The Harveian Oration

ON

HARVEY'S WORK CONSIDERED IN RELATION TO SCIENTIFIC KNOWLEDGE AND UNI- VERSITY EDUCATION IN HIS TIME.

DELIVERED BEFORE THE ROYAL COLLEGE OF PHYSICIANS
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BY

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MR. PRESIDENT, FELLOWS OF THE COLLEGE, AND GENTLEMEN.—In the first place I have to thank you, Sir, for entrusting me with the most honourable duty of delivering the annual oration founded by our greatest associate, Dr. William Harvey, the supreme glory of our College, whose memory we all cherish and whose work is universally regarded as the peculiar pride of English medicine. In founding this oration he enjoined in the deed of gift that the orator should exhort the Fellows of the College to search out and study the secrets of nature by way of experiment, and for the honour of the profession to continue in mutual love and affection among themselves. It was also his wish that on this occasion should be commemorated those benefactors of the College who by gifts or by their contributions to medical knowledge have forwarded the interests of this College in the course of the bygone year.

RECOGNITION OF HARVEY'S WORK.

Harvey's work has been justly regarded as remarkable by its great success in his own lifetime, and especially in his own country and among his colleagues in this College, where there appear to have been no discordant voices. So far from it being true, as a recent British writer has ventured to say, that the only criticisms on his work were heard from his fellow-countrymen, the very contrary is the truth, and, as Willis expressly says, the appearance of Harvey's book seems almost immediately to have attracted the attention of all the better intellects among the medical men of Europe. The controversy on the circulation was carried on abroad rather than at home, for Harvey seems to have won over to his side all the men of his own country who by their education and acquirements might have been fitted to array themselves against him, and the first publication to deal with the question by one of Harvey's countrymen was that of Dr. George Ent, who undertook to defend Harvey's teaching against the criticisms of *Parisanus*.

A century had to elapse before the voice of criticism was heard from any British authority, and then it was the extremely able but somewhat quarrelsome anatomist Dr. William Hunter, who sought to depreciate the work of Harvey by comparing it with the discovery of America by Columbus, and the astronomical induction of Copernicus, disparaging Harvey's mental abilities on the ground of his failure to recognize the value of the discovery of the lacteals by *Asellius*, whose book was published about the same time as that of Harvey on the circulation of the blood (1627). William Hunter's quarrel with his glorious brother John over the placental circulation does not show him in a very amiable or even an altogether honest light; and much as we may regret that so able an anatomist should have adopted this hypercritical attitude, I think we may fairly say that his comments in no way succeeded in diminishing the glory of Harvey.

Contributions to Harveian Literature.

Successive Harveian orators have so diligently explored the somewhat scanty literary remains that throw any light upon the life and doings of our illustrious fellow-countryman, that the College warmly appreciated the address by the late President, Sir Thomas Barlow, who occupied this chair in October, 1916, and by his munificence had placed in the possession of the College certain documents, consisting of eight of Harvey's own letters written at the time when he accompanied the Earl of Arundel on an embassy to the Emperor Ferdinand. Although these letters deal with only a short episode in the life of Harvey and throw

no light whatever upon his physiological researches, they are exceedingly welcome as being contemporary accounts in his own handwriting, illustrating some at least of the difficulties that a traveller in those days met with even when forming part of the suite of a British Ambassador. It is not often that a Fellow of this College enjoys the opportunity of making a benefaction which is so closely related to the personality of Harvey, but it is possible that in the much greater attention now paid to the State papers which were so long neglected, more may be found bearing upon the life of Harvey in his position at the Court of Charles I, where he undoubtedly enjoyed the favour and the personal friendship of the King.

The College must acknowledge a valuable contribution to its Harveian literature in the publication of a memoir to recall the seventeenth century friendship of Finch and Baines, written by Dr. Malloch, a captain in the Canadian Army Medical Corps. These two graduates of Cambridge in the seventeenth century went from Cambridge to France and thence to Padua, where the professor who lectured to them on anatomy was Antonio Molinetto. Finch was a brother of Lord Nottingham, whose niece was the wife of Harvey, for whom he entertained the greatest veneration. From Padua they went to Pisa, where Finch was appointed professor of anatomy, his course of lectures including both morbid and comparative anatomy. While there he examined a live torpedo (*T. narce*) sent him by the Grand Duke of Tuscany. He describes a "pricking sensation like that which comes when you suddenly put cold fingers to the fire," on touching the fish. Later when it died he dissected it, and his report is extant; it is to be issued shortly by the Historical MSS. Commission edited by Mrs. Lomas. The friends returned to England soon after the Restoration, Baines being appointed professor of music at Gresham College, and both were unanimously elected Fellows of this College, partly no doubt on the ground of their relationship by marriage and friendship with the illustrious Harvey. On June 20th they received their degrees as Doctors of Physic at Cambridge, and in the same month the King knighted Finch, the like honour being conferred on Baines eleven years later. Finch returned to Italy and again taught anatomy at Pisa. In 1665 he was appointed the King's resident at the Court of Tuscany, and stayed there with Baines until the death of the Grand Duke in 1670. Finch was next sent to the Porte as English Ambassador, and remained in Turkey till 1681, when Sir Thomas Baines died, and Finch brought the body home; he died shortly after, according to his epitaph—"Of sorrow at the loss of Sir Thomas Baines." They were both buried in the chapel at Christ's College, Cambridge, where in memory of their friendship Finch founded two fellowships and two scholarships.

BENEFACTORS OF THE COLLEGE.

Among the great benefactors of this College whose names cannot be passed over in silence are the two Hameys, father and son; Theodore Goulston, founder of the Goulston lectures; Sir Theodore Mayerne; Dr. Richard Caldwell, who with John Lord Lumley founded the Lumleian lectureship; Lady Sadler, founder of the Croonian lectureship in memory of her first husband, Dr. William Croone; Dr. William Wood Bradshaw, founder of the Bradshaw lecture; Mrs. FitzPatrick, who founded the FitzPatrick lecture on the history of medicine in memory of her husband, Dr. Thomas FitzPatrick; and Dr. Gavin Milroy, one of the pioneers in the subject of public health, who left £2,000 to endow a lectureship on State medicine and public health and subjects connected therewith. Further, as announced by Sir Thomas Barlow last year, there is the foundation of the Streatfeild Research Fund, endowed with £10,000 in 2½ per cent. annuities given by Mrs. Eliza Streatfeild for the purpose of the endowment of research, the fund being vested in the joint names of the two Royal Colleges, who act as its administrators.

On December 16th, 1916, the College received through our Fellow, Dr. Malins, of Birmingham, a gift of £500 from Mr. F. W. Mitchell, to be devoted to the object of the research, investigation, and treatment of tuberculosis.

On October 26th, 1916, under the will of Mrs. Fanny Hertz, of 40, Lansdowne Crescent, W., the College became possessed of a fine portrait of the late Dr. J. E. Bridges, which has been hung in the hall.

In addition valuable donations of books have been made to the library.

A CRITICISM OF HARVEY'S VIEW.

An instructive criticism of Harvey's opinions was published two years ago by the late Professor Curtis, of Columbia University.¹ In Harvey's lifetime he was often asked by his opponents to explain the purpose of the circulation, and he was never able to give a satisfactory reply. Why should the blood traverse the lungs, return to the heart, be distributed to the whole of the body, and then be brought back again to the heart in order to be transmitted again through the lungs? What did the blood gain by its passage through the lungs? Harvey taught that it was ventilated or cooled there, deriving heat from the heart, which was the centre of bodily heat. We may wonder why Harvey, following Aristotle, should regard air as cooling fire. Surely the effect of air on fire must have been known to him, and it certainly seems strange that Aristotle should have said that air keeps fire from consuming the fuel too fast. Was he not familiar with a smith's furnace, and with the manufacture of charcoal by limiting the access of air? Harvey knew that air was necessary to a candle and to fire, but did not know why. He accepted the doctrine of "spirits," an expression used by Aristotle, Erasistratus, and Galen as something derived from the air and introduced into the circulation with the blood (Erasistratus) or by itself (Aristotle).

Nearly a hundred years before Harvey's time Realdus Columbus (1559) taught that air was mixed with the blood in the lungs, where the transfer took place from the right to the left side of the heart. But this great fact that the blood in its passage through the lungs took up air was rejected by Harvey. He heads the passage: "Spirits not from Air," and he quotes an experiment to show that air does not pass into the blood, as he evidently expected to see the blood frothy if this were so.

Harvey maintained these views all his life and never understood the function of respiration, which is not surprising, as he was ignorant of the nature of combustion, of oxidation, of the corpuscular structure of the blood, and of the function of haemoglobin. He was unable to explain the difference in colour of arterial and venous blood, but he sought to minimize the importance of this by pointing out that both when drawn and allowed to stand become nearly the same colour and not of any great difference of either consistency or bulk. He knew that during life the arterial blood in the lungs was redder and that the lungs were florid. He could never explain why the fetus could live without air and yet after birth be readily suffocated by air being excluded. He always followed Aristotle in the doctrine that the heart was the primordial centre of life, and Curtis thought that Aristotle was familiar with the pulse from observing the incubating egg, where the heart makes its appearance early, and to which he consequently attributed all the chief functions of the body, including the affections, feelings, senses, and the like. Hence we still speak of the heart as the seat of emotion, of "a change of heart," "Unto Thee all hearts are opened," "Cleanse our hearts," etc. It never occurred to Harvey to inquire into the nature of the fumes given off during expiration. In Harvey's time the view was generally held that the blood is distributed to the tissues from the liver in spite of the existence of the pulmonary artery and the lungs in life being full of blood, but it is probable that medical men were blinded by the fact that after death the lungs are usually bloodless.

Harvey, moreover, was not constant in his allegiance to the heart as the centre and source of the motive power of the circulation, for as early as his lecture notes of 1616, and even in his latest utterances, he regards the blood as endowed with movement, and in his treatise on generation he asserted the primacy of the blood—"the leaping point"—the pulsating vesicle which he regarded as the first beginnings of the embryo. The blood, he says, is prior to its receptacle, the contained to its container. He maintained that the order is first the blood, second the pulsation, and third the vesicle. The blood is the "first to live and the last to die." Here, as Curtis says, Harvey was misled by his confidence in what we call naked-eye appearances and his want of better appliances. It would have been logical of Harvey had he attributed the pulse and the heart beat to the "leaping blood," but in his letter to Riolaus he says it was due to the boiling or bubbling of fermentation. He thought the swelling of the blood caused by its innate heat stimulated the auricle to contract, and he located this effect just between the openings of the

superior and inferior cavae, where we now place the bundle of His. The contraction of the auricles is, then, the cause of the contraction of the ventricles.

Curtis points out the difficulty Harvey was in owing to the backward state of physics. He was fourteen years younger than Galileo, who was unable to explain the common pump, and Harvey's discovery was made public thirteen years before Torricelli's momentous work on the movement of liquids. We must therefore recognize that many of the questions which by us are readily answered were in the days of Harvey quite insoluble, but we owe him our gratitude for the enormous advances he made with the means at his disposal.

CAMBRIDGE UNIVERSITY IN THE SIXTEENTH AND SEVENTEENTH CENTURIES.

It is of interest to inquire what were the opportunities afforded by Cambridge to the student who desired to study medicine, and how far it was possible for him to set out on the path of such learning as in those days would be regarded as at least preliminary to his studies.

The sixteenth century was not favourable to the English universities. They suffered greatly from the religious convulsions of the period. Not only were the abolition and disendowment of the religious houses causes of financial embarrassment, but sectarian considerations rather than those of character and learning were paramount in the choice of the heads of houses and professors. Religious differences could not but influence the willingness of parents to send their sons to the universities, and the resulting decline in numbers with the consequent loss of pupils' fees, impoverished the university exchequer, and such was the lowering of the standard of scholarship that the libraries were spoiled by the selling of so-called "useless" books.

The University in the Reign of Edward VI.

On the other hand, in the reign of Edward VI (1547-53) were founded the five Regius professorships in Divinity, Civil Law, Physic, Hebrew, and Greek, each being endowed with a stipend of £40, and so far as it goes we may take the professorship of physic as some evidence that the study of medicine was not altogether ignored. The first incumbent of the chair was Dr. John Blythe, of King's College, an M.D. of Ferrara, for at this time and perhaps for a century later Cambridge men had to go abroad for instruction in strictly professional subjects. John Caius left Cambridge in 1539 for Padua, where he lectured on Aristotle, in return studying "Medicine and Anatomy," which is some evidence that at Cambridge these subjects were less cultivated than Greek.

In the reign of Edward VI the university attracted many students, of whom too many were absorbed in theological controversy (Ascham); moreover, it was complained that the majority were mere boys, the sons of wealthy parents, who never became serious students, but by their presence interfered with the attendance of a poorer class who would give up their whole time to study. The prevailing spirit of the university was indolence. In 1558 Caius had spoken of the disappearance of "the poor, modest, diligent student who rose early, lived on scanty fare, and respectfully capped his seniors." Gone, too, were the dignified elders of former times, of sedate countenance and stately mien, punctilious in wearing academic dress, and punctual in attendance at the disputations in the schools. The undergraduates had discarded long gowns and caps, their garments were gaudy, they gambled and drank, and discipline was so much relaxed that those whose misconduct led to their expulsion from one college had no difficulty in obtaining admission to another.

The offices of the university became sinecures; for example, there seemed to be no objection to Ascham, the public orator of the university, living abroad, while Ridley retained his Mastership of Pembroke when Bishop, at first of Rochester, and afterwards of London. The doctor's degree was taken in scarcely any faculty, and as there were no examinations, and disputations had become neglected, such as were given could scarcely be regarded as evidence of learning or ability. If Cambridge had not sunk as low as certain German universities which Bucer condemns for giving degrees for money, yet there was much indolence among the resident Fellows, who lived like drone bees on the fat of the colleges.

In the new code of Edward VI, introduced in 1549, the textbooks of the professor of medicine were to be Hippocrates and Galen.

Foundation of Caius College.

In the reign of Mary (1553-1558) there was little in the state of the university to give satisfaction to any lover of learning, and the only fact which at this time can be regarded as conferring a real and permanent benefit upon the university was the foundation of the college that bears the name of Dr. Caius, who was private physician to the Queen, was nine times elected president of this College, and bore a professional reputation inferior to none of his contemporaries in this country.

Dr. Caius was a staunch Catholic, but he had travelled and seen much of men and things, so that he possessed an open and tolerant mind. He had studied anatomy under Vésalius at Padua, had visited other Italian universities, and had formed the acquaintance of the chief scholars of France and Germany. Being unmarried and wealthy and somewhat of a recluse, he retired to Cambridge, where he became a Fellow of Gonville Hall. In 1557 he obtained a licence from Philip and Mary to refound the college as co-founder with Edmund Gonville and Bishop Bateman, endowing it with the manor of Croxley and Snellsall and several other properties. When the college was reconstructed in 1572 it was to consist of a Master, thirteen Fellows, and twenty-one scholars, the Master being a Bachelor or Doctor of one of the three faculties.

It is noteworthy as bearing upon the question of the state of medical education in Cambridge that the holders of medical Fellowships and those only were permitted to repair for the prosecution of their studies to the Continent, for, says the statute: "Theology and Civil Law may be studied just as well here as there," and it is fair to infer that medical science could not. These travelling Fellows were required to go to a "good school," preference being given to "Padua, Bologna, Monte Pulciano, and Paris."

Neglect of Learning.

On the accession of Elizabeth the fresh instructions to the Commission for the Reorganization and Reformation of the Universities followed closely those (1549) in the reign of Edward VI, but with the notable omission of the clause for the foundation of a Chair of Medicine and one of Civil Law. It is not necessary to recount the troubles and differences which occurred at Caius College owing to the personal unpopularity of Caius, who was disliked by the majority of the Fellows, and who retaliated by showing his contempt for their indifference to learning and their lax conduct, the manners of the students of this period leaving much to be desired.

We have seen that a generation before the study of Greek was pursued with much success at Cambridge, but it had become so neglected that eminent scions of the university, like Whitgift and Walter Haddon, were ignorant of it, and Giordano Bruno, who visited England and Oxford in 1582, complains that the Oxford undergraduate "drank too much beer," while his seniors were "pedantic and stupid"; but perhaps it is unfair to assume that these faults extended to the sister university. Companionable behaviour, the capacity to sit long at table after dinner and supper, were more helpful to a degree than reputation acquired in the schools, or any display of ability there evoked.

The attendance upon the lectures of the university professors fell off, no doubt in part in consequence of the development of the college system, undergraduates preferring to get such instruction as they desired in the classrooms of their college tutors; but if to the college system may be not unfairly attributed the decay of professorial teaching at Oxford and Cambridge, it may, on the other hand, be credited with having preserved these institutions from such stains on morals and manners as still mar the reputation of the chief German universities.

When Caius was in Italy he was a zealous disciple of Giovanni di Monte (1508-1552), who was the first modern to teach medicine at the bedside, which he did at the hospital of St. Francis. Unfortunately, Caius did nothing to transplant this method to his native country, and it was at least two centuries before clinical teaching was practised, even in a rudimentary fashion, in British hospitals.

Francis Glisson, Regius Professor of Physic at Cambridge.

The career of Francis Glisson, a former president of this College, illustrates to some extent the state of medical education at Cambridge, where he was Regius Professor of Physic from 1636 until his death in 1677. He entered Caius College in 1617, graduated B.A. in 1621, M.A. in 1624, and M.D. in 1634. He lectured at first on normal, morbid, and comparative anatomy, and in 1640 gave the Goulstonian lectures of this College. Up to this date—that is, four years after being appointed Regius professor—he lived in Cambridge, but in 1640 he took a house in Colchester, where he "soon obtained much practice" and where he continued to live until after the siege of that city, when he became much impoverished and moved to London. Here he took a house in New Street, in the parish of St. Bride's, and resided there up to his death in 1677. He was president of this College in 1667-8-9. In 1675 the university obliged him to appoint Dr. Brady as his deputy at Cambridge, but the fact that he was non-resident for over forty years of his incumbency of the professorship may not unfairly be taken to indicate the little interest felt in medical education at Cambridge.

As is well known, Glisson was an energetic student of his profession and published many valuable monographs, especially that on rickets and on the anatomy of the liver; by the latter his name has been preserved and is familiar to all medical students from "Glisson's capsule," applied to its external fibrous sheath. His portrait, painted at the age of 75, is in the possession of this College.

WEBSTER'S "EXAMINATION OF ACADEMIES."

One looks to Webster's book, the *Examination of Academies*,² for a criticism of the work of the university at or about Harvey's time, but it is disappointing. Webster was evidently a fanatical puritan who found fault with the universities because they professed to train men for the ministry, whereby they are said to fill them with vain knowledge. He expressed doubt whether the knowledge of Greek and Hebrew could in any way aid the right understanding of the Gospel, and thought that only the Spirit of Christ could convey this information. He praised such mystics as Jacob Boehme; he believed in the existence of a heavenly dialect, which was what John heard and God used in speaking to Adam; that animals probably communicated with one another by it.

He objected to the Aristotelian philosophy and preferred to it the teaching of the Rosicrucians, and that of our "learned countryman" Dr. Fludde. He condemned the medical profession for adhering to what he calls "ignorant, wicked and blind Pagans," for neglecting magic and cabalistic science and that "great book" the *Macrocosm* of Paracelsus. He quoted with approval the saying, "For the Lord hath created the physician, not the schools," and he condemned the neglect of that "laudable, excellent, and profitable science" of physiognomy, the neglect of the science of celestial signatures, and the study of natural dreams.

Coming to more reasonable criticism, he found fault with the uniformity of method followed in teaching by the slothful performance of the Acts, there being only four in the year, to these being conducted in Latin, which tended to obscurity and to the neglect of our mother tongue. He says that the "Romans used Latin and prohibited Greek" (?), while the Greeks wrote in their native language. He thinks too much importance is assigned to the opinions of the ancients, and that Lord Bacon has indicated a better method than that of the scholastic philosophy, that physics and chemistry should be taught by laboratories as well as libraries.

While there is much in this with which a modern would agree, the criticism on the whole is peevish and unreasonable, and suggests nothing that has any direct bearing upon the improvement of medical education.

Webster seems to have had small right to pose as the critic of the universities, for it is at least doubtful whether he was at any time a member of either of them. He speaks of himself as educated at Cambridge, but no trace of him can be found in the university registers according to the *Dictionary of National Biography*. He was ordained in 1632, was curate of Kildwick in Craven in 1634, and master of the grammar school at Clitheroe in 1643. In the civil war he seems to have taken the Parliamentary side, and

was surgeon and chaplain to a regiment in the Parliamentary army, becoming a Nonconformist and being "intruded" as vicar of Milton in Yorkshire and also at All Hallows in Lombard Street. He acquired some fame as a preacher, but later on he fell into discredit, for his books were seized in 1657 and he gave up the ministry. Later in life he studied metallurgy and practised medicine. He died at Clitheroe in 1682.

"THE VINDICATION OF ACADEMIES."

Webster's book was answered by John Wilkins and Seth Ward in the *Vindication of Academies*.³ In this defence of the universities the authors complained that Webster, and even Hobbes, were ignorant of the present state of the universities and of the grounds of those arts and sciences which they pretended to improve. Surprise is expressed that the universities should be condemned as rigidly bound to Aristotle and accused of ignoring the modern advances in knowledge which have modified his teaching. On the contrary, all modern ideas were freely discussed—the anatomical and magnetical philosophy and the Copernican astronomy. It is said that both in the public lectures and private classes of the universities those things which they are accused of neglecting are taught and are well learnt. Particular exception is taken to the criticism which maintained that university teaching is not only useless but harmful to candidates for the ministry, for such academic knowledge "added to the gifts of grace must be only helpful and not injurious."

On the other hand, Webster's praise of the Rosicrucians, of Jacob Boehme and of judicial astrology show him to be a credulous fanatic. Further, Webster is accused of plagiarism, of stealing whole sheets of Gassendi's book, and of being wholly dependent upon those translations to which he had access for his knowledge of foreign writers. The accusation that the study of chemistry was neglected was denied, and with some reason it was pointed out that, the practice of medicine being an art which is based on observation and experience, new discoveries in anatomy do not always involve alterations in practice equal to that in theory, but have often confirmed and established practical rules.

Webster's objection to the use of the term "divines" as blasphemous is treated as ridiculous, but it is conceded that "theologian" is better, and the complaint of the use of the Scriptures in scholastic exercises is inconsistent with the desire expressed that Christian principles should be introduced into the schools of physical learning. Moderns may agree with the contention that students should be taught to use their hands in laboratory work, but there is force in the objection that the wishes of parents must be respected, and that in the sixteenth and seventeenth centuries it was not thought desirable to teach young gentlemen natural philosophy, chemistry, agriculture, or mechanics, but they should be trained to be rational and graceful speakers and fitted to move in polite society.

Webster's critic, John Wilkins, the Bishop of Chester, was one of the most learned and estimable men of that age. He adhered to the Parliamentary side in the civil war, and was Warden of Wadham College in 1648. He had the reputation of being a wise, beneficent, and tolerant head of the college, and he may be justly called the founder of the Royal Society. The weekly meetings of the London philosophers, when held in Oxford, took place in the Warden's lodgings. Although siding with the Commonwealth, he preserved the university from the ignorant commanders and soldiers who, unrestrained, would have demolished all places and persons that pretended to learning. He was afterwards appointed Master of Trinity College, Cambridge, where he was greatly honoured and loved, but at the Restoration he was deprived of this post, as it had been long promised to Henry Ferne. He was made Prebend of York and Dean of Ripon. He procured the incorporation of the Royal Society in 1662, becoming its first secretary. He lost his library and valuable MSS. in the great fire of London. He was made Bishop of Chester in 1668 and died in 1672. He is generally supposed to have written the preface to Seth Ward's *Vindiciae Academicarum*.

"AN ARK FOR SUBMARINE NAVIGATION."

Bishop Wilkins was interested in many things, and Professor Joly, of Trinity College, Dublin, has recently

drawn attention⁴ to his little volume, entitled *Mathematical Magic*, in which one chapter is headed "Concerning the possibility of framing an ark for submarine navigation, the difficulties and conveniences of such a contrivance."

This invention seems to have been produced by a Dutchman named Cornelius Drebbel, who was born in Alkmaar in Holland in 1572, and came to England in 1604, where he secured the favour of James I, and was given lodgings in Eltham Palace. He left England at the invitation of the Emperor of Germany, but was involved in the misfortunes of the Thirty Years' War, when he was thrown into prison. Through the intermediation of James I his release was procured, and he returned to England, where he remained until his death in 1634. He appears to have enjoyed the esteem of his contemporaries, especially of the Hon. Robert Boyle, who refers to him as a "deservedly famous mechanician and chymist."

The great interest to us of Drebbel's work is that he appears to have been much ahead of his contemporaries in appreciating the function of respiration. It is said that he built a ship in which a man could navigate under water from Westminster to Greenwich. In the boat "a person could see under the surface of the water, and without candlelight, as much as he needed to read in the Bible or any other book." This remarkable ship was in 1645 yet to be seen lying in the Thames or London river (C. van der Oude). Boyle accepted the testimony of what he called "a few credible persons" that Drebbel could enable men to continue under water without suffocation or even inconvenience, for, as he says, it is "not the whole body of the air, but a certain quintessence or spirituous part of it that makes it fit for respiration, which, being spent, the remaining grosser body of the air is unable to cherish the vital frame." So that, besides the mechanical contrivance of his vessel, he had—

a chemical liquor which he accounted the chief secret of his submarine invention, for when from time to time he perceived that the finer and purer part of the air was consumed or overclogged by the respirations and steams of those who went in his ship he would, by unstopping the vessel full of his liquor, speedily restore to the troubled air such a proportion of vital parts as would make it again for a good while fit for respiration, whether by dissipating or precipitating the grosser exhalations, or by some other intelligible way.

According to Boyle, Drebbel kept the nature of the liquor a close secret, and justified his own inquiry because the man and his invention were so extraordinary, all the more so as it was 150 years before the discovery of oxygen by Priestley and Lavoisier, and of the part played by it in respiration. It was not until 1681 that John Mayow published his conclusion that respiration and combustion are analogous phenomena. Drebbel must have discovered some means for removing from respired air its poisonous properties, as by drawing it through lime water to absorb the carbon dioxide, by which it would be possible to prolong the voyage, and the ventilation of the boat may have been assisted by pipes going to the surface, the air being drawn in by fans or pumps. It is certain that the bishop realized the difficulty presented by respiration in the problem of submarine navigation, and that he fully appreciated the work of Drebbel in overcoming this part of the problem.

While Harvey failed to grasp the function of respiration and set aside the suggestions that had been made by others under the crude form of the action of "spirits" on the blood, it is quite plain that these contemporaries of Harvey allowed their minds to run farther than his on the chemical side of these questions, and were closer than he to understanding the nature of the physiological questions involved. His failure in this respect was probably due to his ignorance of chemistry, which Aubrey says he was wont to undervalue, and speak against those who practised its doctrines.

BISHOP WARD.—OTHER CRITICISMS OF THE UNIVERSITIES.

Seth Ward, successively Bishop of Exeter and Salisbury, was a distinguished mathematician, mathematical lecturer at the University of Oxford, and afterwards Savilian professor of astronomy in 1649. He entered as a Fellow Commoner at Wadham when John Wilkins was warden, and when the fame of the college attracted many men of eminence. These gatherings probably constituted the nucleus of the Royal Society. After the Restoration he was made successively Prebend, Dean and Bishop of Exeter. He was subsequently translated to Salisbury,

and became Chancellor of the Order of the Garter. His controversies with Hobbes and Webster caused him some trouble. He is the reputed author of the *Vindiciae Academicarum*, in which he replied to the criticisms of the universities which Webster and Hobbes had published in the *Academicarum Examen*.

Hobbes, the author of *The Leviathan* (1588-1679), was a somewhat bitter critic of the universities in his day, particularly on the ground of their adherence to the Aristotelian philosophy and physics. He says: "The philosophy schools through all the universities of Christendom grounded upon certain texts of Aristotle," and these institutions were merely useful as a handmaid to the Roman religion; they rendered no knowledge of the subordinate and secondary causes of natural events or "physiques," but merely empty words. Thus they said that bodies sank because they are heavy or because they desire to be at rest. He also criticized their teaching of the civil law, but although there was doubtless much with which to find fault, he says nothing about the art of medicine or the way in which it was taught.

Dr. C. A. Mercier⁵ is of opinion that Paracelsus and van Helmont had much to do with preparing the ground for the reception of Harvey's new doctrine. He thinks that by their bold challenge to the Aristotelian doctrines they rendered it possible for Harvey to state his novel opinions without being regarded as uttering blasphemy, but he is almost as severe a critic of Oxford and Cambridge as was Hobbes two hundred years earlier. He quotes a statement of Averroes that Aristotle is "the perfection of truth, that his understanding attained the utmost limit of human ability," and that "it may truly be said of him that he was created and given to the world by Divine Providence, in order that we might see in him how much it is possible for a man to know." This tribute may seem exaggerated to the non-academic mind, but "it would not be considered at all exaggerated in the University of Oxford even to-day." He gives no facts whatever in support of this charge. However, there may be something in what he says, for had not Paracelsus and van Helmont shown that Aristotle could be contradicted without calling down fire from heaven, Vesalius might not have had the courage to publish his discovery of the non-porosity of the cardiac septum.

TEACHING OF MEDICINE AT CAMBRIDGE IN HARVEY'S TIME.

It is not easy to trace any evidence of the teaching of medicine at Cambridge in the time of Harvey. In vol. iii of Venn's *Biographical History of Gonville and Caius College* (p. 253) we find the following:

It will be observed that no reference has been made in the above sketch to any such officer as a medical lecturer. The fact is that though the College had for centuries enjoyed a medical reputation, no trace of any systematic instruction in the subject can be discovered until very recent times. Indeed, the earliest lecturer recorded by tradition is the late Sir George Paget, who is known to have held the office from about 1848 until he ceased to be a Fellow in 1852. Since that date such lecturers have been regularly appointed. The increased scope of the work, owing to the great addition to the number of students, was recognized in 1831, when the title was changed from Medical Lecturer to Lecturer in Natural Sciences and Director of Medical Studies. That some instruction, however, in the shape of what we should now call anatomical demonstration was occasionally given in the College can be proved by one or two interesting facts. In the first place, in the register of the parish of St. Michael—the College lies in the parish—there is an entry of burial under the date April 6th, 1601, of "Mr. Hutton, the anatomyr of Key's College."

Venn took it for granted at first that this gentleman's connexion with anatomy was of the active kind, and that we had here evidence of a very early demonstrator in the college. But it now seems certain that he played the part of the subject, for it is recorded that Dr. Grimston, "one of our Fellows," made a dissection in the college just four days before. That similar instruction was carried on twenty-five years later seems plain from the statement of Dr. Joseph Mede, that he attended anatomy lectures in "our College." In the register of Great St. Mary's, the parish in which the schools, now absorbed into the public library, were situated, several such entries are found. The earliest of these is in 1566, when it is recorded that "John Figgan mad anatomy at the scholes and buried here, the 12th March." This was during the residence of Dr. Caius, seven years before his death.

Professor A. Macalister informed Dr. Venn that this is the earliest contemporary record known to him of the actual performance of human anatomy in England. Again, in 1628, there is an entry that "John Smith, a prisoner at the castle that was anatomised, was buried." In a note, Dr. Venn says that it perhaps accounts for the prefix "Mr." to Hutton's name, a title at that time confined by university usage to Masters of Arts and Fellow Commoners, in the direction of Dr. Caius that the burial of such anatomized bodies should be "orderly and reverential."

In the same volume (p. 47) we find the following:

On the same day (Patent Roll, August 1st, 1564) is added the Royal License, for the purchase of the houses from Trinity. A new and very important concession was included in this license. It was a formal grant from the Queen (Elizabeth) of bodies for dissection to the effect that "they and their successors shall have for ever, at their free discretion and will, without the contradiction of anyone, two human bodies for anatomy, condemned by law for theft or homicide and dying in the town castle or county of Cambridge. And that they may freely dissect them at their will, with the reverence due to the human body, for the increase of medical knowledge; and this without any payment." Dr. Caius gave careful directions in his statutes concerning these dissections, desiring that "every year during the winter there shall bespent by the students of our College, on anatomy and on the worthy burial of the dissected bodies at St. Michael's 26/8. The president and everyone residing in College to attend the burial of the remains with as much respect and ceremony as if it were the body of some more dignified person; and this on account of the advantage they have thus received. And the Master shall see that the students of medicine do not treat the body with any lack of respect or humanity." It is to be feared that very inadequate use was made of this privilege.

In his *Advancement of Learning* Bacon mentions that the study of medicine was based upon the use of dead bodies for dissection.

It is further evidence that dissection was practised in Cambridge in the seventeenth century that Sir Charles Scarborough (1616-94), who was a Fellow of Caius College, published a manual on dissection (*Syllabus Musculorum*), but there appears to have been no dissecting-room, public or private, until after the passing of the Anatomy Act, 1832. Science and its votaries, indeed, found no permanent home at Cambridge in the time of Harvey. Gilbert of Colchester, who, as Bacon says, had made a philosophy out of a loadstone, had been long removed to London, where as royal physician he enjoyed favour and good fame, and died in 1603. Physiology as a subject did not exist, and the knowledge of the functions of the organs, apart from their structure, was elementary and very often fundamentally erroneous. In spite of Bacon's commendation, morbid anatomy was entirely neglected, perhaps because, as he pointed out, this study was much more difficult than that of normal anatomy, the latter being presumably uniform in all healthy subjects, while the former presented endless variety. Its difficulty undoubtedly hindered any advancement, for it is not until the second half of the nineteenth century, when fairly complete *post-mortem* examinations were made on the bodies of all persons dying in hospitals, that the subject became familiar, and morbid appearances grew to be generally known to hospital physicians, and were expected to a less extent from students.

IMPULSE GIVEN BY HARVEY TO BRITISH PHYSIOLOGY.

There can be no doubt that in the sixteenth and seventeenth centuries those Cambridge men who desired to study scientific medicine could not do so at home, and resorted to the Italian universities to study under such great masters as Vesalius, Fallopius, and Eustachius, whose success was rather in descriptive anatomy than in physiology. Harvey's work was of great importance because, although he added no new facts, he placed a new interpretation on what had been more or less common knowledge for 2,000 years, and stimulated an advance in medicine which has continued up to the present time. This advance was mainly due to his employment of vivisection, by which method he laid the foundations of physiology and thereby of the progress of medicine. Physiology has been rightly called the Institutes of Medicine, which must march hand in hand with pathology and be its guide. Its progress depends upon the advance of many sciences, especially of chemistry, in that department which we call organic or physiological. This was a new science forty

years ago, and has been built up within the lives of many of us. It has opened out a wide prospect and gives promise of revolutionizing medical study.

The impulse that the work of Harvey gave to British physiology is shown by naming those who followed him in the next one hundred years.

Thomas Wharton (1614-73), physician to St. Thomas's Hospital, studied at Cambridge and Oxford, discoverer of the sub-maxillary gland, and author of *Adenographia* (1656).

George Joyliffe (1627-58), M.D.Cantab., F.R.C.P., discoverer of the lymph ducts.

Francis Glisson (1597-1677), M.D.Cantab., Fellow and President of this College, author of famous monographs on rickets and the anatomy of the liver.

Thomas Willis (1621-95), M.D.Oxon., F.R.S., F.R.C.P., recognized saccharine diabetes and described the anatomy of the brain (the circle of Willis).

Richard Lower (1631-91), M.D.Oxon., F.R.S., F.R.C.P., performed transfusion.

Edward Tyson (1650-1708) and Samuel Collins (1618-1710) were comparative anatomists.

Clopton Havers described the Haversian canals.

William Cowper or Cooper (1666-1755) described "Cowper's" glands.

ADVANCE OF MEDICINE IN SECOND HALF OF NINETEENTH CENTURY.

But it cannot be claimed that at Cambridge or elsewhere there was any real progress in medical education. Here and there men of genius made discoveries, but they were not aided by any organization either inside or outside the university or medical school. Men like the Hunters did their work at their own expense, and for many years to come even the teaching of anatomy owed most to what was done in private schools.

The best that can be said for British medical education is that it was based upon some genuine knowledge of practical anatomy and bedside acquaintance with diseases. But it was not until the second half of the nineteenth century that a true spirit of reform entered into the schools. In no place was this more manifest than at Cambridge. Although it is still necessary, and probably always will be, for the Cambridge student to seek clinical experience elsewhere, he may find at Cambridge all that he desires in laboratory opportunities, and, within due limitations, for clinical research.

If Cambridge has proved itself worthy of its association with the illustrious Harvey, this is equally true of the great hospital of St. Bartholomew's, with which perhaps his professional connexion is more generally recognized. Harvey left Cambridge apparently as soon as he had completed his arts curriculum, taking no part of his medical education there, and, although he returned there for his degree, he owes to Italy the instruction that opened the way for his great discoveries.

HARVEY AS PHYSICIAN TO ST. BARTHOLOMEW'S HOSPITAL.

Of his labours as a physician at St. Bartholomew's we know little, and what records remain do not impress us very favourably with the work done in those days by those who held such appointments as that of Harvey. When he was originally appointed he was only obliged to attend once a week, and he was never formally required to visit the wards. The number of patients seen in the hospital must have been very small, for as late as 1749 the numbers are given as—in-patients, male 16, female 15; out-patients, male 50, female 50, each week; and there is no reason to believe that a hundred years earlier they were more numerous.

Apparently the patients were obliged to come to the doctor and not the doctor to the patients, as one of the rules says:

It is the duty of the matrons and sisters to complain to the doctor if any poor lurk in the house and do not come to him at his sittings or take the medicine he prescribes, but cast it away and abuse it.

It is difficult for us to understand the position of such a man as Harvey holding a post which, to us, seems scarcely likely to afford him any return in the way of useful experience. The salary was inconsiderable, some £20 a year with an allowance for fuel and "livery," but it is possible that the appointment indirectly led to a certain amount of practice, for undoubtedly he made money by his profession, although Willis suggests that his brother Eliab employed the "small capital" accumulated

by him during his active years of practice and before the breaking out of the civil war to such good account that he actually died a rich man. The period during which he may have earned a considerable professional income must have been from about 1607 to 1630.

HARVEY'S LATER YEARS: HIS GIFT TO THE COLLEGE.

After the latter date, when he went abroad with the Duke of Lenox, it is doubtful whether he ever had much opportunity for practice. In 1633 he went with Charles to Scotland, whence he followed him to Oxford (1642), and in 1646, on returning to London, he resigned all his appointments, and as his wife was dead he took up his residence with his brothers Eliab and Daniel. It was then that Harvey felt himself fully justified in making over his paternal estate, then worth £56 per annum, to this College as a free gift during his life and as a provision for the objects of which this annual oration forms part.

He died at the advanced age of 80 on June 3rd, 1657, and I cannot do better than repeat the words of Willis:

So lived, so died one of the great men whom God in virtue of His eternal laws bids to appear on earth from time to time, to enlighten and to ennoble mankind.

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THE CURE OF INGUINAL HERNIA.

BY

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THE high percentage of men who suffer from inguinal hernia has made the problem of their treatment a serious one during the present war. Trusses appear to be most unsatisfactory when used by soldiers. In my personal experience I have rarely seen a truss controlling a hernia. The truss appears to be worn for choice with the hernia unreduced. It may be stated that we regard an inguinal hernia as a congenital deformity due to the presence of an abnormal process of peritoneum. This defect is combined with a lesser acquired defect—namely, an abnormally long process of omentum, or more rarely mesentery. The treatment indicated appears to be abolition of the abnormal process of peritoneum and removal of the redundant omentum. The choice of an operation which will cure the hernia and render a man fit for service in the shortest possible time becomes desirable. Having had charge of a special department for the cure of hernia, dealing with cases at the rate of about 500 a year, the need for a simple operation giving adequate relief and followed by a rapid convalescence has been impressed upon me.

It occurred to me that much of the trouble following the operation for radical cure of hernia, and many of the recurrences, were due to the well-intentioned but ill-advised efforts of the surgeon to effect repair. Bearing in mind that the success of an operation lies in the simplicity thereof, I evolved the procedure described below. The majority of herniæ occurring in men of military age are amenable to cure by a small operation. The operation described below has been performed as a routine method in all cases. The advantages of this operation as a treatment in the hernia of children will be apparent. The principles borne in mind are to remove the sac at the highest possible level with the minimum disturbance of tissue. The cutting and interference with tissues has been reduced to such a degree that very rapid convalescence follows, and the reaction associated with hernia operation is obviated. The advantages of an operation which reduces the cutting of tissues down to an inch incision in the skin and superficial fascia, and a small incision in the spermatic fascia, will be apparent. No dissection of tissues is undertaken; just as Matas in his operation for aneurysm avoided injury and disturbance of surrounding structures by attacking an aneurysm from within the sac, we avoid dissecting, cutting, or injuring the delicate or important structures which surround a hernial sac by attacking the hernia from within the sac.