards the improvement of zoological science that a direct contact with a foreign fauna affords. The pundits at Oxford were satisfied with a so-called natural history written in 326 B.C., and based on the discoveries of Alexander the Great during his eastern campaigns. The more active spirits found outlet for their energies in commentary that was puerile and in a gradual apotheosis of *Language*, with concomitant neglect of *Matter*, in classical writings. Fortunately, however, the allurement of oceanic discovery and the expansion of foreign trade were favourable to the advancement of science, and gave a few members of our university the opportunity of seeing nature for themselves. For those who were unable to travel and open the pages of the great book of nature, there were specimens, living or dead, of foreign forms of life in collections brought home by travellers, or

[1] Harting, *Rodd's Birds of Cornwall*, 29.

pictures of exotic animals and plants and landscapes made by them, all of which may implant in the mind a first impulse to travel into distant countries.

The persistent neglect of collections made by early scientific travellers has been very detrimental to the progress of the Biological Sciences.

A most important contribution to our knowledge of the zoology of northern Africa and the Levant was furnished by THOMAS SHAW 1694–1751 of Queen's College.[1] After taking his Master's degree in 1720 he went out as chaplain to the English factory at Algiers; visited Egypt and Cyprus in 1721, Jerusalem and Mount Carmel in 1722, Tunis and Carthage in 1727. He made several journeys into the interior of Algeria, Tripoli, and Morocco. After his return to England he became a fellow of Queen's College and of the Royal Society, Vicar of Godshill, Regius Professor of Greek, and Principal of St. Edmund Hall (1740) which he raised 'from a ruinous condition by his munificence', and was termed its 'instaurator'. His large folio volume of travels[2] is finely illustrated with plates of animals and plants and is full of interesting descriptions of insects, mammals, and fishes. An attempt to identify the animals of the Bible gave point to his researches, and his antiquarian tastes led him to publish *inter alia* the first good picture of the skull, bill, thigh-bone, and tibia of a mummied *Ibis*. His book was most favourably received: 'Fly, fly to secure it,' advised Dibdin.[3] And Gibbon specially

[1] The atmosphere of Queen's College appears to have been particularly favourable to the production of naturalists during the eighteenth century. GEORGE WALDRON, matric. 1706, described the natural features of the Isle of Man in a work whence Sir Walter Scott drew much of the information reproduced in *Peveril of the Peak*. W. G. MATON, physician to Queen Charlotte, was an accomplished naturalist. JOHN WALLIS, matric. 1733, was the author of a Natural History of Northumberland. EDWARD RUDGE, matric. 1781, described new plants from Guinea. The work of SHAW, PENNANT, and BARRINGTON is mentioned in our text.

[2] T. Shaw, *Travels or Observations relating to several parts of Barbary and the Levant*, 1738; 2nd. edit. 1757. He printed as an appendix, a *Method of making Sal Armoniac in Egypt* from camel dung, which he learnt from Dr. Lisle, fellow of Magdalen College. It is of interest as a very primitive operation of Organic Chemistry practised by the Arabs. His correspondent was probably the Rev. Dr. THOMAS LISLE, who wrote *A Letter from Cairo* in August 1734.

[3] Dibdin, *Libr. Comp.* 1824.

excepts him from the crowd of 'blind' travellers who do not use their eyes. Several of his natural history specimens were left to the University.

The great attraction of exotic forms of life was felt by Sir Ashton Lever, 1729–88, who matriculated at Corpus Christi College in 1748. After forming at his seat at Alkrington Hall near Manchester the best collection of indigenous live birds, he purchased about 1760 several hogsheads of foreign shells at Dunkirk. These, with his collection of stuffed birds and many anthropological objects, formed the nucleus of a museum, which he moved up to London in 1774 and installed in Leicester House, Leicester Square. It filled sixteen rooms, the passages and staircases, and was called the 'Holophusikon'. Madame d'Arblay visited it in 1782 (*Diary*), six years before it was sold by lottery to James Parkinson, who exhibited it in the Rotunda on the south side of Blackfriars Bridge. In this new abode the collection was described by George Shaw of Magdalen Hall,[1] and again by E. Donovan at the time of its sale in 1806.

The study of systematic biology was sufficiently far advanced by the middle of the eighteenth century to make it quite clear that, owing to the great differences between southern and northern species, the English renderings of the names of animals and plants in the classical authors were wholly misleading. To provide scholars with the material essential for the understanding of ancient Greek writers on animals and plants, Dr. John Sibthorp, 1758–95, of Lincoln College undertook two journeys in Greece and the Levant, where he collected and studied the flora and fauna. In 1784 he engaged at Vienna a very excellent draughtsman, Ferdinand Bauer, who under his instructions drew the animals he had obtained on his tour at Constantinople, in Crete, Cyprus, and in the islands of the Aegean. Bauer's zoological drawings are bound up in four volumes, entitled *Fauna Graeca Sibthorpiana, or Drawings of the Animals of Greece and the Levant*: they illustrate 18 mammals, 85 birds, 19 amphibia, and 100 fishes of Cyprus.

[1] G. Shaw, *Museum Leverianum*, 1792.

Vol. i. Contains Mammalia (11), Tortoises (4), Amphibia (3), Lizards (12), Snakes (15), Fish (49).
Vol. ii. Fishes, pls. numbered '95 to 178'.
Vol. iii. Birds, 114 pls., briefly described by P. L. Sclater, *Ibis*, 1904.
Vol. iv is a volume of studies in pencil: comprising about 62 leaves of fish, 7 of birds, 2 of snakes and 1 bat.

That Sibthorp's fine work for zoological science should have been neglected is due to the fact that in this home of classical learning scholars specialized on a few works by the popular authors of which there were many translations, and left the writings of scientific authors severely alone. Among such neglected classics is Dioscorides, of whose works no English translation has ever seen the light. For several generations Sibthorp's zoological work has remained hidden away in a botanical library. Its rightful custodians have other duties than that of securing its publication, and few zoologists have ever seen it.

Thomas Pennant, 1728-98, of Queen's College was, however, also an exception to eighteenth-century somnolence. In his boyhood he was given a copy of Francis Willughby's *Ornithology* by his kinsman Richard Salusbury, the father of Mrs. Thrale, and to this gift he attributed his early taste for natural history. He was for a time an undergraduate at Queen's College, where he matriculated in 1744, but did not take a degree. In 1754 he travelled in Ireland, but here he kept a very imperfect journal; 'such', he adds, 'was the conviviality of the country'. In 1765 we find him visiting France, and staying with Buffon. At Ferney he visited Voltaire, whom he found 'very entertaining and a master of English oaths'; on his return journey at the Hague he met the celebrated Pallas. The first part of his *British Zoology*, begun in 1761, appeared in 1766, and his *Synopsis of Quadrupeds* five years later.

At various times in his life, Pennant thoroughly explored a large part of Britain. He also visited the Farn Islands off the Northumbrian coast in 1769 and the Isle of Man in 1774; he travelled round the coast of Scotland—altogether a most interesting life—and made copious notes on the fauna, especially on the birds of the coast. In 1781 he published *A History of*

Quadrupeds, a new and enlarged edition of his *Synopsis*; and three years later his *Arctic Zoology* appeared, partly based on information received from G. Low.

Pennant occupies a leading position amongst the zoologists of the eighteenth century, and although his work has been considered below the standard of that of Buffon, he was a really learned man, and he had an undoubted faculty for making dry and obscure things readable and plain. The estimation in which Pennant was held by his contemporaries is partly illustrated by Dr. Johnson's appreciation—'He's a whig, sir, a sad dog. But he's the best traveller I ever read; he observes more things than any one else does'—and partly by the fact that the premier book of Nature Study in the English language was addressed to him and to another member of Queen's College, DAINES BARRINGTON, in the form of letters.

This, *The Natural History of Selborne*, was the work of GILBERT WHITE,[1] 1720–93, Fellow of Oriel College.

No work by any of the great Masters of Science of either University has had a greater popularity than the letters of this country parson, who but for them might have remained unknown. *The Natural History of Selborne* was the first book of the kind to appear in this country: after a hundred and thirty years it is still sought after by numberless readers to whom the scenes and animals described in it are equally unfamiliar. It was not written for publication. It was part of a private correspondence carried on between White and Pennant from 1767 to 1776 and with Daines Barrington 1769–1787, the whole with additional letters being printed in 1788, when the index, 'an occupation full as entertaining as that of darning of stockings', was prepared.

It is not easy to analyse the secret of its great success. Professor Alfred Newton, who has, perhaps, better than any other critic, penetrated beneath the

[1] White's principal writings are:

Account of the House-Martin or Martlet. Phil. Trans. lxiv, 1774.

Of the House-Swallows, Swift, and Sand-Martin. Phil. Trans. lxv, 1775.

The Natural History and Antiquities of Selborne. 4to. London, 1789.

A Naturalist's Calendar, with Observations in Various Branches of Natural History. 8vo. 1795.

surface of White's somewhat stiff literary style, notes his genius for nearly always observing the right thing in the right way, and for placing before us in a few words the living object he has observed. In a sense he almost identifies himself in feeling with the animal he is describing. He was 'a scholar and a gentleman', and a philosopher of no mean depth. Lowell set down the 'natural magic' of White to the fact that, 'open the book where you will, it takes you out of doors'. All is told with a complete absence of self-consciousness or self-importance. His observations or remarks stand on their own merit, but they are narrated with a faint shade of humour that is all his own. From cover to cover there is the charm of a country life which is peculiarly English, something of the feeling of the English School of Landscape Painting and of the English Country House. The beauties of *The Natural History of Selborne*, apart from the way in which they directly appeal to naturalists, grow on the reader who is not a naturalist, and the more they are studied the more they seem to defeat analysis.

The outlines of White's career have often been sketched. We will but recall that his grandfather, Gilbert White, had been a Demy of Magdalen contemporary with John Hough, afterwards President of the College, and had been appointed Vicar of Selborne in 1681 when the living was held in low esteem and passed over by all senior Fellows, for the house had 'naked walls' and there were hovels in the front court. In this house Gilbert White was born on July 18, 1720. His younger brother, John White of Corpus Christi College, also gifted with a taste for zoology, corresponded with Linnaeus about the Fauna of Gibraltar, where for a time he was stationed. Gilbert came up to Oriel in 1740: he was elected a Fellow in March 1743–4, and in 1752 became Proctor and Dean of the College.

At about the same time he began to keep a 'Garden Kalendar', which he kept up until 1767, thereafter continuing it as a more elaborate 'Naturalist's Journal'. His zoology was largely self-taught. He had his Selborne always before his eyes, Ray's *Synopsis Methodica Avium et Piscium* serving him as a text-book, and he was 46 years of age before he embarked on the study of

botany. Much of his life he spent on horseback riding about visiting friends and relations in Sussex, London, and Oxford, taking clerical duties, but declining livings until the one and only one he wished for should become vacant. Meanwhile his uncle Charles, who died in 1763, had left him his Selborne house, known as the 'Wakes', and he preferred to live there amid 'Nature's rude magnificence' at Selborne, where we may think of him, led by the Muse he invoked for his invited friend:

> Oft on some evening, sunny, soft, and still,
> The Muse shall lead thee to the beech-grown hill,
> To spend in tea the cool, refreshing hour,
> Where nods in air the pensile, nest-like bower.

And far below

> There, like a picture lies my lowly seat,
> A rural, shelter'd, unobserved retreat.

In striking contrast to the life-work of the author of Selborne is that of the next Oxford zoologist on our list. Like White, GEORGE SHAW, 1751–1813, of Magdalen Hall was a born naturalist; he was destined for the church, but his love for science proved too strong, and he went to study medicine at Edinburgh. In 1787 he took his degree of M.D. and set up in practice in London. In 1887 he took part in founding the Linnean Society of London. In 1791 he went into the British Museum as assistant-keeper of the natural history department and succeeded to the keepership in 1807. While the breezy Hampshire uplands nurtured the sportsman and observer of open air life, London produced the museum naturalist, the describer of dried skins. Dr. Shaw was the author of *Speculum Linnaeanum* 1790; *Museum Leverianum* 1792; *Zoology of New Holland* 1794; *General Zoology* 1800–12; *Naturalist's Miscellany* in 24 vols. 1789–1813. He was emphatic on the necessity of illustrating his work with coloured plates. The descriptions of the 'Naturalist's Miscellany' are written in most elegant latinity.

For Dr. G. Shaw was a scholar, as it is called, as well as a man of science. The peculiarity of his conversation was a phraseology, adopted for the sake of the jest, in which science and scholarship were forced into the service of

common life. If he meant to tell you that some one offered to shake hands with him, he would say, 'The animal protruded its tentacula'. He excused himself to his brother, the Argonaut, who reproached him for appearing before breakfast in a well-worn coat, 'it is my ante-jentacular coat, Jack'; and answered his apologies for troubling him with a letter to London, by saying, 'I shall put it into the denarian post, and there my trouble will end'.

I spent a day with him most agreeably at the Museum; and saw that well-guarded collection to great advantage. We even went down into the cellars, where was a vast vault filled with coal. 'This puts to shame the subfenestral carbonaria of your alma mater.' Every university-man knows how the coal-porter brings his sack on his shoulder, and empties the load into the hollowed-out window-seat.[1]

For nearly a century the natural history collections belonging to the University had been allowed to fall into a sorry state of neglect for which it is difficult to blame the keepers, who were either incompetent or underpaid, generally both. With the appointment of the Duncans, matters took a different turn.

The elder brother JOHN SHUTE DUNCAN 1769–1844, of New College, only held the keepership of the Ashmolean Museum for three years, being succeeded by his brother PHILIP BURY DUNCAN 1772–1863, also of New College, in 1826. Their services will be referred to below, but it must be mentioned that the Zoological Museum once more became a living entity during the reign of the younger Duncan from 1826–55. He rescued the relics of the Tradescant Collection, he rearranged the Museum and catalogued it, and in many departments the value of his work has persisted to the present day.

Archbishop Howley said, 'I question whether any two men with the same means have ever done the same amount of good'. And to crown all they were human: in their museum the Buckland children might ride the stuffed zebra, and know all the animals as friends, if not yet as relations.[2] It was at this period too that the habits of a Cape hyaena ('Billy') were studied by BUCKLAND in Oxford. He was given shins

[1] H. Best, *Personal and Literary Remains*, p. 224.
[2] *Life of Frank Buckland.*

of beef and performed admirably on them, 'leaving precisely those parts which are left [in the Hyaena cave] at Kirkdale, and devouring what are there wanting, and leaving splinters and scanty marks of his teeth on the residuary fragments which are not distinguished from those in the den'. At Christ Church the great geologist was also carrying out his more careful but cruel experiments of immuring living toads in holes in rocks, in order to test the possibility of the truth of the stories about living toads being found imprisoned in rock cavities, or even in a lump of coal.

At this time zoological teaching in Oxford was non-existent. A keen student could attend the anatomy lectures of Sir Christopher Pegge and the chemical classes of Dr. Kidd. One of those who did so was WILLIAM JOHN BRODERIP 1789–1859, of Oriel College, who afterwards adopted the legal profession, and accumulated in his chambers at Gray's Inn a superb collection of mollusca which was ultimately purchased for the British Museum. With Sir Stamford Raffles he was one of the founders of the Zoological Society in 1826. He was a most delightful writer: few books of their kind are more pleasant to read than his *Zoological Recreations* 1847, and *Leaves from the Note Book of a Naturalist* 1852. In 1837 he wrote on the Dodo, effectively demolishing the view previously expressed by J. E. Gray that the pictures of the Dodo were made up artificially by joining the head of a large vulture to the legs of a great gallinaceous fowl.

Another collector, and one to whom Oxford owes her first chair of zoology, was FREDERICK W. HOPE 1797–1862, of Christ Church. Through his munificence and love of entomology Oxford has come to possess the only considerable zoological collection, besides books, which is really of first-rate importance when judged by international standards. And when bestowing his insects Hope also founded a professorship to which J. O. WESTWOOD was nominated. For reasons of health this benefactor was obliged to winter abroad on the Mediterranean, where he made a special study of crustacea and fish and continued to add to his previous gifts to Oxford. Hope also collected a fine series of portraits of naturalists and more than 20,000 engravings of natural history

objects, all of which are believed to have been given to Oxford by him.

The Anatomy School at Christ Church 1796-1860

The Anatomy School, in 'Skeleton Corner', as it was called, was the centre of anatomical and zoological studies in Oxford for nearly two-thirds of a century. A fair idea of the way in which it was managed is obtainable from the Accounts and from the Minutes of the annual visitations by the Dean and other members of the Governing Body of the House. From these Minutes, which cover the period 1796–1860, the following items have been abstracted :

Extracts from the Minute-book of the Anatomy School, Christ Church.

At a Visitation of Dr. Lee's Anatomical Theatre held Oct^{r}. 29, 1796. The following donations, made to the School since the last Visitation, were exhibited by Dr. Pegge, and ordered to be deposited in their proper places and to be entered in the Catalogues.

Three books. Rev. Mr. Palmer.
Bradypus tridactylus with young. Marquis of Buckingham.
Expenditure by Dr. Pegge.

Walter on the Nerves	2	2	–
Foot of a Horse, injected		10	6
Anas tadorna stuffed	1	1	0
	3	13	6

Ordered that this be allowed and paid to Dr. Pegge.
Ordered, that a mahogany case, the property of the last Anatomical Reader, be purchased for use of School, and that a new Green Cloth be allowed for the Upper Room.

Expenditure allowed at Annual Visitation of the Anatomy School.

1797. 24 Oct. £5 12 6
Dried preparation of Ductus arteriosus and Ductus venosus of Foetus.
Dried preparation of Vesiculae seminales of Horse.
Wet preparation of Placenta injected.
Spirit preparations of Hydatids from Human Body.
Large jaw bone with two serrated teeth, in calc. schistus from Stonesfield, purchased for 10*s*. 6*d*.

	Expenditure allowed at Annual Visitation of the Anatomy School.
1798. 26 Oct.	9 19 10
Section of Head of Horse.	
Heart and great Arteries of Horse with part of spine.	
Uterus of Calf.	
Scull of Caribb from Mr. Jannings.	
Young Emu. Marquis of Buckingham.	
Chicken with 4 legs, etc.	
1799.	38 19 0
A long list of anatomical preparations were acquired.	
1800.	27 16 8
1801.	15 18 5
1802.	10 19 0
Cast of Venus of Milo.	
Skeletons prepared by Knapp.	
1803.	
1804.	37 0 11½
Preparation of Heart by Dr. Bourne.	
1805.	39 5 0
Preparations from Italy.	
A Platina Retort, gift of Rt. Hon. Ld. Grenville. The Lee's Reader was permitted to lend it, when wanted, to public Reader in Chemistry, taking always an acknowledgment for it and requiring it to be returned when no longer wanted.	
1807.	26 17 4
Tiger's Head.	
Red Deer head.	
Skulls of Chinese and York.	
1808.	7 9 11½
	21 3 0
Sir Christopher Pegge gave 2 skulls from New South Wales.	
1809.	31 3 11
1810.	60 10 9
Spirits of wine £10 4 9	
Preparation Glasses 21 0 0	
Jawbone of Mammoth 5 5 –	
Head bones of Ornithorhynchus 3 3 –	
Sir Ch. Pegge's donations—	
Coluber natrix with pike in mouth.	
Hirudo medicinalis laid open.	
Crawfish casting its shell.	
Stomach of cod.	
Intestines of dogfish.	
79 specimens in all, including many invertebrates. This series was the foundation of the study of Comparative Anatomy in Oxford.	

1811. 84 18 10
Long series of Vertebrate preparations from Sir Ch. Pegge.
Pegge engaged W^m. Pembry to keep preparations in order and repair them, and ordered a new green silk curtain to his private cabinet of preparations.

1813. 56 7 9
47 specimens of Vertebrates from Sir Ch. Pegge.

1814. 47 5 0
40 6 5

1815. 54 7 7

1816. 133 2 10¾
A Microscope ordered and a Lecture Table.

1817. 91 18 0
Cary, mathematical Instrument maker, for a Microscope £14 16 8.

1818 (?). 43 15 8
Dr. Kidd presented specimens showing the conversion of animal matter into adipocere.

1819. 120 6 8
Wax model of adult female.
Anatomie du Gladiateur combattant, pres. by Dr. Alex. Hood.

1820. 100 3 4½
Large Air Pump for drying the preparations (Cary. £55 13).
Kidd's model of Eye.

1821. 144 8 6
Quicksilver Pneumatic Trough.
Scales of usual size but made with great accuracy.
Platina evaporating cups and Thermometer.

1822. 116 7 6½
Model of Chinese Monster (donation).
Purch. 76 lb. Quicksilver @ 4/6 per lb. £17 2 0
Balance with platina pans 11 16 6
Cary for platina cups and thermometer 18 19 9

1823. 83 17 6½
Buckland gave a cast of a fossil Rhinoceros head.
Kidd purchased Anatomical drawings.

1824. 101 17 8½
13 drawings of the Gryllotalpa made according to Kidd's instructions £12 12 0

1825. 69 18 5
Weiss' instrument for extracting poisons from stomach.

1826. 125 4 11
£50 allowed to Kidd for an Assistant in the Dept. of Comparative Anatomy.

1827. 134 10 8

	Expenditure allowed at Annual Visitation of the Anatomy School.
1829.	798 7 6½
Dr. Ogle for expenditure at sale of Brook's Museum £378 15 2.	
Dr. Ogle for specimens £25 0 0.	
1830.	399 11 9
1831.	214 2 6
1832.	175 1 8
Allen for asst. £50	
1833.	184 13 6
Dr. Auzoux's Model. Cost £145	
1834.	54 5 1
1835.	64 1 8
1836.	82 1 6
Mr. Hitchings, Surgeon (one corpse) £20	
1837.	78 3 8½
,, ,, (spring course) £20	
1838.	73 17 9½
,, ,, ,, ,, 20	
1839.	94 12 2
,, ,, ,, ,, 20	
1840.	50 12 0
,, ,, ,, ,, 20	
1841.	97 5 11½
,, ,, (2 courses) 40	
1842.	67 10 11½
Dr. Kidd's account included an assistant in dissection £10 – £19 9.	
Microscope of Alex. D. Campbell Esq. of St. John's £17–	
1843.	41 12 5
1844.	20 0 9
1845.	39 8 1
1846.	70 7 8
1847.	288 16 5
Acland	
Animals for dissection £22 18 –	
Instruments 15 3 11	
Spirits and Glass 68 15	
Books and Drawings 40 6 11	
Coals and Carpentry 23 10 6	
New Shelves 60 4 1	
Assistant (Dr. Melville for 6 months) 50 – –	
1848.	{ 296 14 4 / 89 1 0
Osteological Specimens purchased in Paris £85 1 –	
W. Pembrey appointed Assistant.	
1849.	274 17 4½
1850.	208 17 11
Orang outang £5.	
Dr. Carus £50.	

1851. Wyatt, builder £65. Carus £60.	368	13	3
1852.	116	1	9
1853. Asst. for April £10.	275	15	9
1854. Dowson (Assistant) £40.	200	19	9
1855. Pathological female (wax model) £60. Assistants (Dowson and another) £100.	297	3	7
1856.	219	11	2
1857.	415	14	6

With regard to the large expenditure incurred in 1829, it may be noted that during the previous year Dr. Buckland discovered that a considerable sum had accumulated which might be claimed for the benefit of the Museum. In July 1828 he wrote to Sir R. Murchison in great delight at his discovery. 'I am going to town in a day or two to attend the opening of Brooke's sale, for I have found out £1200 that we can lay out for our anatomical school at Christ Church, which will quite set us up, unless we find powerful rival bidders in the two new London Colleges.'[1]

In November 1857 GEORGE ROLLESTON was elected Lee's Reader in the place of Dr. Acland, who resigned on being appointed Regius Professor of Medicine, and at the annual visitation the Dean was requested to convey to Dr. Acland the high sense entertained by the Lee's Trustees of the excellent services rendered by him. The present author would however here note that the efficiency of a scientific department in which material objects for study are a *sine qua non*, depends in no small measure upon the annual grant paid to it. During the half century preceding 1847, the year of Dr. Acland's appointment, the annual grant to the Anatomy School was on the average under £70 a year, indeed it had been as low as £20 three years previously. During Acland's tenure of the office, twelve years, he received no less than £3,280 13*s.* 10*d.* for his department—or about £273 a year! and he had a stipend of £600 a year.

It was also ordered that Mr. Dowson's salary should be paid up to Christmas 1857 and that on his then retiring,

[1] Gordon, *Buckland*, p. 88.

a gratuity of £50 should be presented to him. CHARLES ROBERTSON was appointed as assistant to Rolleston at a salary of £60 a year, and it was arranged that Woodward's wages should be paid by the Lee's Reader.

1858.	Last payment under the		Acland	regime		£228	7	0½
	First	,,	,,	Rolleston	,,	41	6	4
1859.	Second	,,	,,	,,	,,	86	14	4½
1860.	Third	,,	,,	,,	,,	91	8	10

In 1858 in addition to the establishment charges, Rolleston expended £5 4*s.* on a Smith and Beck microscope, and in 1859 he asked that £10 be paid to the porter to keep the building clean. In this year he gave two courses in Anatomy and Physiology, attempting to realize the objects of Matthew Lee. He arranged practical classes in which students received instruction by actual demonstration and dissection. He noted that of forty-eight persons attending, fifteen were Christ Church men. Thirty-six tickets of admission were granted to visitors; and seventy-eight descriptions of anatomical preparations were added to the manuscript catalogues, pains being taken to render them as serviceable to students as possible. It was Rolleston's chief aim to make the best possible use of the specimens already collected, rather than to add to the collection. The *Pathological Series* was removed to the medical department of the New University Museum. 783 persons visited the School.

In 1860 Rolleston was appointed Linacre Professor of Anatomy and Physiology and he carried off Charles Robertson to the University Museum with him, whither the Collections of the Lee's Trustees soon followed. Robertson was appointed Demonstrator of Anatomy, and his skilful work became widely known beyond the University through his *Zoological Series with Dissections in Illustration* that was exhibited in the Educational Department of the Exhibition of 1862. To this favourable conjunction of a young and enthusiastic professor, Rolleston, with a skilful dissector, Robertson, and of the Lee's and other zoological collections *under the same roof* with the magnificent collection of books in one of the best of existing scientific Libraries, the Radcliffe Library, the world of science owes one of the best modern original text-books, Rolleston's *Forms*

of Animal Life, 1870, which reappeared in a second edition as the most learned text-book of its day in 1888, having been mostly rewritten by W. Hatchett Jackson of New College. There is no doubt that as a course for students the application of Comparative Anatomy in accordance with the methods of Rolleston and of the Oxford School has proved the best training at any University.

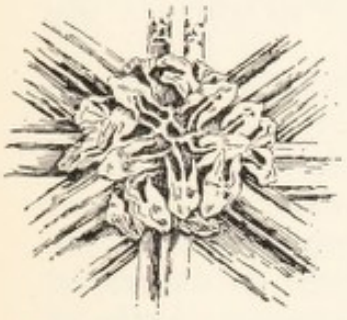
VI

BOTANY

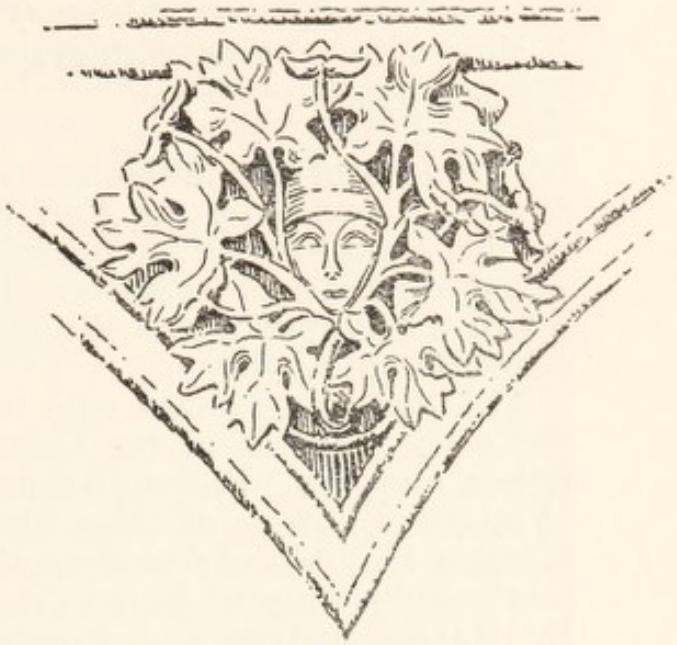
THE earliest representations in Oxford of plants, that are undoubtedly of local origin, are stone carvings by the hands of unknown masters of Gothic sculpture. They have left us here, as elsewhere, deep-wrought corbels and bosses that tell of close observation of nature; as, for instance, the cleverly designed boss of Arrowhead leaves (*Sagittaria sagittifolia*) in the vaulting of the Latin chapel in the cathedral. But the finest assemblage of all may be seen on the stone arches that once bore the shrine of St. Frideswide.

Mr. S. A. Warner, the latest writer on the subject, recognizes twelve distinct species, some of which are thought to have been chosen in allusion to the healing powers of the saint, while the oak and the ivy refer to her place of refuge. However this may be, all who have studied the carvings agree in praising their marvellously natural and accurate detail. By Mr. Warner's permission we reproduce four illustrations from his new work on Christ Church.

Maple, *Acer campestris*, with winged seeds. S. side.
Sycamore, *Acer Pseudoplatanus*, with winged seeds. N.
Oak, *Quercus robur*, with acorns and empty cups. N.
Hawthorn, *Crataegus Oxyacanthus*, with two distinct leaf forms on the same spandrel. W.
Ivy, *Hedera Helix*. N.
Water Crowfoot, *Ranunculus aquatilis*. On boss. S.
Columbine, *Aquilegia vulgaris*. S.
Greater Celandine, *Chelidonium majus*. S.
White Bryony, *Bryonia dioica*. W.



ARROWHEAD BOSS, XIV CENTURY.



MAPLE, *c.* 1289.

HAWTHORN, *c.* 1289.

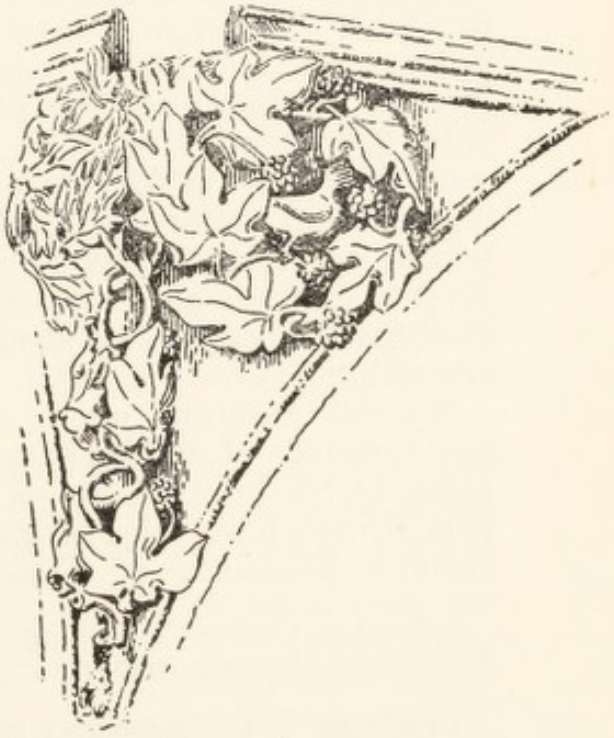


FIG. IVY.

Hogweed, *Heracleum sphondylium.* On cusp. E.
Vine, *Vitis vinifera,* with grapes and tendrils. E.
Fig, *Ficus.* E.

Accounts of the antiquities of the Oxford Physick Garden, founded by the Earl of Danby in 1621, and of the contributions to Botanical Science, especially in the direction of systematic botany, have been published so recently that it is unnecessary to traverse the same ground again.[1]

The leading botanists who interested themselves in the early progress of the Garden were the Bobarts, father and son, Philip Stephens of New College, William Browne of Magdalen, Robert Plot, and Robert Morison of Aberdeen, while improved methods in the cultivation of fruit were practised or described by Ralph Austen and Robert Sharrock, both of New College, and 'very knowing in vegetables', by William Hooper of Magdalen, and by Francis Drope, and their example was doubtless followed by many an Oxford man in various parts of the country, as for instance by Oliver Le Neve of Hart Hall, at Witchingham in Norfolk.[2] Nathanael Highmore of Trinity on retiring to Purse Candel in Dorset became a great florist. In a letter to Oldenburg, dated Oxford, Aug. 29, 1664, Robert Boyle quoted his practical experience, presumably gained in Dorsetshire, that 'there is scarce any mold comparable for flowers to the earth which is digged from under old stacks of wood, or other places where rotten wood has been lain'. The names of the Evelyns, father and son, of Balliol and Trinity respectively, will be celebrated as long as histories of Gardening are written.

Special mention must also be made of Walter Stonehouse of Wadham and Magdalen; of William How of St. John's College, the young compiler of the first British Flora, the *Phytologia Britannica*; of Christopher Merrett of Gloucester Hall and Oriel; of

[1] Gunther, *Oxford Gardens*, 1912; Vines and Druce, *Dillenian* and *Morisonian Herbaria*, 1907, 1914; Gunther, *Early British Botanists*, 1922.

[2] *Calendar of Correspondence of Oliver le Neve*, edit. by W. Rye, Norwich 1895.

William Cole of New College; and especially of Thomas Johnson; all of them members of the circle of John Goodyer of Hampshire. Robert Lovell, a Student of Christ Church, compiled *A compleat Herball*, which was printed in Oxford by Henry Hall, and reached a second edition in 1665.

Of the professors of the eighteenth century, Sherard's nominee, Dillenius, and John Sibthorp were the only two whose botanical work did not bring Oxford botany into disrepute. For a time George Shaw, the zoologist, acted as deputy lecturer.

In the Museum, Herbarium, and Library at the Garden there are no really old botanical specimens or pieces of apparatus of historic interest, with the exception of the older *horti sicci*. The following are the more important of the old collections of Dried Plants:

	Specimens.	Locality.	Approximate date.
Gregory of Reggio	300	North Italy	1606
Jacob Bobart	2,000	Oxford Garden	1656–1670
Bobart and Robert Morison	6,500	General	1680–1714
Charles Du Bois	13,000	,,	1690–1723
William Sherard	14,000	,,	1696–1726
Thomas Shaw	660	Barbary	1720
James Dillenius	575	Britain	1724–1741
John Sibthorp	2,000	Greece	1786–1794

In addition, the following of the older collections of dried plants are preserved among the manuscripts in the Bodleian Library:

John Southwell's collection of dried flowers and leaves. **c. 1620–30.**
MS. Arch. Selden B. 3 (3333).

Purchased at Leyden for £4. The specimens are neatly fastened by paper straps. Near the beginning is an attached leaf bearing 'Thiss anatomized Iuye-leafe I found in mye Garden at Croyden Mar: 19: $16\frac{39}{40}$', stated to be in Archbishop Laud's hand.

The Tradescants' Hortus Siccus (?).

MS. Ashmole 1465.

Probably collected for or by the Tradescants, ff. 3–160.

G. Wheler's Hortus Siccus.

MSS. Ashmole 1800–3.

In four volumes containing 80, 114, 90, and 104 leaves.

Liber Plantarum cccclxii Medicinalium secundum Pharm. Londin.

MS. Ashmole 1502 (7528).

William Howlet's Collection. xvii cent.

MSS. Bodl. Adds. D. 94–6 (27839–41).

a. 'Volumina 3^{ia} Plantarum desiccando conservatarum, curâ Guil. Howlet M.D., privigni V. Cl. Pe: Barwick, qui mihi Dono Dedit J W [or T. W.].

MS. Bodl. Adds. D. 97 (30312).

b. 'Catalogus Plantarum quibus utuntur medici.'

Barbadoes Plants.

MS. Rawlinson, C. 403 (12257).

Descriptions of 74 plants, with leaves of some.

T. Br.'s Physick Garden Plants. Early xviii cent.

MSS. Lat. misc. d. 25–6 (31821–2).

'Plants taken from the Table-book and observed growing in the Physick Garden.' The lists in the hand of 'T.Br.' who was apparently living in Oxford early in the eighteenth century. The collection was presented by the Librarian of Oriel College in 1895.

Edward Morgan's Hortus Siccus. 1672–82.

MSS. Ashmole 1797–9 (6547).

Each of the three volumes contains about 160 leaves. Morgan lived at Bodesclen, cf. Gunther, *Early British Botanists*, 1922, p. 308.

The vegetable rarities collected by Tradescant, and handed on by Ashmole to the University in 1683, have with possibly a single exception, disappeared. In 1912 we reported that all were lost or destroyed, but we have since discovered one specimen that was catalogued as being in the Ashmolean collection in 1830.

It is in 'visible hiding', a solitary botanical rarity, removed from all the other botanical collections in the University and placed in so conspicuous a position as to escape notice. It is no doubt where Acland or Rowell put it, tied up alongside one of the round iron shafts that support the roof over the zoological and geological collections in the University Museum. In Duncan's catalogue it is described as a 'Bamboo cane, 60 feet long, in two pieces, the lower part of which had a circumference of 16 inches'.

The Ashmolean collections also included a series of twenty-four Wax Models of Fungi made by Louis Calamai of Florence and presented to the Museum by Dr. Buckland; and another series of thirty-two Skeletons of Leaves and Seed Vessels presented by J. S. Duncan. Both series are listed in the Catalogue of 1836.

A few collections of dried plants are preserved in some of the College Libraries, e.g. at Corpus Christi College where there are a few dried leaves collected by WILLIAM CLAYTON, and inserted in his painted copy of *Dodoens* 1616 which he presented to the Library in 1667. In 1676 WILLIAM CREEDE also made a collection: 'The number of ye plants which I collected and gum'd in my booke ye first yeare I made my Collection viz. 1676, was was very neare thirteen hundred.'[1] Merton received the *Herbarium vivum* of CHARLES WILLUGHBY, M.D. and a fellow of the College in 1673. And an extensive collection by ROBERT HUNTINGDON, Fellow 1680, from eastern Mediterranean lands gives names of plants in French and Arabic, but no localities. But the most interesting of all, the herbaria of JOHN GOODYER, c. 1620, formerly in the library of Magdalen College, have been allowed to perish without record by their proper custodian. At Wadham is the *Hortus siccus* of William Paine, 'Bottanist', from the Rivers, Fields, Woods and Gardens of Dorset, Somerset and Wilts. A.D. 1729. And perhaps of the same date is the OGLANDER herbarium at New College.

Though she is the happy possessor of these valuable collections, Oxford can hardly pride herself on having rendered them very accessible to students. Her teachers have not known how to use them, and, as a consequence, the dried plants have lain by without rendering to science

[1] Note in Stevens, *Cat. Oxon* (Corpus Library P. 14. 3).

the full services of which they might have been capable. And yet there would have been many willing students of Botany, had the University only provided suitable instruction for them.

Lord Herbert of Cherbury, for instance, who had come up to University College in his thirteenth year, rightly 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'. The experience of Sir Joseph Banks in the eighteenth century has not been very unlike the experience of other would-be botanical students within the memory of the present generation. The story is well worth repeating.

Having passed a few months among his favorite plants, it became necessary that he should proceed to Oxford, to be entered as a gentleman commoner of Christ Church, as had been decided on shortly before the death of his father. His love of natural history was not diminished, and he hoped that means would be found among the learned of the college to enable him to pursue it. Botany, however, was the prevailing object of his wishes; but he found, to his severe disappointment, that no lectures were given by the botanical professor. Though disappointed, he was not of a temper to be discomfited, much less defeated. He made application to the botanical professor, and obtained permission from the learned doctor to find out and engage a lecturer, the expense to be wholly defrayed by his pupils. In vain, however, was his search in Oxford; no one could be found, there, capable of undertaking the class; but he heard of one at Cambridge, and forthwith went over to that university.

The delight of Banks may be imagined on his falling in with the very kind of person best suited to his purpose, whom he at once engaged and carried back with him to Oxford—Mr. Israel Lyons, a learned botanist and good astronomer. He delivered a course of lectures on botany, and gave lessons on astronomy to the students, in which Banks of course largely participated; but Lyons very soon returned to Cambridge, after delivering lectures on both subjects to about sixty pupils: he was a learned mathematician and became a calculator for the "Nautical Almanac". Banks did not forget his friend and instructor. He obtained for him the appointment of astronomer to Captain Phipps, on his Polar voyage.[1]

[1] Sir John Barrow, *Sketches of the Royal Society*, p. 15.

Among our pioneers we may number LHWYD, the first writer on fossil plants in England. A few Oxford men of the eighteenth century distinguished themselves beyond the University radius. RICHARD RICHARDSON (1663–1741) a wealthy amateur who acquired an unusual knowledge of Cryptogams, some of which he grew in his hot-house, stated to have been the second hot-house constructed in England. LIGHTFOOT, b. 1735, of Pembroke College compiled a *Flora Scotica* in 1777, which was partly based on his own observations in 1772, and on the Dillenian Cryptogamic herbarium at Oxford. THOMAS ANDREW KNIGHT (1759–1838), up at Balliol about 1778, is remembered for his work on sap in 1801, supported by experiments on the 'ringing' of trees. He was a great friend of Sir Humphrey Davey.[1] AYLMER BOURKE LAMBERT (1761–1842) of St. Mary Hall, an original member of the Linnean Society, completed an important monograph on the genus *Pinus*, and described the *Cinchona*. WILLIAM HERBERT (1778–1847) of Christ Church and Exeter College, afterwards Dean of Manchester, made a special study of hybridization in the Amaryllideae.

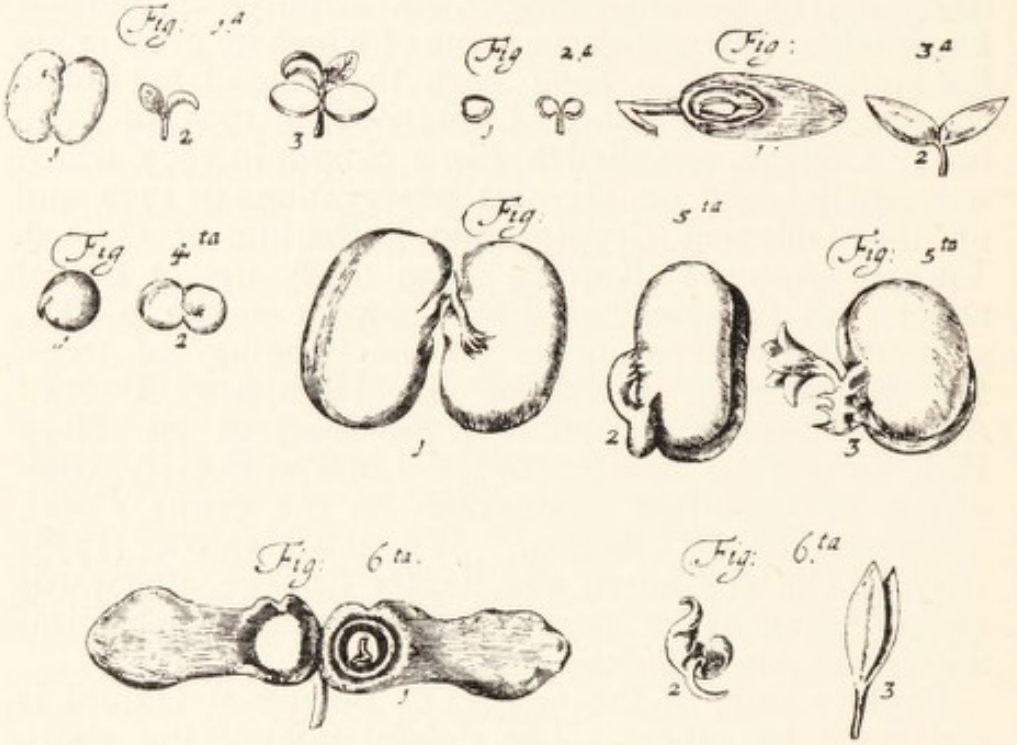
Banks's story of the neglect of Botany at Oxford is confirmed by others. The doleful tale of the shortcomings of the Garden, of its useless greenhouses and extravagant management, has already been told, so that there is no need to repeat it again here. A great change for the better was made in February 1834 by the appointment of CHARLES GILES BRIDLE DAUBENY as professor of Botany. Daubeny was a real 'live wire'. He raised a considerable fund for the restoration of the Garden, he swept out the 'Augean stables' of his department; and for thirty years of the nineteenth century the Botanic Department and botanical studies really flourished in Oxford. Daubeny was a man with a European reputation earned by the merit of original work in many fields.

PHYSIOLOGY OF PLANTS.

In the general revival of science that occurred during the seventeenth century, plants were soon recognized

[1] Reynolds Green, *History of Botany*, pp. 295–305.

as fit subjects for the experimentalist. The methods of the Belgian pioneer, Van Helmont, were repeated with modifications, and in their turn suggested further lines of research. For instance Sir KENELM DIGBY,



HIGHMORE'S FIGURES OF THE GERMINATION OF SEEDS, 1651.

Fig. 1. The Kidny Bean opened; in which is a little crooked leaf folded up, which being displayed, shews it self, as in the second; and when, being set, it arises above ground, it is such a Plant as the third shews; with the very same leaves and no other.

Fig. 2. A Colewort seed: the first shews both leaves, with the stalk folded up, as they lie in the husk of the seed; the second shews it come up out of the ground.

Fig. 3. The small germen of an Ash; lying with his two leaves in the kernel of an Ash, both in the husk inclosing them. The second shews him sprung up above the Earth, at his first coming abroad.

Fig. 4. The young germen of the Pease in the midst of the grain, and its breaking forth.

Fig. 5. The young plant in the midst of the Bean: with the manner of his putting forth, with the same leaves displayed in the third, which are wrapt up in the first and second.

Fig. 6. The young Maple wrapt up in his husk: the second shews him a little unfolded, when it is taken out of the husk. The third shews him gotten from his shell, and the surface of the earth.

the pupil of Laud and of Thomas Allen, in the intervals of dabbling in other sciences is said to have been the first to notice the importance of vital air (i. e. of oxygen) to plants.[1] Digby's views on the physiology and reproduction of plants are stated and criticized by NATHANAEL HIGHMORE of Trinity College, who wrote 'A short Censure' on them. The sciences of physics and chemistry had hardly made sufficient progress to afford a firm basis for vegetable physiology, but in the work of Highmore, and particularly in his detailed sketches of the germination of seeds, may be seen a first attempt at an investigation that was carried further by Malpighi in his *Anatome Plantarum*. Curiously enough the work of Malpighi is quoted over and over again in histories of Botany, but the work of Nathanael Highmore is never mentioned, yet it anticipated that of Malpighi by a quarter of a century.

Highmore's drawings illustrate the scope of his work. They appear on the same plate as the two figures showing the later stages in the incubation of a hen's egg on p. 164. It will be noticed that he was aware of the leaf nature of some cotyledons.

The Transpiration of Plants was demonstrated in June 1669 by JOHN WILLS, M.A., Fellow of Trinity College:

> He took two glass vials with narrow necks, each holding 1 lb. 8 oz. 2 drms. of water . . . into one of these glasses filled with water, he put a sprig of florishing mint (which before had grown in the water) weighing 1 oz.; the other glass he also fill'd with water, and exposed them both in a window to the sun. After ten days time he found in the bottle where the mint was, only 5 oz. 4 drms. of water remaining, and no more, so that there was 1 lb. 2 oz. 6 drms. spent, the mint weighing scarce 2 drachms more than at first.
>
> From the other glass, where water was put of the same weight, and no mint, he found the sun had exhaled near one ounce of water, and therefore concluded it drew but so much out of the first glass, at least not more: So that allowing 1 oz. for what the sun had exhaled, there was in those ten days spent by the mint, 1 lb. 1 oz. 6 drms. of water; and the mint being increased in weight only 2 drms., 'twas

[1] Digby, *Discourse concerning the Vegetation of Plants*, 1660.

plain the mint had purely expired in those ten days 1 lb. 1 oz. 4 drms. that is each day above an 1/2 oz., which is more than the weight of the whole mint. Whence he concluded that . . . every sprig of mint, and most other herbs in the field, every summer's day attract more nourishment than their own weight amounts to.

He also argued that a plant with moist leaves like the *Pinguicula* and the *Ros Solis* sucks up moisture faster than the sun can exhale it, and is bedewed all over at Noon-day.[1]

The fundamental discovery that certain parts of the body of a plant are not solid but are divided up into 'little boxes or cells' is due to ROBERT HOOKE of Christ Church. By employing a method which has since become part of the training of every laboratory botanist, viz. that of cutting sections, Hooke demonstrated the existence of a cellular structure in the case of cork and of the epidermic cells on the under surface of a nettle leaf.[2] He even examined thin sections of charcoal by transmitted light, and discovered its similarity to cork. On cutting 'an exceeding thin piece of cork and casting the light on it with a deep plano-convex glass, I could exceeding plainly perceive it to be all perforated and porous, much like a honey comb, by that the pores of it were not regular'. To the hollow spaces he gave the name 'cells', and to the partition walls 'interstitia'. His extraordinary ingenuity of mind and his restless searching after new topics of interest prevented him from following up his discovery further—indeed it was not until a hundred and seventy years later that Schleiden formulated the complete generalization that all plants are made up of cells. But the first step in such a cell-theory was undoubtedly the achievement of Hooke.

Thirteen of the chapters of the *Micrographia* are devoted to the minute anatomy of plants. The matters treated of are Charcoal; Petrify'd Wood; Pores of Cork and other Bodies; Plants growing in the blighted or yellow Specks of Damask Rose-leaves and Bramble-leaves; Blew Mould and Mushromes; Moss; Form of Sea weed; Surface of Leaves; Stinging points of Nettles; Beard of Wild Oat; Seeds of Venice (= Venus) Looking-glass, Thyme, Poppy, Purslane.

[1] Plot, *Nat. History of Oxfordshire*, 1677.
[2] *Micrographia*, 1667.

An important advance in our knowledge of the reproduction of the lower plants was made by ROBERT MORISON. The relatively bulky seeds that are produced by all the higher flowering plants are not produced by ferns, which nevertheless are sometimes found surrounded by a tiny progeny. The production of little ferns around the old ones suggested the production of seed, but as none could be seen, it was thought to be the invisible product of certain brown patches on the back of ripe fern-leaves, from which a fine dust can be shaken. Among those who believed in sympathetic magic this dust or invisible fern-seed was a valuable possession, for it was reputed to make its possessor invisible also. The application of the microscope soon put an end to the myth of invisibility, but Morison had previously tested the matter by actually sowing 'dust' from a hart's-tongue fern, and getting an abundant crop of prothalli, which he took to be the cotyledons of young ferns.

A matter of far greater originality was the discovery of the sexuality of plants made by Sir THOMAS MILLINGTON of All Souls College. Notwithstanding that mankind has always been well acquainted with the fact that plants produce seeds, and that seeds develop into plants, none of the early Greek Fathers of science understood that a process of fertilization always, or almost always, precedes the production of seed. Doubtless the early cultivators of the palm-tree were better instructed, but their special knowledge formed no part of the culture that had been handed down. Even so close an observer as Malpighi, armed with the power of his microscope, failed to detect the real secrets of the pollen and the function of flowers. It remained for our Sedleian Professor of Natural Philosophy to put forward the suggestion that in plants 'the *attire* (= anthers) doth serve as the male, for the generation of the seed'. This idea was not published by Millington himself, but was mentioned by him to Grew, who announced it in 1676 in a *Lecture on the Anatomy of Flowers*[1] and in his *Anatomy of Plants* published in 1682. More than a decade later, Professor Camerarius of Tübingen established the truth of Millington's discovery by convincing experimental proof.

[1] *Phil. Trans.*, Nov. 1676.

Millington was a man of a most charming personality, who filled the important office of President of the College of Physicians to the approbation of all. His praises have been sung by Garth in the fifth canto of his *Dispensary*, under the name of Machaon.[1]

In the eighteenth century questions of vegetable physiology appear to have lost all interest to the Oxford mind, but notable advances were made in Cambridge by Stephen Hales in his private Laboratory in Bennet College. He investigated transpiration and the movement of water in the wood, measured the forces of suction and root-pressure, and proved that air contributes largely to the nutrition of plants. His book of *Statical Essays*, 1727, attracted the attention of the scientists of the four leading countries of Europe and was translated into their languages.

At Oxford we have to pass over a hundred years and more before we meet with any notable attempt to advance the science. In 1834 CHARLES DAUBENY of Magdalen College was appointed to succeed Dr. Williams in the Sherardian Chair of Botany, and once more the torch of botanical research was kindled in Oxford. In the year before his appointment to the chair, Daubeny had prepared a *Memoir on the degree of selection exercised by plants with regard to the earthy constituents presented to their absorbing surface*,[2] and had also studied the Irritability of Plants. A research of the first importance soon followed. In Dec. 1835 he read a paper before the Royal Society *On the action of Light upon Plants, and of Plants upon the Atmosphere.* In this investigation he anticipated the work of Draper in 1844, by showing that although vegetable metabolism depends upon the brightness of light, yet light of the various colours of the spectrum differ in their action on plants. This fundamental discovery was made by introducing the fresh leaves of various plants into jars of water saturated with carbonic acid gas, by exposing them to sunlight transmitted through various coloured media and by

[1] Machaon whose experience we adore,
Great as your matchless merit, is your power.
At your approach the baffled tyrant, Death,
Breaks his keen shaft and grinds his clashing teeth.

[2] *Trans. Linnean Society*, xvii.

then collecting and measuring the oxygen given out by the leaves. The coloured media had been examined spectroscopically by Prof. Baden Powell, and, with the exception of the port-wine screen, are still in existence. The results clearly show a difference between the effect of the rays of various parts of the spectrum, and thus must be regarded as of epoch-making importance as inaugurating a new line of thought and of further discovery. Although chlorophyll is formed equally well in light of all wave-lengths, the formative processes require the more refrangible rays. The apparatus used by Daubeny in these classic experiments was piously preserved by the present writer, but it is now doubtful whether it will be permitted to remain for a whole century in the Laboratory which he built. He also found that the irritability of the Sensitive Plant depended on the light of certain colours. In after years his knowledge of vegetable physiology and of chemistry was placed unreservedly at the disposal of agriculturists, for whose benefit he published a long series of articles dealing with manures, the rotation of crops, the various ingredients of the soil, the vitality of seeds and the like.[1]

[1] Cf. *Bibliography* of Dr. Daubeny in *History of the Daubeny Lab.*, Oxford 1904. When on one occasion the announcement of one of Daubeny's Rural Economy lectures was published in the *Herald*, 'a day after the fair', the following effusion appeared in the next week's number:

Dr. Sibthorp's Professor of Rural Economy
Will deliver a Lecture next time—on Gastronomy.
Not calling his Magdalen cook's skill in question,
But himself cooking up some rare food for digestion.
No Ragouts will he offer, with Sauces suspicious,
Or high-seasoned Stews fit to feast an Apicius,
Denounced by a Paris, and held by a Prout
To be full of dyspepsia, head-ache, and gout;
But sound economical Soup for the many,
Such as Soyer dispenses—three pints for a penny.

In this Lecture, in truth be it said you'll be shewn
How to breakfast on Starch, and to dine off a bone;
How from sugar and gum loads of fat secrete,
And maintain with potatoes the animal heat;
How bread unfermented the palm bears away,
Unless arsenic unluckily comes in its way;
But how doe-cake and hominy 'beat all creation,'
So Jonathan tells us, for fattening a nation.

Attention has been drawn to long-continued periods of the neglect of Botanical science within the University; but we might also pursue the possible consequences of such neglect in the world outside, and find in the shortcomings of the study at Oxford a cause of its occasional neglect by the State. A memorable instance was pointed out in plain and forcible terms in the columns of *The Times* for July 10, 1872, after Kew and Dr. Hooker, a botanist of international reputation, had been so infamously treated by a relatively ignorant Commissioner of Works, a Mr. Ayrton, as to call forth an indignant memorial to the Premier, W. E. Gladstone of Christ Church, complaining of the treatment 'which the eminent Director of the Botanical Establishment at Kew has systematically received at the hands of Mr. Ayrton since his appointment to the office of First Commissioner of Works'. The memorial was signed by Sir Charles Lyell, Mr. Charles Darwin, Sir James Paget, Professors Huxley and Tyndall, and the Presidents of the leading scientific societies in London. Its object was to endeavour to avert the 'calamity to English science' of the resignation of Dr. Hooker. On reading between the lines one sees that if Mr. Gladstone had only been rather better educated while he was an undergraduate at Christ Church, he would not have permitted the Ayrton-Hooker episode to develop to the extent of becoming a 'scandal to the English Government'.

How Liebig, with due help from Kreatine, sends on
A slice of a fox with the flavour of venison.
Why Samoyedes and Fins on train oil will regale,
And a Greenlander dines for a month off a whale;
Whilst garlic in Italy tickles the palate,
And the Spaniard sups well on garbanzos and salad,
To Sandy his porridge and cakes are so dear,
Whilst a German's content with sour kraut and small beer;
Why beef to an Englishman's prowess adds fuel,
Though he's meek as a lamb, if you feed him on gruel;
Why, when Bruin wakes up in the spring from his lair,
And would fain, like a Christian, his toilet prepare,
He's sadly deficient in grease for his hair;
And what more than all else is likely to stagger us,
Why beans were taboo'd, like roast meat, by Pythagoras,
Who stinted his followers to Carbon on Fridays,
And kept all his 'Proteine compounds' for High days.
These, and many more facts than you e'er can conjecture,
Will be duly dish'd up, if you'll come to the Lecture.

VII

GEOLOGY

British Geology owes so much to Oxford men that it will not be far off the mark to call Oxford the cradle of the science in this country. But though it is a fact that the individual achievements of members of our University have been more pre-eminent in this than in any other branch of science, yet none has received so little recognition, financial or otherwise, from the University as a body.

Besides the illustrious collectors of fossils and minerals, Plot, Lhwyd, Borlase, Lister and others, we can also boast of, as belonging to us, those who have done most to promote the investigation of Nature in Geology. William Smith (1769–1839) 'the Father of English Geology' was a native of the little village of Churchill in the north of Oxfordshire; Buckland (1784–1856) the discerner of Diluvial formations, whose lectures were the most popular in the University at that time; Daubeny and Phillips, both renowned as teacher-researchers; and Lyell (1797–1875), of Exeter College, 'the man to whom English Geology owes most'.

Oxford men are all geologists. They have been so ever since the beginning of things. For do we not proudly explain that the Town is built on a gravel patch between the Cherwell and the Isis, and is therefore reasonably healthy, notwithstanding the clayey water-meadows all round. Who amongst us cannot discourse on the weathering of the Oxford stone, at once our greatest asset and the greatest drain on our resources. To it our buildings owe their rapid coming of age, and our builders a perennial prosperity. But though we

are all geologists, the Geological Department is the most starved of all our Scientific Departments, and the Geological Trusts among the least observed of all our Trusts. The Science for which its adherents have given of their best most freely, is the one least honoured in Oxford to-day. Yet geology has always advanced in spite of the University. Not uniformly, but in tides or stages much as Nature proceeded when laying down strata round the Globe.

Floods and clays, formed stones and giants' bones have doubtless aroused the curiosity of the inhabitants of the Thames valley from the most remote times, but the interest was momentary, leading to nothing more. Even those who groped after learning in the pages of Aristotle or Herodotus, Strabo or Pliny, and encountered a reference to some strange geological event, made nothing of their find, though they could parallel the event in their own experience. Doubtless an occasional early Oxford student, like JOHN GARLAND (*fl.* 1230), would compile a *Liber de Mineralibus*, but the real science of Geology remained dormant till a man greatly gifted with a morphological mind arose, who, leaving books, went direct to Nature. No less a man than Leonardo da Vinci (1452–1519) who revealed to the modern world that in the shape of fossil shells lies the *proof* that they are remains of organisms that were once alive, and that the limits and levels of sea and land are always changing.

During the earlier centuries of the University, Oxford students contented themselves with the more obvious facts of physical geography and with a general discourse on the shape of the earth, much as did NATHANIEL CARPENTER of Exeter College, who 'delineated forth Geography in two bookes, containing the sphaericall and topicall parts therof' in a work that was printed at Oxford in 1625.

JOHN AUBREY (1626–97) of Trinity College shares with Martin Lister the first conception of a geological map. 'I have often times wished', he wrote in his *Natural History of Wiltshire*, 'for a mappe of England, coloured according to the colours of the earth; with markes of the fossiles and minerals.' He also observed

that the 'dirty clayey country' of North Wilts bred a race of slow and dull and heavy of spirit, melancholy, contemplative, and malicious men, very different to the chalk of the southern parts.

Both ROBERT LOVELL of Christ Church, with his *Pammineralogicon*, Oxford, 1661, and the more scientific WALTER CHARLETON of Magdalen Hall, with his *De Variis Fossilium Generibus*, 1668, endeavoured to epitomize all that was known of the minerals of their day. They were both biologists, and, as in the case of Linnaeus a century later, their works on stones have fallen into almost complete oblivion.

The idea that fossils, the medals of creation, might be used '*to raise a chronology* and to state the intervals of the time wherein such or such catastrophes and mutations have happened' is due to ROBERT HOOKE of Christ Church. He brought forward his geological views from 17 June 1667 to 1688, in the form of *Discourses of Earthquakes*, read to the Royal Society, but finally published two years after his death in the *Posthumous Works*, 1705.[1] He discoursed on the extinction of species, the possibility of changes of climate, and of other geographical features and boundaries, including 'the sad catastrophe of Sodom and Gomorrah'. He argued against fossils being a mere *lusus naturae*, and so disagreed with Plot, who as a chemist was naturally not very expert on this point. There is much common sense in the writings of Robert Hooke.

In 1677 an impetus was given to the study of local geology which reacted on that of other counties, by the appearance of the first and best *Natural History of Oxfordshire, being an Essay towards the Natural History*

[1] Hooke, *Lectures and Discourses of Earthquakes and Subterraneous Eruptions explicating the causes of the rugged and uneven face of the Earth, and What Reasons may be given for the frequent finding of Shells and other sea and land petrified substances, scattered over the whole Terrestrial Superficies*, 1705. Hooke's posthumous memoir is illustrated with seven plates of fossils, engraved from drawings found after his death among the Sloane MSS. There was no explanatory letterpress, a deficiency subsequently made good by his editor. Plate i contains 28 figures of Ammonites; pl. ii, Nautilus, Argonauta, Spirula (4 figs.); pl. iii, Echinoids (10 figs.); pl. iv, Mollusca, Sharks' teeth, &c.; pl. v, Mastodon tooth, Crab, Encrinites, Cidaris spines, Corals, &c.; pl vi, Ammonites, Bivalves, &c.

of England, dedicated to Charles II. It was a most notable achievement whether judged by the importance of its scientific contents, or the readable manner in which they were presented, or the value of the illustrations of nearly a hundred fossils engraved by MICHAEL BURGHERS, the University chalcographer of the day.

ROBERT PLOT (1640-96), the author, had matriculated from Magdalen Hall in 1658, where he was a pupil of Jos. Pullen, but had migrated to University College in 1676. No one before him had attempted so thorough a survey of his county. In 1670 he had issued, single sheet 'Enquiries to be propounded in my Travels through England and Wales', under seven heads, 'Heavens and Air', 'Waters', 'Earths', 'Stones', 'Metals', 'Plants', and 'Husbandry'. Four of his seven categories were geological, and to assure himself of the accuracy of the answers he projected a 'Philosophical Tour'. The circuit of his first report was, however, wisely restricted to his home County, and the result was the book that has brought him fame.[1]

The following list of names is an attempt to apply modern names to the fossils and minerals engraved by Michael Burghers in illustration of Plot's *Natural History of Oxfordshire.*[2] The original specimens were either in Plot's own collection, or in the possession of the various benefactors who contributed to the cost of the plates and to whom their respective plates are dedicated.

TAB. II. Dedicated 'To the right Worsp[ll] the learned and curious Artist S[r] JOHN COPE Baronet, this second Table of formed Stones whereof ye 9[th] and 10[th] are found in his own grounds is humbly dedicated by R. P., LL.D.'

1. *Selenite.* Kimeridge Clay. Headington.
2 and 3. *Isocrinus* sp. (Stems). L. Lias. Claydon.
4, 7, and 8. *Isastraea explanata* Goldfuss. Coral Rag. Headington.
5. *Thamnastraea concinna* Goldfuss. Coral Rag. Headington.

[1] Plot's other works include a treatise, *De Origine Fontium tentamen philosophicum. In praelectione habita coram societate philosophica nuper Oxonia instituta ad scientiam naturalem promovendam.* Oxford, 1684.

The Formation of Salt and Sand from Brine. Phil. Trans. xiii. 96.

Observation on the substance called Black Lead, l. c.. xx. 183.

[2] The modern names have been supplied by Mr. W. J. Arkell of New College.

6. *Isastraea explanata* Goldfuss. If Corallian. Steeple Barton.
   Or, *Isastraea limitata*.[1] If Gt. Oolite.
9 and 10. *Clypeus Ploti.* Inf. Oolite. Cotswolds.
11. *Micraster praecursor* Rowe (Cast). Chalk. Aston Rowant.
12. *Echinobrissus scutatus.* Corallian. Iffley.
   (Anal valley omitted)?
13. *Conulus conicus.* Chalk. Chilterns.
14. *Echinocorys vulgaris.* Derived from Chalk. Ewelme.

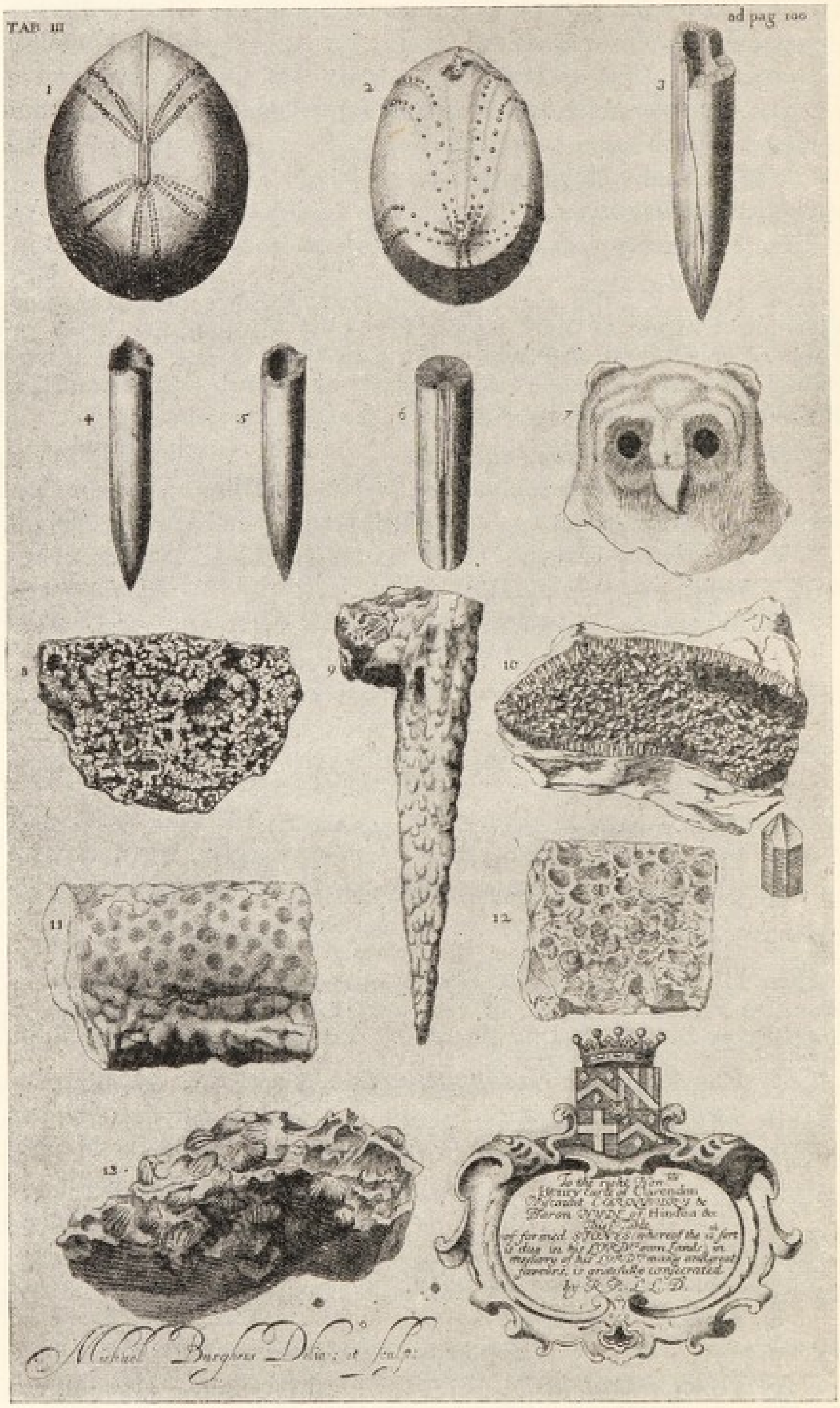
TAB. III. 'To the right Hon^ble HENRY Earle of CLARENDON, Viscount CORNBURY and Baron HYDE of Hindon, etc., this 3^rd Table of formed Stones (whereof the 12^th sort is dug in his Lord^ps own Lands, in memory of his Lord^ps many and great favours, is gratefully consecrated by R. P.'

1 and 2. *Echinocorys vulgaris.* Chalk. Pyrton.
3. *Belemnites abbreviatus.* Corallian. Headington.
4 and 5. *Belemnites* sp. Inf. Oolite? or Lias? Rollright.
6. *Belemnites sulcatus.* Oxford Clay. St. Clement's.
7. (Flint + imagination?) Whitchurch.
8. Weathered corallian limestone. (As quarried now at Wootton.)
9. Stalactitic calcite, from fissure in 1st. Corallian. Headington.
10. Calcite crystals lining cavity in 1st. Corallian. Headington.
11. Plant remains? *Stigmaria ficoides.* Coal.
12. Probably *Ostrea sowerbyi.* Forest Marble. Wychwood.
13. *Tetrarhynchia tetraedra* var. probably. M. Lias. Adderbury.

TAB. IV. 'To the right Hon^ble ARTHUR Earle of ANGLESEY, Viscount VALENTIA Baron of Newport Pagnel, Mount Norris, etc., Lord Privy Seale, &c., this 4^th table . . . is humbly offered by R. P.'

1. *Pseudomelania Heddingtonensis.* Corallian. Headington.
2. *Cerithium muricatum.* Corallian. Headington.
3. *Spondylus spinosus* or *Pecten cretosus?* Chalk. Henley.
4. Gt. Rollright.
5. *Ceromya concentrica?* Corallian. Headington.
6. *Rhynchonella concinna.* Gt. Oolite. Burford, etc.
7. Young *Epithyris Bathonica?* Gt. Oolite? Cornwell.
8. *Terebratula punctata?* Mid Lias. Hornton.
9. Loop of 'Terebratula' preserved in calcite.
10. *Pecten articulatus.* Corallian. Headington.

[1] Edwards and Haime, 1851, *Mon. Pal. Soc.*, p. 114.


TAB III
ad pag 100
To the right Hon^ble
Henry Earle of Clarendon
Viscount CORNBURY &
Baron HYDE of Hindon &c
This Table
of formed STONES whereof the 11th sort
is dug in his LORDps own Lands; in
memory of his LORDps many and great
favours, is gratefully consecrated
by R.P. L.L.D.
Michael Burghers Delin: et Sculp:

11. Like *P. demissus* as regards the wings, but probably meant for *P. leus.* Corallian. Headington.
12 and 13. *Pecten vagans.* Corallian. Headington.
14. *Lima?* (Localities too vague for determination.)
15, 16, and 17. *Lima rigida?* Corallian.
18. *Gryphaea incurva.* Derived from Lias. ?Gravels Cowley, etc.
19. *Ostrea* sp. 'Gravel.' (?)

TAB. V. 'To the Worsp^ll THOMAS STONOR of Watlington Park and Stonor Esq., this 5^th table of Formed Stones chiefly resembling Shellfish of the Crustaceous kind, whereof the 3^rd and 4^th sort were found in his owne grounds, is humbly presented by R. P.'

1. *Modiola scalprum.* L. Lias. Cleydon.
2. *Lithodomus inclusus.* Corallian. Headington.
3. ? Internal cast of *Cidaris.* Chalk. Stonorhouse.
4. *Cidaris* sp. Chalk. Stonorhouse.
5. *Stomechinus* sp.? Gt. Oolite? Teynton.
6. *Pseudodiadema?* Gt. Oolite? Teynton.
7. *Thecosmilia annularis* Fleming (Fragment). Corallian? Nr. Shotover.
8. Probably *Cosmoceratcs.* Oxford Clay? Oxford.
9. *Quenstedtoceras lamberti.* Oxford.
10. *Cosmoceras* or *Aspidoceras.* Oxford.
11. ? L. Lias? Cleydon?
Oxford Clay? Cleydon?
12. *Perisphinctes* (*P. giganteus* or *? bononiensis*). Portlandian. Thame.
13. *Stephanoceras Humphriesianum.* Inf. Oolite. Gt. Rollright.
14. *Coroniceras rotiforme* from the L. Lias? (No locality.)
15. *Aspidoceratas.* (*A. perarmatum* type.) Corallian. Sandford.

TAB. VI. 'To the right Worsp^ll the virtuous and most accomplisht Gent. S^r THOMAS CHAMBERLEYN Baron^t this sixt Table of Formed Stones w^th all imaginable respect is humbly dedicated by R.P.'

1. Flint. Chalk. Stockenchurch.
2. *Thecosmilia annularis.* Coral Rag. 'N^r Shotover.'
3, 4, and 5. Flints.
6. Flint flaked by weathering. N^r Shotover.
7. *Lithodomus* in flint? Sponge? Chilterns. N^r Sherbourn.
8 and 9. *Cidaris florigemma.* (Spines.) Corallian.
10. Incrustation on grass. 'The cascade.' Summertown.

11. *Pleurotomaria* —? Teynton, or *P. reticulata.* 'Nr Shotover.'
12. *Serpulae.* } Corallian. 'Nr Shotover.'
13. *Serpulae.* }

Tab. VII. 'To the right Worspll Sr John D'Oyly Baront in whom lodg all the virtues of his anciente house. . . .'

1. Cast of a *Perna* (+imagination)? Corallian. Headington.
2. *Cardium dissimile.* Portlandian. Headington.
3. *Pholadomya Phillipsi.* Cornbrash. Brize Norton.
4. *Homomya gibbosa.* Inf. Oolite? Shetford.
5 and 6. Doggers in 'Portland Sand'. Shotover.
7. *Trichites Ploti.* Corallian. 'Nr Shotover.'
8. Half of a hollow flint from river gravel? Magdalen College.
9. *Micraster* sp. Chalk. Chilterns.
10.
11.
12. *Exogyra nana.* Corallian.
13. Probably *Ventriculites radiatus* Mantell. Chalk. Stockenchurch.

Tab. VIII. 'To the right Worspll the learned and curious Artist Sr Thomas Penyston Baront this 8th table of formed Stones whereof the 4th 5th and 7th were found in his own grounds is humbly presented by R. P.'

1. Flint nodule. Chalk. Chilterns.
2. *Cyathophora* [*Stylina*] *ploti.* (Edwards and Haime.)[1] 'Gravel' (?) Oxford.
3. (*Anabacia orbitoides* from the Gt. Oolite?)
4. Probably *Megalosaurus* or *Cetiosaurus.* Cornwell.
5. Molar tooth of Ox.
6. Dogger concretion from the Portland Sand. Shotover.
7. ?Spindle whorl stone. Cornwell.
8.
9. *Anabacia complanata* (Defrance.)[2] Gt. Oolite.
10. Calcite.
11.
12. Iron Pyrites? Marcasite? Around Cornwell.
13 and 14. Crystals of Selenite.

This setting forth of the lists of Plot's type-specimens acquires added interest when we remember that notwithstanding his intimate acquaintance with so many fossils, bearing so close a resemblance to recent

[1] See Edwards and Haime, *Mon. Pal. Soc.*, 1851, p. 106.
[2] *Loc. cit.*, p. 120.

forms of life that the Dane, Steno of Padua, would have had no doubt as to their origin, Plot sought to explain them as the result of an inanimate physical force. In this he was but following in the footsteps of observers such as Beal who in 1664 presented the Royal Society with a box of stones to illustrate 'the process of the plastic spirit in shaping perfect cockles, muscles, scollops, headless serpents, fishes, thunder-stones, etc.' Misled by chemical experiments in his laboratory, Plot appealed to what we now call the force of crystallization as the sole explanation of the diversity of organic form.

> There is no other Principle that we yet know of naturally shooting into *Figures*, each peculiar to their own kind, but *Salts*; thus *Nitre* always shoots into *Pyramids*, *salt Marine* into *Cubes*, *Alum* into *Octo-*, and *Sal Ammoniac* into *Hexahedrums*, and other mixt *Salts* into as mixt *Figures*.
>
> Of these spontaneous inclinations of *Salts* each peculiar to its *Kind*, we have further evidence in the *Chymical* Anatomy of *Animals*, particularly in the *Volatile Salt* of *Harts-horn*, which in the beginning of its ascent is always seen branched in the head of the Cucurbit, like the Natural *Horn*.

Plot then proceeds to suggest that the five *Points* of *Astroites* and *Asteriae* 'making angles where they are joined at the center of 72 *Degrees*' are due to a *Salt* not much different from *that* which forms *Snow* flakes with six principal *Radii*, all joined in Angles of 60 *Degrees*. *Belemnites*, which are all striated from a center seem to have somewhat of an *Antimonial*, but a more prevalent quantity of a *Nitrous Salt*. *Conchites*, *Pectinites* and *Ostracites* . . . seem to own their origin to *Urinous Salts*. And the helical figure of *Ophiomorphites* may perhaps be explained by the *Regulus Martis Stellaris*.[1]

Plot's method of gleaning facts by a questionnaire needs discrimination; to sift the answers takes both time and trouble. The lack of one or the other of these entities may, on a later occasion, have enabled the Staffordshire gentry to boast that they had 'humbugged old Plot'. He certainly went very wrong over the identification of the leg bone of a Mammoth found in the parish of Cornwell and kept in the Anatomy

[1] Plot, *loc. cit.*, p. 122.

School, which he took to have belonged to a son of Anak.

But what is *instar omnium* in this difficult point, there happily came to *Oxford* while I was printing of this, a living *Elephant* to be shewn publickly at the Act, *An.* 1676 with whose bones and teeth I compared ours; and found those of the Elephant not only of a different shape, but also incomparably bigger than ours, though the beast was very young and not half grown. If then they are neither the bones of *Horses, Oxen,* nor *Elephants,* as I am strongly persuaded they are not . . . it remains that (notwithstanding their extravagant magnitude) they must have been the bones of *Men* or *Women* . . . Sons of Anak . . . Titans . . . Giants. Plot, p. 136.

EDWARD LHWYD (1660-1709), of Jesus College, and Keeper of the Ashmolean Museum, was the author of a prolonged inquiry into the nature of fossils. Having the advantage of collections which had already become considerable, he was able to produce a work of some importance, the *Lithophylacii Britannici ichnographia sive Lapidum aliarumque Fossilium Britannicorum singulari figura insignium distributis* . . . . . with letters about the more remarkable marine fossils and mineral species, London, 1699. In this work Lhwyd catalogued the figured fossils in the Ashmolean Museum, but owing to his absence on a collecting tour in Wales, many inaccuracies crept into the book, and a second and revised edition was issued in 1760 under the editorship of Lhwyd's successor in the Keepership, W. Huddesford.

Lhwyd's other contribution to geological literature

was his tract *De stellis marinis*, fol. Leipzig, 1733, which contained the substance of his public Lectures at Oxford in 1701–7. It was also incorporated by Huddesford in the second edition of the *Lithophylacii*. He was proposed for the Fellowship of the Royal Society in 1708, but his candidature was opposed by Woodward who regarded all fossils as a consequence of the Flood, whereas Lhwyd was convinced that fossils originated from the semina of fishes raised by vapours from the sea, which falling with the rain were carried into the inner parts of the earth. The opposition was, however, unsuccessful.

Martin Lister, 1638?–1712, though not originally an Oxford man, is deserving of special remembrance as one of the earliest benefactors of the Ashmolean Museum. He gave a fine collection of shells, with the original drawings, over a thousand in number, made by his daughters Susannah and Mary for the *Historia Conchyliorum*, 1685. He was created M.D., Oxon, 1684. His *Proposal for a new sort of Maps* appeared in the *Philosophical Transactions* for March 1683.

The Oxford naturalists of the eighteenth century described their local fossils and minerals as part of a general study of antiquities. Eminent among them Dr. William Borlase, 1695–1772, of Exeter College. He was best known by his *Observations on the Antiquities of Cornwall*, 1754, and by his *Natural History of Cornwall*, 1758; soon after this date he made over his entire collections to the Ashmolean Museum.

The cabinet inscribed with his name, in which the collections were kept, is now (1924) used for housing old wine bottles. Not a single specimen of the Borlase Geological collections placed in the care of Ashmole's keepers has survived. Borlase might as well have sent his treasures to Twickenham to add to the decorations of his friend Pope's grotto.

Thomas Pennant, 1726–98, the distinguished zoologist, left Queen's College in 1745, to travel in Cornwall, where Borlase advised him to make a special study of the fossils and minerals of the county. In 1750 he published a memoir on an Earthquake felt at Downing,[1] but his later works were zoological and topographical rather than geological, and have been referred to as such on

[1] *Phil. Trans. Abridgement*, x, p. 511.

page 185. Another Oxford geologist of the time was Mr. WICKHAM, 'a young clergyman who has a good fortune and lives with his father at Shirburn in Dorsetshire. He is a very agreeable gentleman and was not long ago at College. . . . He has for some time been a great Collector of Shells, and is now as fairly catch'd in the fossil trap as any one I have ever met with.[1]

The great work of WILLIAM SMITH (1769–1839) has been often reviewed. His introduction to Geology was made when as a lad he played at marbles with spherical fossil terebratulae, that he had collected from the Oolite rocks on which Churchill, his native village, was built. These Oolitic beds occupy the middle place among the principal divisions of the great Secondary group of rocks. Young Smith, thoroughly acquainted with the fossils of his local quarries, soon recognized that they differed from those of the Triassic and Lias beds that lie beneath, and from the Cretaceous and Wealden fossils of a higher level.

By profession he was a mineral surveyor and engineer, and business took him across a considerable tract of country. Starting from Bath, which stands near the Great Oolite, he carefully explored the Secondary formations above and below it. He ascertained that these always occur, like the tiles on a roof in a certain determinate order; that each formation contains fossils peculiar to itself, from which he deduced that the organisms of one geologic age differed from those of another, and that similarity of fossils enables a geologist to predicate identity of epoch; that the formations run diagonally across the kingdom in nearly parallel lines from north-east to south-west. His first account of his discoveries was published in 1799, and his great stratigraphical map of England and Wales was issued in 1815. This map, compiled in odd half-hours snatched from his professional labours, has been described as a Herculean achievement, which indeed it is, for Smith had no public support, and was not encouraged by any general sympathy with his labours.

Before the publication of Smith's researches only two of the entire series of Geological strata were known

[1] Letter of Smart Lethieullier to W. Huddesford, 1760. MS. Ashmole, 1822, f. 101.

approximately, but these, the Coal Measures and the older Tertiaries (London Clay, &c.), came just below and just above Smith's strata. So that when his new chapters were prefaced and followed by the previously discovered chapters, the middle and main portion of Geological History was complete. It needed only a beginning and an end. The beginning of the story was contributed by Roderick Murchison, who gave the name Silurian to the older fossiliferous system, and by Hugh Miller, who named the Old Red Sandstone, while the task of writing an appropriate ending was undertaken by Charles Lyell (1797–1875), a member of Exeter College. He studied the Tertiary formations, and established the four great divisions that have become familiar to us. Both Murchison and Lyell obtained knighthoods in recognition of their writings.

Smith introduced the names, Red Marl, Lias, Forest Marble, Cornbrash, Crag, Portland and Purbeck Beds, and London Clay, which have all been taken into general use, many having been adopted by foreign geologists to mark epochs of geological time.

There seems, however, to have been very little definite teaching of Geology in the eighteenth century, and even collections of fossils were only to be found in the 'cabinets of the curious'. The scientific use of the term 'Geology' is said to go no further back than 1778 when it was casually introduced by De Luc in one of his works. In London a good collection of fossils and minerals was to be found in the keeping of Sir Humphrey Davy at the Royal Institution, and in Oxford there was the disordered assemblage of minerals and organic remains in the Ashmolean Museum. In general matters geological were in a state of stagnation, a stimulation was needed.

This was given on November 13, 1807, by the founding of 'a little talking geological dinner club'. Thirteen chemists and mineralogists interested in Geology met at the Freemason's Tavern in Great Queen Street. Among them were Sir Humphrey Davy, James Parkinson, Richard and William Phillips, and George Bellas Greenough, M.P., the first president of the Geological Society of London, who was perhaps the keenest of the little party. The Rev. J. J. Conybeare of Oxford,

Professor R. Jameson of Edinburgh, Dr. J. Kidd, Professor of Chemistry at Oxford, Professor John Playfair of Edinburgh and others were elected as honorary members. And thus was instituted the Geological Society 'for the purpose of making geologists acquainted with each other, of stimulating their zeal, of inducing them to adopt one nomenclature, of facilitating the communication of new facts, and of contributing to the advancement of Geological Science, more particularly as connected with the mineral history of the British Isles'. In the year 1811 the Rev. W. D. Conybeare became a member of the Society; and he was followed by William Buckland in 1813; Daubeny, Mantell, and Sedgwick in 1818; Lyell and Henslow in 1819; G. Poulett Scrope and Murchison in 1824.

The Geological Revival in Oxford

So long as the Ashmolean collections were accessible, and Lecturers on Chemistry drew on them to interest their pupils in the provenance of chemical substances, the study of geology must always have found some place, even though a subordinate one, in the curriculum of the University. The first to introduce Geology as a distinct subject was JOHN KIDD, M.D. (1775–1851), who was Professor of Chemistry from 1805–10. He was the author of a *Mineralogy* in 1809, and of *A Geological Essay* 1815. His teaching was given in a 'subterranean class-room' under the Ashmolean Museum where 'nearly all the scientific teaching at Oxford had been accomplished since the days of Robert Plot'. And there Buckland, J. J. and W. D. Conybeare, Daubeny, W. J. Broderip, and others received their earliest initiation. Dr. Kidd resigned the Readership of Mineralogy in 1813 and was succeeded by WILLIAM BUCKLAND (1784–1856), Fellow of Corpus, who taught mineralogy and geology.

In these days when Oxford scientific professors are too often chosen from any university in preference to our own, we like to think of Buckland as heir to the divine afflatus of what was best in Oxford geological tradition. Already as an undergraduate he took his first lesson in field geology, as he himself has told us, 'in a walk to Shotover Hill with Mr. Broderip, who

knew much about fossil shells and sponges from Mr. Townsend, the friend and fellow-labourer of William Smith, "theFather of English Geology". The fruits of my first walk with Mr. Broderip formed the nucleus of my collection for my own cabinet, which in forty years expanded into the large amount which I have placed in the Oxford Geological Museum.' His lectures and his speeches were characterized by the 'union of the most playful fancy with the most profound reflections'.

One of his lectures delivered in the Ashmolean Museum is commemorated both in a picture and a poem.

SPECIMEN OF A GEOLOGICAL LECTURE

BY PROFESSOR BUCKLAND.

Attributed to Dr. SHUTTLEWORTH, late Bishop of Chichester.

IN Ashmole's ample dome, with look sedate,
Midst heads of mammoths, Heads of Houses sate,
And Tutors, close with undergraduates jammed,
Released from cramming, waited to be crammed.
Above, around, in order due displayed,
The garniture of former worlds was laid,
Sponges and shells in lias moulds immersed,
From Deluge fiftieth, back to Deluge first,
And wedged by boys in artificial stones,
Huge bones of horses, now called mammoths' bones;
Lichens and ferns which schistose beds enwrap,
And, understood by most Professors,—Trap.
Before the rest, in contemplative mood,
With sidelong glance, the inventive Master stood,
And numbering o'er his class with still delight,
Longed to possess them, cased in stalactite.
Then thus with smile supprest. In days of yore
One dreary face Earth's infant planet bore;
Nor land was there, nor ocean's lucid flood,
But mixed of both, one dark abyss of mud,
'Till each repelled, repelling, by degrees,
This shrunk to rock, that filtered into seas,
Then slow upheaved by subterranean fires,
Earth's ponderous crystals shot their prismy spires,
Then granite rose from out the trackless sea,
And slate, for boys to scrawl, when boys should be.
But earth, as yet, lay desolate and bare,
Man was not then,—but Paramoudras were.

'Twas silence all, and solitude; the sun,
If sun there were, yet rose and set to none,
Till fiercer grown the elemental strife,
Astonished tadpoles wriggled into life;
Young encrini their quivering tendrils spread,
And tails of lizards felt the sprouting head.
(The specimen I hand about is rare,
And very brittle; bless me, sir, take care.)
And high upraised from ocean's inmost caves,
Protruded corals broke the indignant waves.
These tribes extinct, a nobler race succeeds;
Now sea-fowl scream amid the plashing reeds;
Now mammoths range, where yet in silence deep
Unborn Ohio's hoarded waters sleep.
Now ponderous whales . . . . .
[Here by the way, a tale
I'll tell of something, very like a whale.
An odd experiment of late I tried,
Placing a snake and hedgehog side by side;
Awhile the snake his neighbour tried t' assail,
When the sly hedgehog caught him by the tail,
And gravely munched him upwards joint by joint,—
The story 's somewhat shocking, but in point.]
Now to proceed.
The earth, what is it? mark its scanty bound,
'Tis but a larger football's narrow round;
Its mightiest tracts of ocean—what are these,
At best but breakfast tea-cups full of seas.
O'er these a thousand deluges have burst,
And quasi-deluges have done their worst.

It being the intention of the versifier to produce at present only a specimen of his intended Work, he has omitted the following fifty lines, exclusively geological, concluding with—

These bones I brought from Germany myself;
You'll find fresh specimens on yonder shelf.

As also a digression of 2,300, of which the concluding couplet is—

So curl the tails of puppies and of hogs;
From right to left the pigs, from left to right the dogs.

And also for the same reason the subsequent still more digressive digression, which is terminated by the following admirable reflection. The whole passage consists of 5,700 lines:—

Not wild, but tame cats only, tease their prey.

The concluding couplet, which is given without any addition from the mouth of the learned lecturer, is here subjoined solely because it serves as an additional proof, if such were wanted, of the close connexion between geological speculation, and (not the ideas only, but) the language of complete poetry.

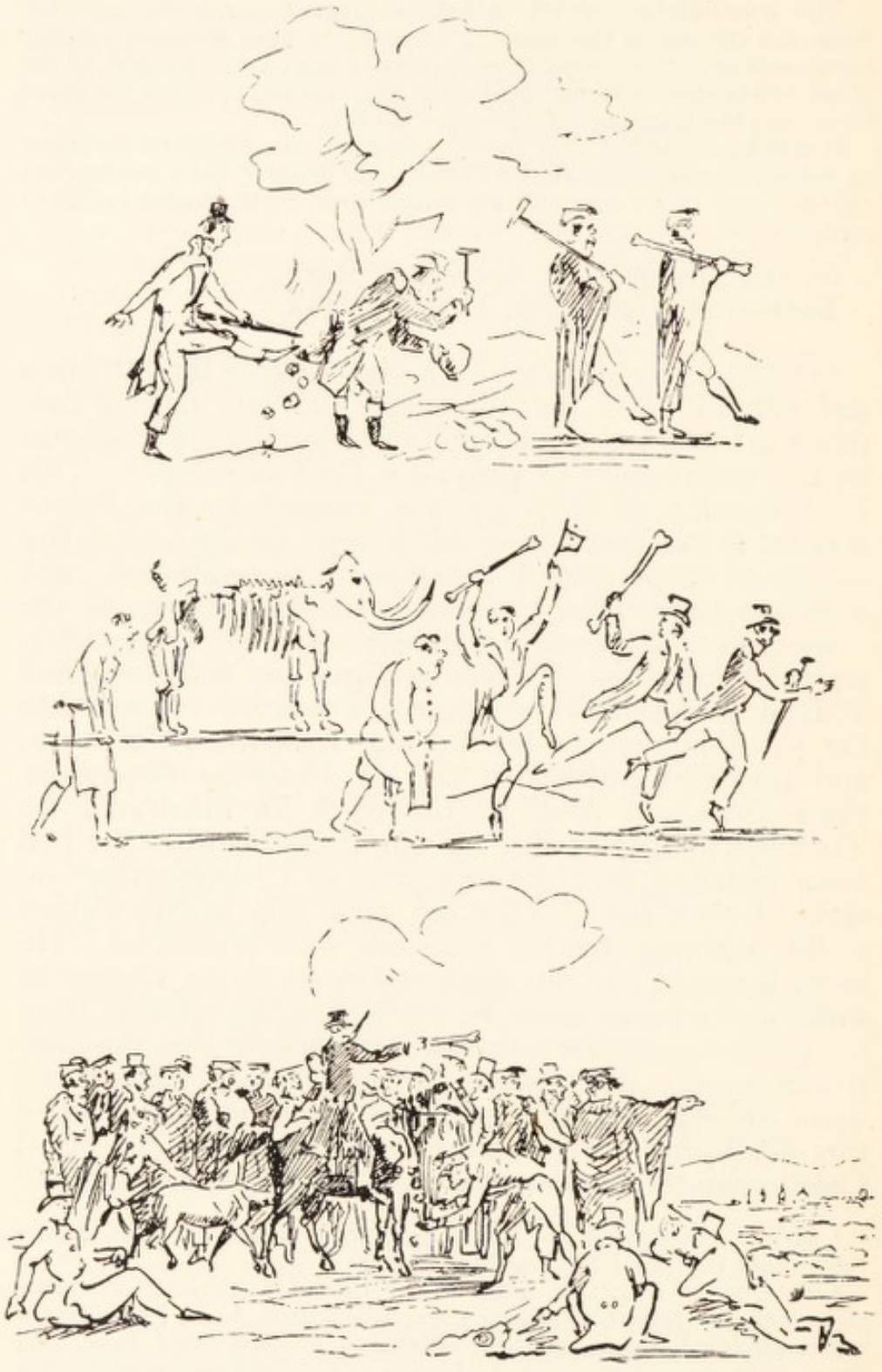
It will be observed, that though intended as a common sentence of Adjournment, it has all the fluency and grace of the most perfect rhythm, and of its own accord slides into verse, and hitches in a rhyme :—

Of this enough. On Secondary Rock,
To-morrow, Gentlemen, at two o'clock.

'His courses attracted in a high degree the attention and admiration of the university, and very largely contributed to the public recognition of geology as a science by the endowment in 1819 of a Professorship.'[1] This Professorship of Geology was created by the Prince Regent at the instance of Sir Joseph Banks, and to the delight of all his friends Buckland was nominated. He attracted the whole University by the novelty of the subject and his lively treatment of it. Howley, afterwards Archbishop, Sir Philip Egerton,[2] Whately, and P. Duncan attended the lectures, which he committed to the press in 1823 under the title *Reliquiae Diluvianae*; and this was succeeded by his *Vindiciae Geologicae*. How Buckland *lived* in his work is illustrated by Tuckwell's story of how on one occasion when he had been puzzling over the footprints of Cheirotherium on slabs of rock, the idea flashed upon him at two o'clock in the morning that the footsteps were testudinal. He woke his wife, and she hastened down to the kitchen to make some paste while he fetched in the tortoise from the garden; and the pair saw with delight that the footprints on the paste were almost identical with those upon the slabs of rock. He was informing his class of this discovery: 'It would seem', queried a sceptical Caledonian, 'that your animals always walked in one

[1] Mrs. Gordon, *Life of Buckland*, 1894. Portlock, *Obit. Notice* Geol. Soc. 1857, and Sollas, 1905, p. 219.

[2] Sir Philip Egerton, 1806-81, of Christ Church, in conjunction with his friend Viscount Cole, afterwards Lord Enniskillen, collected fossil fishes all over Western Europe, and described them in some eighty published memoirs. Both palaeontologists were among the helpers of Dr. A. Günther, the father of the present writer, and left their collections to the British Museum.



EXPEDITION TO SHOTOVER.

direction?' 'Yes,' was the reply, 'Cheirotherium was a Scotchman, and he always travelled south.'

Field work and geological excursions were an important item in his teaching, and were long remembered by those who were privileged to take part in them. Thirteen years after one of them, Edward Forbes, wrote the following effusion:

ON DR. BUCKLAND'S GEOLOGICAL EXCURSION TO SHOTOVER HILL IN 1847[1]

BUCKLAND, STRICKLAND, FORBES, and GREENOUGH,
MARQUIS NORTHAMPTON, PRINCE CANINO,
DELABECHE on Fossils keen
STOKES and BRODERIP, ELY'S DEAN
And He who spanned the Menai stream,
And lifted high in air his massive iron beam—
(The work of giants, it would seem,
Or the Cyclops, or the Titans of the Poet's lofty Theme.)
He, too, is past, the shadow of a dream!
With their hearts so cheery, so rich their lore.
We hear their melodious voice no more,
Their pale ghosts flit on the Stygian shore,
With the shades of the mighty spirits of yore,
Where Achilles and Homer are gone before—
So Dante and Virgil sweetly sung,
And his lyre the mournful Orpheus strung,
With their fabulous myths and their gifted tongue—
Where rules that stern and silent Queen
Of sad and melancholy mien—
The dark and beautiful Proserpine.
They're past, but still their name is dear,
Like the Evening Star, our twilight to cheer,
Their memory claims the generous tear,
As those who thro' Life's storm fulfill'd their career.
These were Buckland's bold Banditti
Of the Geological Committee,
That storm'd without remorse or pity
Clay-pits, stone-pits, hedges, mounds,
Where the ochre of Shotover Hill abounds.
Alas! we're no continuing city!
'Ere thirteen springs have run their rings—

[1] From Dr. Daubeny's *Commonplace Book* in Magdalen College Library.

When the thrush its vespers sings
And its scents the violet flings,
We look in vain the while
For their well-remembered tones! their ever welcome smile!
We miss, too, JOHNSON's radiant look,
Who watch'd the stars in Heaven's own book.
Thus with us, too, pranced his horse
The late ARCHDEACON WILBERFORCE
(With his good brother, in high force;
He, too, has run his mortal course!)
'Ere he fell over those boulders and blocks,
Those Roman metamorphic rocks;
All that the pious Protestant shocks—
All that the savage Calvinist mocks,
When we pray the Virgin and blessed St. John
T'intercede for our souls with her dear Son—
When we lose the light of the Sun,
When our mortal race is run,
When our earthly task is done,
And the grim Fates cut the thread they spun.—
When the bowl is broken, the silver cord loosed,
And to the sweet setting stars, our eyes are closed—
And then—and then—and then!
'When shall we three meet again?'

Oxford, July 4, 1860. E.

Buckland's wide knowledge was combined with an intellectual honesty that made him incapable of accepting any travesty of the truth. On his wedding tour he visited the shrine of Santa Rosalia in Palermo. It was opened with all due reverence by the priests, and the relics of the saint shown. Buckland at once saw that they could not be the remains of Santa Rosalia. 'They are the bones of a goat', he cried out, 'not of a woman'; and the sanctuary doors were abruptly closed.

Some ten years later he was tilting against protestant orthodoxy in Oxford. The theologians of Christendom had always taught the literal acceptance of the Mosaic story of Creation. Buckland, greatly daring, in 1836 published his Bridgewater Treatise, *Geology considered with reference to Natural Theology*. After that, the Deluge. 'The Clergy, the Dons, the Press fell upon him in a mass.' Dean Gaisford thanked God on the

Professor's departure for Italy, 'We shall hear no more of his Geology'. Pusey organized a protest against the conferring of a degree on Owen, and Keble clinched a bitter argument by the conclusive dogma that 'when God made the stones he made the fossils in them'.

'Worse was still to come; the "Six Days" were to be impeached; the convenient formula "before the Flood" to be dispossessed; the old cosmogony which puzzled Mr. Ephraim Jenkinson to fade slowly from the popular mind ... and in the great awakening of knowledge which severed theology from science and recast Biblical criticism, he [Buckland] was amongst the earliest and most energetic pioneers.'[1]

Another Wykehamist, eleven years younger than Buckland, was CHARLES DAUBENY (1795–1867), of Magdalen College. After taking honours in the school of Literae Humaniores he migrated to the Edinburgh Medical School, where he came under the stimulating influence of Professor Jameson.[2] Daubeny's geological apprenticeship was passed among the volcanoes of the Auvergne which he described in letters to his teacher, and which he afterwards worked up with other matter in his *Description of Active and Extinct Volcanos*, 1826. Unfortunately his outlook was limited by a theory inherited from Von Buch, that volcanic craters owed their form to elevation from below instead of to deposition from above. His knowledge of chemistry—he had been appointed to succeed Dr. Kidd as Aldrichian Professor of Chemistry four years earlier—enabled him to give effective support to the views of Gay-Lussac and Davy that water coming in contact with uncombined bases, such as potassium, &c., beneath the oxidized crust, was an efficient cause of the high temperature that led to earthquakes and volcanic eruptions.

In his vacations he visited all the volcanic regions of Europe; he analysed and examined all the gaseous emanations and hot springs from Bath to Thermopylae to which he could obtain access; his collections of rock-

[1] Tuckwell, *Reminiscences*, p. 36. In 1845 Oxford consisted of *Arians*, *Tractarians*, *Retractarians*, and *Detractarians*.

[2] Daubeny's notes taken of Jameson's lectures are preserved with other scientific manuscripts of the period in Magdalen College Library.

specimens from volcanic regions and of literature relating thereto were the most extensive and well arranged of any that had ever been brought together by an Oxford man; and he left all in trust to Magdalen College.

Although the manifold occupations of his last twenty-five years left him less leisure for geological research, he never forgot his first love, and even in 1867, the last year of his life, he published a paper on the subject of his first printed work in 1821, on the geology of the extinct volcanoes of France. Had there been no Buckland, Daubeny would perhaps have added the Professorship of Geology in Oxford to his other three Chairs.

At the beginning of the nineteenth century the aftermath of the controversy between German Neptunists and the Volcanists still promised to exercise a retarding influence on the knowledge of volcanic structure. So long as volcanic basalts were believed by the disciples of Werner to be of aqueous origin, so long was advance delayed. Even geologists as eminent as Von Buch and Alexander von Humboldt were for a time misled by their master's views, so that it took little less than an eruption of Vesuvius (in 1805) to correct them; but even so, a quarter of a century elapsed before the matter was placed beyond the pale of controversy.

After a visit to the Auvergne in 1802 Leopold von Buch explained volcanic craters by his fallacious theory of Elevation. He considered that rocks, originally lying in horizontal beds, were pushed up by subterranean forces associated with the earth's internal heat. He was reputed the greatest geologist of his day, and persuaded geologists generally that he had found craters of elevation in all the volcanic regions visited by him. The refutation of this theory was the work of a member of Pembroke College, Oxford, and of St. John's College, Cambridge, GEORGE JULIUS POULETT THOMSON (1797–1876), almost a contemporary of Daubeny's and some twenty-three years junior to Von Buch. Young Thomson spent the winter of 1817–18 in Naples and continued his studies there in 1819, incorporating the result with his researches on the volcanoes in Central France in 1825 under his newly adopted name of SCROPE.[1]

Scrope disproved the theory of the Elevation-Crater,

[1] *Considerations on Volcanoes.*

and laid the foundation of the present views on volcanic eruptions, viz. that a volcano is to be ascribed to the accumulation of volcanic products round a vent, which is usually situated over a superheated subterranean magma saturated with water and forced up to the surface by the force of expanding vapours. In these views Scrope was afterwards supported by Lyell, but, we regret to add, not by Daubeny, who was still obsessed by the 'Craters of Elevation' of Von Buch.

Scrope's later work upon the influence of subaerial denudation in the formation of valleys and the shaping of the surface features of the land was also of great consequence in advancing the progress of modern geology.

The time of which we are writing has been aptly described by Sollas (1907) as the 'Golden Age of Geology'. The Great Masters of this brilliant period are Buckland, Sedgwick, Murchison, De la Beche, Von Buch, Elie de Beaumont, Omalius d'Halloy and others. Each had made his particular contribution to the general fund of knowledge, it now remained for the master-mind to pass the sum of their attainments under review, to elucidate the leading conceptions of Geology, to discuss the causes both of the slow development of these studies and of the many false directions which they had too often taken.

This was the work of a member of Exeter College, perhaps the most eminent member that Stapledon's Foundation has ever nurtured, CHARLES LYELL (1797–1875). While an undergraduate his interest in geology was fostered by the lectures of Buckland, and it became enthusiasm during a three months' tour which he made with his parents through France, Switzerland, and Upper Italy. After visiting Cuvier, Humboldt, and Prévost in Paris in 1823, and touring Scotland with Buckland, he in 1828 went over the volcanic regions of the Auvergne, Rome, Naples, and Sicily. The result of these and other travels was the publication of *The Principles of Geology being an attempt to explain the former changes of the Earth's surface by reference to causes now in action*, 1830–3—a work 'in itself sufficiently important to mark almost a new era in the progress of our science' (Conybeare).

In this work he brought a great talent for exposition into play to make it as clear to the general reader as to

the geologist, that geological changes have been brought about by natural agencies that are still in operation at the present day. He never ceased to lay stress on this point and to refute those who found in intermittent catastrophe the explanation of geological change.

More than any one else Lyell has taken 'the leading position in the world as the exponent of geological processes, and the chronicler of the advances made to our knowledge of the structure and history of the earth' (Woodward), and with this brief mention of the first of the Moderns we conclude this review of Early Geology in Oxford.

Geological Collections.

The old University Collections contained in the Anatomy School included many fossils and mineral specimens some of which are listed under more or less vague names in Hearne's Catalogue printed on page 274. We have also stray mentions of others, as, for instance, of a specimen of 'Orphiomorphit', which was identified by Plot as the *Cornu Ammonis cristatum* of John Bauhin. He adds that 'There is another amongst the κειμήλια of the Medicin School, of above eight inches diameter, taken up as they say somewhere about Corpus Christi College'.[1]

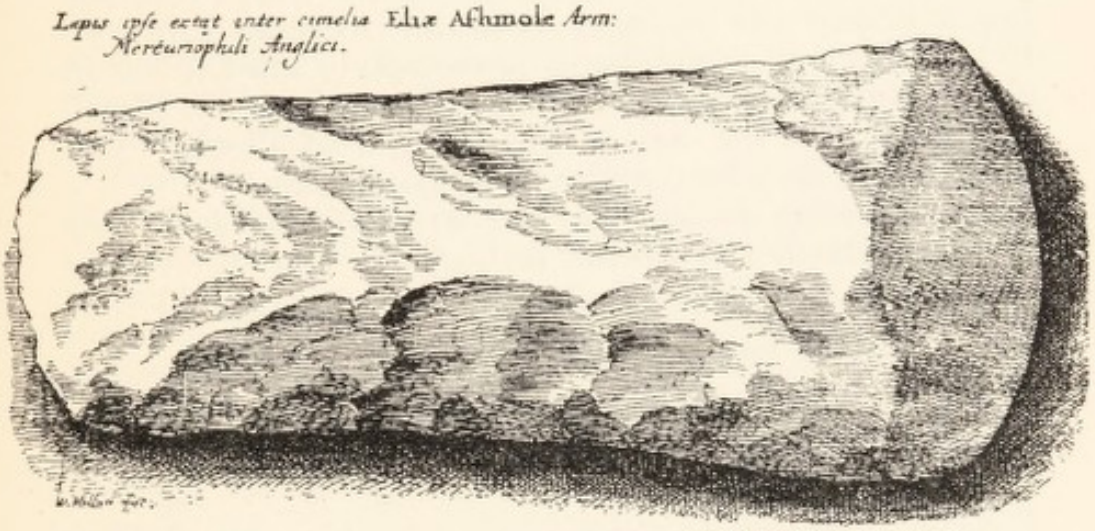
Plot also informs us that 'We have also here [in the Medicine School] at Oxford a *thigh-bone* that came from London, three foot and two inches long, which I guess may be of an agreeable proportion with ours'.[2]

Whether the entire Tradescant collection of stones ever arrived in the Ashmolean Museum is uncertain. It was certainly a collection of importance thirty years before. It was divided into two categories: *Gemmae* or Precious Stones, including 'Astroites' and 'Asteria', which may have been fossils, and *Fossilia*, which were classified under the heads 1. Metallica; 2. Terrae; 3 and 4. Succi concreti; 5. Lapides selectiores; 6. Materiae petrifactae. The complete list is given below on p. 406. There is reason to believe that Ashmole's own collection of fossils etc. did not come to Oxford, but was destroyed by the fire in the Temple. There is, however, a very

[1] Plot, p. 110.

[2] *l. c.*, p. 135.

perfect representation of one of his specimens still extant. This, a fine flint implement, was engraved by Hollar for Dugdale as one of the illustrations to the *Antiquities of Warwickshire*, 1656. It was a specimen of the greatest value in the history of archaeological science, for it led to the foundation of the intelligent study of flint implements as a means whereby to 'date' the remains of early man, and of contemporaneous geological deposits. Before the discovery of Dugdale



Ashmole's Neolithic Flint Implement found at Oldbury.

and Ashmole it was assumed that flint was of too refractory a nature to be worked by man. Nevertheless, to such thoughtful persons as Paracelsus, the shapes of what are now universally recognized as 'worked flints' seemed to demand some explanation. Paracelsus called them *Gamahus*, and stated that of gamahus there are two varieties: i. Found in sand and streams, fashioned exactly as if made by man, but in fact created by God, and endowed with miraculous powers, and ii. Artificial stones on which images of men and animals have been impressed by a peculiar constellation.[1]

Dugdale was the first founder of the Science of Flint Implements by his recognizing Gamahus as artificial objects, made by the ancient Britons 'inasmuch as they had not the knowledge of working iron or brass to such

[1] Paracelsus, *Opera* ii, 1658, pp. 499, 502: Edm. Chilmead, London, 1650, p. 96.

uses', and his best illustration was drawn from Ashmole's specimen.[1]

Another, but less important, stone in Ashmole's collection was a great rarity, a *lapis odoratus*, a stone that smelt of violets, sent him by J. Sutherland, keeper of the Edinburgh Botanic Garden.[2]

It is highly probable that a rearrangement of the Minerals according to their chemical constitution was one of the first tasks that fell to Plot as keeper. A 'List of the Minerals', in the hand of the botanist, Professor Jacob Bobart the younger, is in the Bodleian Library.[3] It is written in a notebook immediately after a list of plants, and before 'Some few hasty notes from Dr. Plott', indicating that the writer was a pupil of Plot's. The MS., which may be dated c. 1685–90, begins

The following Metals, Oars etc. are Kept and to be seen in Mr. Ashmole's Musaeum in Oxford.

'Many more have been added since Dr. Plots time.'[4]

TAKEN FROM DR. PLOTTS TABLES, M.S.

Metals are *Perfect, Imperfect.*

Perfect: *Gold* Native, Factitious
Silver ,, ,,

Imperfect: *Copper*
Iron
Soft Lead
Tin

These also Native or Factitious.

The list is printed in extenso as *Appendix C*, pp. 440–7.

A most important accession was the Lister collection of Shells, which arrived in the early days of the Museum and comprised what was probably the finest series of recent and fossil shells in Britain. And in 1691, Plot gave his own considerable collection, which included the type specimens figured in his *Natural History of Oxfordshire*, 1677.

The successor in the Keepership, EDWARD LHWYD, followed Plot's example by also presenting the whole of

[1] Dugdale, *Warwickshire*, 1656, p. 778.
[2] Bruckmann, *Epist. Itineraria* 13, cent. i.
[3] MS. Lat. misc. d. 25, pp. 68–82.
[4] The note between quotation marks is a later addition. The reference is MS. Lat. misc. e. 29.

his collection of fossils in 1708. And with the exception of the Borlase collection of crystals, metals and minerals, given in 1758, the rest of the eighteenth century seems to have passed without further additions to the geological side of the Museum. This last collection included all the types of Cornish minerals described for the first time in the History of Cornwall. They have all been lost: but the original show case inscribed

GUL^{s}. BORLASE *A.M. S.R.S.* D.D.

with graffiti '*E. Thomas All Souls 1791*' (written twice over) is kept in the New Ashmolean Museum in Beaumont Street.

Towards the end of the century Sir CHRISTOPHER PEGGE once more aroused an interest by private lectures on mineralogy, and in 1800 his cabinet of minerals was acquired by the university by purchase. 'About this time Dr. Kidd, the first holder of the office of Reader in Mineralogy, began the formation of a new collection in Geology; to which William Conybeare and many others of his pupils contributed. Mr. Henry also presented through Dr. Kidd, a series of valuable specimens in mineralogy. Dr. Buckland, who followed Dr. Kidd in this office in 1813, and who became also reader in Geology in 1818, presented his entire mineral collection to the University in 1823. In 1824, the Rev. John Josias Conybeare bequeathed to the University another large collection of specimens in geology and mineralogy, together with cabinets containing them, and £50 for the purchase of additional specimens in mineralogy.'[1]

In consequence of these and many other additions, the collections became too large to be contained in that part of the Ashmolean Museum allotted for their exhibition, so in December 1830 it was settled that the western portion of the middle and upper storeys and attics in the old Clarendon Building recently vacated by the University Press, should be applied to the use of the Reader in Mineralogy and of the Reader in Geology. I have not been able to ascertain the exact date of the moving of the Geological collections. The physicist, Professor Rigaud, appears to have secured possession of his new

[1] Ingram, *Memorials.*

quarters by April 2, 1832, but owing to protracted discussions about cupboards, Geology did not get properly installed until much later. The cost of the removal and of the refurnishing of the new rooms and of those for the lectures on Natural and Experimental Philosophy was defrayed by a grant of £3,000 voted by Convocation on June 11, 1831, and the refitting was carried out under the supervision of the architect Sir Robert Smirke.

In 1832 Dr. RICHARD SIMMONS of Christ Church presented a choice collection of minerals, for which appropriate cases were provided in the north-west room of the Clarendon. But apparently the collections were not opened to the general public for some years, for on November 19, 1838, Dr. Buckland proposed an arrangement for opening to general inspection the collections of Mineral and Geological specimens 'now upstairs', and those presented by Dr. Simmons. The immediate result was that John Pillinger was engaged at £50 a year for various duties, including that of a general care of the rooms and the particular duty of attending at the Clarendon Museum from one to four on three days a week, to show the collections to visitors, and to work at fitting up cabinets, labelling and arranging collections under the orders of the Professor. He had also to answer the bell and to collect sixpence from each visitor.[1]

So satisfactory were the final arrangements that in 1843 Skelton was able to report that 'the Geological collection, belonging to the Professor of Mineralogy is one of the best in the Kingdom. It is remarkable as one of the oldest, if not actually the first collection of subjects relating to this science made in the kingdom.[2] In February 1851 the University added Dr. Beeke's collection of minerals by purchase for £140.

During the period of Buckland's indisposition, one of his pupils, H. E. STRICKLAND, 1811–53, of Oriel College, a grandson of Edmund Cartwright of Magdalen, acted as deputy, and would in all probability have succeeded to the geology readership had not he met with an early death, being killed by a train while examining the rocks in a railway cutting on Sept. 14, 1853.

[1] *Hebd. Reg.*, 1833–41.
[2] *Oxonia antiqua restaurata*, 2nd edit. 1843.

The collections then fell to the care of JOHN PHILLIPS who was still delivering geological lectures in the Clarendon Building in 1858, within the memory of Professor Boyd Dawkins, who remembers him busy in preparing Buckland's collection for removal to the new Museum. And with Phillips the first Keeper of the new Museum we have reached the limit to our review of the early Geological Collections of the University.

PRIVATE GEOLOGICAL COLLECTIONS.

No account of the geological collections of Oxford would be complete without a mention of the important collections brought together by Drs. Buckland and Daubeny. The Buckland collection was noted for its valuable remains of fossil vertebrates, while Daubeny's series of volcanic rocks collected from various parts of Europe are of great historic interest.

Fowler, the distinguished author of the *History of Corpus Christi College*, suggests that the earliest geological collection in Oxford to be 'arranged on scientific principles' was that of WILLIAM BUCKLAND (admitted to C.C.C. in May 1801), who, regardless of his own personal comfort, caused his large sitting-room, now the Undergraduates' Library in Corpus, to be fitted up as a Geological Museum. Thomas Arnold was among his early disciples there, and there the specimens remained until Buckland removed to Christ Church in 1825. A detailed and graphic description of the room is preserved in a poem by the younger Duncan.

PICTURE OF THE COMFORTS OF A PROFESSOR'S ROOMS IN C.C.C., OXFORD.

Procul este Profani
Procul inscii et vani.

AWAY, ye ignorant and vain!
Away, ye faithless and profane!
Jesters and dainty dandies fly hence,
But enter thou, dear son of science!
And here in mild disorder hurled,
Behold an emblem of the world,
In that chaotic state of old
When flints in Paramoudras rolled!
Here see the wrecks of beasts and fishes,
With broken saucers, cups, and dishes;

The præ-Adamic systems jumbled,
With sublapsarian breccia tumbled,
And post-Noachian bears and flounders,
With heads of crocodiles and founders;
Skins wanting bones, bones wanting skins,
And various blocks to break your shins.
No place is this for cutting capers,
Midst jumbled stones, and books, and papers,
Stuffed birds, portfolios, packing-cases,
And founders fallen upon their faces.
He'll see upon the only chair
The great Professor's frugal fare,
And over all behold, illatum
Of dust a superficial stratum.
The sage amidst the chaos stands,
Contemplative, with laden hands,
This, grasping tight his bread and butter,
And that a flint, whilst he doth utter
Strange sentences that seem to say
I see it all as clear as day;
I see the mighty waters rush,
And down the solid barriers push!
I see the pebbles pebbles chasing,
And scooping out of many a basin;
I see the dreadful dislocation,
And gradual stratification.
His eye in a fine frenzy rolling,
He thus around the fragments strolling,
Still entertains a fond illusion
That all the strata's strange confusion
He shall explain beyond conjecture,
And clear in the ensuing lecture.

P. B. DUNCAN.

May, 1821.

And even in his Christ Church canonry 'the sideboard groaned under successive layers of fossils, and the candles stood on ichthyosaurian vertebrae'. 'In the breakfast-room was a series of books, boxes and papers . . . all blended together in one mass of confusion . . .' In the drawing-room 'one of the round tables is formed entirely of coprolites. Another presents on its highly polished surface all the variety of lava, etc., found at Mount Etna'. Ultimately Buckland bequeathed the collection to the Vice-Chancellor of the University for the use of the Professors of Geology who might succeed him, with all the geological charts, sections, and engravings that might be in the Clarendon Buildings at the time of his death. When the New Museum in the Parks was completed, the collections were moved from the Clarendon Buildings, and a marble bust, erected by his friends and pupils, was inscribed with the pious wish that the relics of the past

recovered by Buckland's industry might be preserved 'in perpetuum'.

'The subsequent history of the collection is a melancholy record of neglect. Owing to a variety of causes, a great part of this valuable bequest to the University remained in the same condition (and with perishing labels), in which it had been removed from the Clarendon,

PROFESSOR AND MRS. BUCKLAND AND FRANK
From Mrs. Gordon, *Life of Buckland*

for half a century. The Hebdomadal Council were urged to apportion a space, when the enlargement of the Museum buildings was contemplated, for the "collection in the cellars", as it was called, and about 1892 a large room was placed at the disposal of the Professor of Geology. There the matter rests, and, it is feared, will continue to rest, unless the University makes a special grant to rescue this bequest from oblivion. Not only does this collection consist of Dr. Buckland's gatherings of the first-fruits of the new science, but,

as he was the greatest authority on geology at the beginning of the century, it includes specimens sent him from all over the world.'

Professor Boyd Dawkins[1] wrote respecting this once famous collection:

'In 1857 Dr. Buckland's collection was in the old Clarendon Buildings, partly in upright glass cases and partly in drawers below. Professor Phillips let me have the run of them, and I spent a good deal of time in working at them; they were all accessible and were mostly unpacked. They were removed to the New Museum, and the arrangement disturbed, so that at present the collection is in a state unworthy of Oxford. The Bucklandean tradition and name, which were maintained in Oxford down to the death of Phillips, are now almost unknown. The Bucklandean collections are now scarcely known as such.'

The collection of CHARLES DAUBENY of Magdalen comprised some fifteen thousand localized and catalogued specimens, contained in 492 drawers: it was the result of a life of travel and collecting. During the last decade of his life his mineral specimens were arranged after the chemical system of Rammelsberg,[2] and his geological specimens were grouped in four categories. 1. Stratified Rocks of all ages. 2. Plutonic and Metamorphic Rocks. 3. Volcanic Rocks, submarine and subaerial. 4. Miscellaneous collections of special topographical interest.

Many of Daubeny's rocks are to be regarded as *type specimens*, and are described in detail in printed memoirs. Of special importance are the long series of rocks containing phosphates and the volcanic rocks. Many of the specimens were specially chosen to illustrate the papers of other workers, Conybeare, Buckland, Jameson, Sedgwick, Murchison, Ramsay, Macculloch, Phillips, Scrope, and others. He had also incorporated in his collection rock-specimens brought home from the Arctic by Captain Parry, from S. America by Darwin on the

[1] Sir W. Boyd Dawkins, Honorary Fellow of Jesus College, Professor of Geology at Owens College. Quoted from Gordon, *Life of Buckland*, pp. 52–3.

[2] *Handwörterbuch des chemischen Theils der Mineralogie*, Berlin, 1841.

famous voyage of the *Beagle*, by Sibthorp from Greece and the Levant, by Buckland from Gailenreuth and elsewhere, as well as specimens of his own collecting from North America 1837–8, and from most of the countries of central and western Europe 1820–50. For these and other collections he built a Museum near the Botanic Garden and bequeathed the whole to Magdalen College with a Trust Fund to help the College to provide for their safe-keeping. The circumstances which have led to this fine collection remaining practically useless for further research are mainly two: 1, the appointment as sole Curator of a person who pretends to no knowledge of geology, and, 2, the alienation of rooms previously allocated to myself as a research fellow for working at the Daubeny collection.

A third notable private collection of fossils was that of JAMES PARKER, 1833–1912, of Oxford, son of John Henry Parker, the archaeologist. Parker's collecting period is described in detail in four notebook inventories of fossils obtained between 1847 and 1877. An early historic entry

1 Stonesfield Jaw bt. of Best Sept. 26 1858 with six other fossils for 4/-

refers to his unique specimen of a jaw of *Phascolotherium Bucklandi* figured by Phillips,[1] acquired for the Oxford Museum in 1913, and destroyed in 1919 by being cut into thin slices.

Within a year of the publication of Boucher de Perthes' discovery of flint implements in the valley of the Somme by Evans and Prestwich in 1859, Parker had visited the site and had brought back to Oxford a collection of the implements, and a set of drawings of sections made by himself of the gravels of St. Acheul.[2] With Boyd Dawkins, on April 22 and May 6, 1862, he ransacked Wookey Hole for palaeoliths and hyaena bones.[3] On July 15–16 of the same year he found a cache

[1] Phillips, *Geology of Oxford*, fig. 236.

[2] J. Parker, *Early Flint Implements from the Somme Valley*, 1862. *Report of the Lecture on the Flint-Implement bearing Beds of S. Acheul, delivered before the Ashmolean Society* Nov. 9, 1872. A twelve-page pamphlet, reprinted from the *Oxford Times*.

[3] Parker's plan of the smaller cavern of Wookey Hole was printed and published.

of *Megalosaurus* bones at Weymouth, which were duly sent to his house in the Turl in two hampers on July 31. In 1864 his acquaintance, Lord Dunraven, sent him the huge antlers of *Megaceros hibernicus* found in Oola bog near Tipperary. But the gem of his now important collection was a unique skeleton of *Streptospondylus Cuvieri*, a carnivorous Dinosaur from the Oxford Clay of St. Giles's pit, Summertown. For many years the bones reposed in the cellars of the Turl until 1913, when, with the rest of the Parker collection, they were purchased by the late W. E. Balston for presentation to the Oxford Museum. The skeleton was mounted at the British Museum; and now, in 1924,[1] is one of the chiefest treasures in our University Museum. He prepared a *Map and Sections of Strata South of Oxford* for the meeting of the excursion of the Geological Association of May 17, 1880, and also a *Rough Section of Purbeck Strata, Durlston Bay*, for a similar occasion in May 1910. These ephemeral publications are now difficult to obtain, as are his Map and three Sections of the South of Oxford, printed in colour. For field work he used a clinometer of his own invention, which his son has been good enough to give to be placed with the Evans Collection of Scientific Instruments in the Old Ashmolean Museum.

Of Parker's archaeological and architectural work this is not the place to speak, but notwithstanding these and his other preoccupations, he kept up an interest in geology to the last. In 1895 he acted as Secretary to the British Association committee on the *Ceteosaurus* remains found at Enslow Bridge, of which committee the present writer's friends Lord Ducie, A. H. Green, and Professor Ray Lankester were also members. Parker's notes and plans are still extant. Professor Green died in the following year.

[1] *Geol. Mag.*, July 1905.

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