THE HARVEIAN ORATION ON HARVEY AND THE RISE OF PHYSIOLOGY IN ENGLAND.

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MR. PRESIDENT,—In obeying your request that I should undertake the delivery of the Harveian Oration, I am painfully sensible of the gravity of the task you have imposed on me. For 239 years, with but few intermissions, the College has, in obedience to Harvey's own wishes, assembled to commemorate its benefactors, and if we can no longer precisely follow Harvey's directions, and "commemorate all the benefactors of the said College by name, and what in particular they have done for the benefit of the College," the remainder of his words are still applicable, for part of the Harveian Orator's duty is "to exhort others to imitate those benefactors, and to contribute their endeavours for the advancement of the Society according to the example of those benefactors." This annual office has been filled during the years that have elapsed since Harvey's institution of it by some of the most illustrious Fellows on our roll—by Garth (1697), Arbutnot (1727), and Akenside (1759); by Mead (1723), Heberden (1750), and Warren (1768), not to mention others of more recent date, men whose names will ever remain fresh in the history of the literature and medicine of our country. I have no claim to be associated with these great names, nor with the many learned and eloquent men who have addressed you in recent years, and I should have shrunk from attempting the task your favour has imposed on me had I not felt that in asking me to undertake it you were mindful of the position which it is my lot to hold in connection with the great hospital to which the immortal Harvey was thirty-four years physician, in which he exercised an influence over its governing body that remains to this day, and where his memory is yet held in reverential remembrance.

I wish it were possible for me to bring forward from the records of St. Bartholomew's Hospital any new facts illustrating either Harvey's life or works; but many years ago Sir James Paget, in his *Records of Harvey*, exhausted all that is known of him from the journals of our hospital. In the fragmentary notices of him which we there meet with he is seen as the trusted adviser to the governing body, and as the maintainer of the dignity of his order rather than as the physician. In his *Prælectiones Anatomicae Universales* we obtain glimpses of his work in the wards of the hospital, and had his *Medical Observations* come down to us there can be little doubt that in them much would have been found which emanated from the wards of the hospital and the dissections of patients who died whilst under treatment there.

Foremost among the benefactors to our College present to the mind of Harvey when he established this annual Oration must have been Dr. Richard Caldwell and Lord Lumley, who together founded and endowed in 1581 the Surgery Lecture, which, under the name of the Lumleian Lecture, Harvey held from 1615 until 1656, and in the course of which he demonstrated to the College his immortal discovery.

I have failed to find out the nature of the connection, if any, between Caldwell and Lord Lumley. The latter succeeded his father, Lord Arundel, as High Steward of the University of Oxford in the year 1558, the year before Caldwell appears to have completely severed his connection with the university. Of Lord Lumley Camden says "that he was a person of entire virtue, integrity, and innocence, and in his old age a complete pattern of true nobility."

By the kindness of our Registrar, my attention has been drawn to the very interesting notice of Caldwell in Hollinshed's *Chronicles*, where an account is given of the first lecture delivered under the terms of this bequest by Dr. Richard Forster, "which was celebrated by a goodlie assemblie of Doctors, Collegiate and Licentiate, as also

some Masters of Surgerie, with other students, some whereof had been Academical. Dr. Caldwell, his white head adding double reverence to his person, notwithstanding his age and impotencie, made an Oration in Latin to the auditors, the same by occasion of his manifest debilities unfinished at the direction speciallie of the President; who after a few words shortlie and sweetlie uttered, gave occasion and opportunity to Dr. Forster, then and yet the appointed Lecturer, to deliver his matter."

It is impossible for me to mention the long list of those who, by their munificence or by the honour which their lives and labours have bestowed on the College, have to be commemorated as benefactors since the days of Harvey.

Within the present year we have had a notable example, not only of the generosity, but, what is still more to be desired, of the brotherly feeling which Harvey desired should exist among us. No one among our Fellows has, during the last fifty years, been a brighter ornament to this College or a greater benefactor to his country or the world at large than Edmund Alexander Parkes. It must be a source of gratification to us all that Dr. Hermann Weber, when generously endowing the College with the magnificent sum of £3,000 for the furtherance of original research on the "Prevention and Cure of Tuberculosis" should have associated Dr. Parkes's honoured name with his own. The triennial prize, which the College has decided to found with this bequest, will tend, let us hope, not only to keep fresh in the memories of many generations of Fellows the genial and liberal donor and his valued friend, but may accomplish the object of the giver and lead to future discoveries by which the ravages of tuberculous disease may be controlled and abated, if not altogether prevented.

It may interest the College to know that the subject selected for the first competition is "The Means, Prophylactic or Curative, deemed by the Author to have Value in the Control of Tuberculosis, especial regard being had to their Application to Human Tuberculosis."

I should like to pause here to set before you at somewhat greater length the useful, pure, and unselfish life of Dr. Parkes and to recall to your memory the excellence of his scientific work in connection with the ingestion and elimination of nitrogen in the system, as well as to draw your attention to the benefits which our naval and military services and the general public have received from his labours in the field of hygiene; but I must pass on now and content myself with thus briefly alluding to the munificent gift of Dr. Hermann Weber and the memory of Edmund Alexander Parkes.¹

Harvey's fame is immortal, and he is to be placed in the same category with Hippocrates, Aristotle, Archimedes, and Newton, who by their genius may be looked upon as not so much the exponents as the founders of their respective branches of knowledge. Aristotle was the first, and in a sense the greatest, of biologists. Harvey was the founder of physiology. Harvey himself was an Aristotelian, educated in all the learning of the schoolmen; and in attempting to estimate his genius and originality it is almost impossible for us in these days of independent thought to realise the crushing influence which authority then exercised on the minds of men; in the words of Dryden, they—

betrayed
Their freeborn reason to the Stagyrite
And made his torch their universal light.*

As in medicine, although there must have been practitioners before the days of Hippocrates, he is to be taken as the starting point, so in biology, notwithstanding the labours of Parmenides, Empedocles, and others of still earlier date whose writings are known to us but by fragments, Aristotle stands alone as the originator of biological science. He, together with his immediate successors, took, as has been observed by Professor Huxley,² "the broadest view of the subject, and man assumed his place as neither more nor less scientifically interesting than his fellows."

Harvey's admiration of Aristotle is profound; he calls him the supreme dictator in philosophy, and in the introduction to the *De Generatione Animalium* says: "Foremost among the ancients I follow Aristotle, he is my leader." Dr. W. Ogle,

¹ Dr. Parkes died of acute general tuberculosis, March 15th, 1876.

² *Epistle the Third.* To Dr. Carleton.

³ Appendix to Richard Owen's *Life*.

in the preface to his excellent translation of Aristotle's work *On the Parts of Animals* says most justly: "The biological treatises of Aristotle are more often quoted than read; and it may be added much more often misquoted than correctly quoted." The prominent feature of Aristotle's biological writings, as indeed of his philosophy generally, is classification, in which respect his writings contrast strongly with the poetical and imaginative treatises of his forerunner Plato.

From the time of Aristotle to that of Harvey no advance was made in physiological knowledge; in truth it had receded, overwhelmed by the glosses and erroneous interpretations so often put on Aristotle's writings.

In attempting to estimate Harvey's merits as a discoverer it is necessary for us as far as possible to realise the state of knowledge at the commencement of the seventeenth century, and the nature of his surroundings. Subsequently to the time of Aristotle, who was very imperfectly acquainted, as he himself admits, with human anatomy, the Alexandrian school, where the two rivals, Erasistratus and Hierophilus, practised human dissection, and had considerably advanced human anatomy; their observations and discoveries were made use of by Galen, who added to anatomical knowledge by his accurate dissections of the lower animals, including apes. The anatomical facts thus observed were of comparatively little use through their being treated as disjointed observations; thus there can be no doubt that Erasistratus observed the lacteals in the mesentery of sucking kids hundreds of years before Aselli rediscovered them in dogs; and Aselli's observations would have proved as barren as Erasistratus's had Pecquet not traced the lacteals to the receptaculum chyli and thoracic duct, which vessel had many years before been noticed by Eustachius in the thorax of the horse, and described by him as the vena alba thoracis.

With the revival of learning human anatomy began to be studied on account of its obvious bearing on medicine and surgery, and by Harvey's time, owing to the labours of Mundinus, Sylvius, Eustachius, Vesalius, Fallopius, and others, the details of the bodily structure of man observable by the unassisted eye were for the most part discovered.

In physiology, on the other hand, there had been no advance whatever, unless the very imperfect knowledge of the lesser circulation be considered as having a claim to be so regarded. It in no way detracts from Harvey's merit or originality that Servetus, Columbus, and Cesalpinus all had an idea of the lesser circulation, without however comprehending it or seeing to what it led, nor that Fabricius had demonstrated beyond doubt the existence of the valves in the veins. Dugald Stewart has remarked, "in the sciences, the observations and conjectures of obscure individuals on the subjects which are level to their capacities, and which fall under their own immediate notice accumulate for a course of years, till at last some philosopher arises who combines these scattered materials, and exhibits in his system not merely the force of a single man, but the intellectual power of the age in which he lives."⁴

Regard must also be paid to the spirit of the times, and the remarkable uprising of independent thought and inquiry which characterises the century immediately preceding Harvey's birth.

Bacon is frequently spoken of as the founder of inductive philosophy and the destroyer of the syllogistic reasoning which had been all-powerful before his day. This may be true when applied to moral philosophy, but is certainly not so when we consider physical or natural philosophy. In his biological writings Aristotle makes constant use of the inductive process, and he points out that it is absurd to suppose that syllogistic reasoning could lead to the discovery of any new principles;⁵ and again he says still more definitely "that reasoning is naturally prior and more known than proceeds by syllogism, yet is that more perspicuous to us which is based on induction."⁶

Aristotle's inveterate custom of specifying a final cause for every structure and organ which he came across in the animal body not only led him into many absurdly erroneous conclusions, but joined with the oft-quoted maxim of Bacon,

"Causarum finalium inquisitio sterilis est et tanquam virgo Deo consecrata nihil parit," has led to the wonderful work he did in biology being less thoroughly appreciated by us than it deserves. Bacon's objection to the consideration of final causes in physics was owing to his belief that it "banished the study of physical causes; the fancy amusing itself with illusory explanations derived from the former." That Bacon was wrong in this view is proved by Harvey himself, for we have it in his own words, as reported by Boyle,⁷ that it was from studying the valves of the veins, and believing "that so provident a cause as Nature had not placed so many valves without design," that he was first induced to think of a circulation of the blood.

Equally false is the belief very generally held that Bacon was the first to revolt from the tyranny of the Aristotelian school. The alliance which had taken place between the Papal Church and the Aristotelians caused those who at the Reformation refused to recognise the infallibility of the Church of Rome also to throw off their allegiance to the tenets of the schools. Luther and Calvin, not to mention lesser men, declared that no man could be an Aristotelian and a Christian; and St. Paul's warning, "Beware lest any man spoil you through philosophy and vain deceit after the tradition of men,"⁸ was a favourite text for the ministers of the Reformation to expound.

The same spirit of inquiry which broke down the tyranny of the Church also freed men's minds from the trammels of the dogmas of the current philosophy. The physicians, by questioning the accepted doctrines of the nature of the universe, were the first to commence this healthy movement, and the widespread popularity of Ramus's teaching very greatly expedited the change which occurred. Ramus, from the commencement of his career, disputed the authority of Aristotle, and may be said to have spent his whole life in opposing the orthodox philosophy of the times, and perished a martyr to his opinions and the rancour of his opponents in the massacre of St. Bartholomew's Day (1572).

Harvey, when at Padua, must have been in the midst of the conflicting theories and bitter controversies of the Aristotelians and their opponents. His even and well-balanced mind prevented his joining either party. Throughout all his writings he pays the greatest respect to Aristotle, and takes him as his main guide in his work *De Generatione Animalium*. He makes also constant references to him in his *Praelectiones Anat. Univ.*; and when Aubrey asked him what he should read, bid him go to the fountain head and read Aristotle, Cicero, and Avicenna. The same authority tells us that Harvey, whilst esteeming Bacon much for his wit and style, was not enamoured of his philosophy. It would be interesting to know how intimate Harvey was with the Lord Chancellor, and whether their communications merely partook of the character of physician and patient, or whether Harvey discussed philosophical questions with the older man.

My predecessors in this office have so fully vindicated Harvey's claim to the discovery of the circulation against the attempts which have been made within recent years to deprive our countrymen of this honour that I will pass on, merely thanking Sir Edward Sieveking and Sir George Johnson for the able and triumphant manner in which they have refuted the statements put forward in favour of Cesalpinus as the true discoverer of the circulation of the blood.

Neither Servetus, Columbus, nor Cesalpinus in any way anticipated Harvey, who not only discovered the greater circulation, but demonstrated it and explained the true motion of the heart. He, and he alone, recognised the muscularity of the heart's wall and perceived and demonstrated that it was the contractile power of the heart which was the primary cause of the pulse and of the circulation of the blood through both systemic and pulmonary vessels. Harvey by a chain of close and acute reasoning, drawn from direct experiments, and from observations on the pulsation in aneurysms and in vessels distal to aneurysmal dilatations and to portions of rigid and calcified arteries, demonstrated once for all that the motion and contraction of the heart was the main, though not the only, cause of the pulse.

Leaving then the *Exercitatio Anatomica de Motu Cordis et*

⁴ *Elements of the Phil. of the Human Mind*, vol. i, p. 217, sixth edition.

⁵ Last chap. *Metaph.*

⁶ *Analytica*, Lib. c. ii, p. 3.

⁷ Boyle's Works, folio edition, vol. iv, p. 539.

⁸ *Colossians*, c. ii, v. 8.

Sanguis, I wish to consider that which Harvey's discovery rendered possible, the rise of physiology, more especially in England, and the part which Harvey himself took in founding it.

It must be always borne in mind that but a portion of Harvey's work has come down to us. We gather from his extant writings that he had collected materials for, if not composed and completed, the following treatises: *Observationes de Usu Lienis*; *Observationes de Motu Locali*; *Tractatus Physiologicus de Amore Libidine et Coitu Animalium*. We do not know how far advanced his *Medical Observations*, to which he makes frequent references; his disquisitions on the *Cause, Uses, and Organs of Respiration*; his *Medical Anatomy, or Anatomy in its Application to Medicine* may have been. Harvey announces, in his first disquisition to Riolanus, his "intention of putting to press this last work," and it must be regarded as an irreparable loss that the world should have been deprived of the material he had collected, for one cannot doubt that his *Medical Anatomy* would have displayed the same master mind as is shown in his other works, and that morbid anatomy would have been advanced to the position it was placed in a hundred years later by Morgagni. As it is we have to collect Harvey's general views of physiology from scattered passages in his works.

Next to his *Exercitatio Anatomica de Motu Cordis et Sanguinis*, his most important treatise is *De Generatione Animalium*. This is an unfinished work. Harvey had probably intended to publish a larger and more complete work, but had failed to satisfy himself on the subject of generation, and what he was persuaded by Sir G. Ent to entrust to him for publication were but the exercises from which Harvey had intended to compile his treatise. Possibly the loss of his *Observations on the Generation of Insects* prevented his undertaking the larger work; for no one who reads the treatise will come to the opinion that Harvey was prepared to publish it in the shape in which we now have it. In the exercises we find much repetition both of words and ideas, much speculative matter on which he expresses no opinion. Not having satisfied himself as to the facts of generation, he allows himself to be under the influence of the

Master Sage of those who know,
(Dante's *Inferno*, Cant. iv, l. 131.)

and wanders off from observed facts into the shadowy but enticing realms of fancy and metaphysics.

It is no detraction from Harvey's merit that he failed in understanding the nature of generation. The necessary means were not in existence; the simple magnifying glasses he used for the inspection of the *punctum saliens* were unable to show him his error in supposing that the male element did not enter the uterus—a conclusion he came to after repeated inspections. Writing of the uterus of the doe after copulation, he says: "I began to doubt, to ask myself whether the semen of the male could by any possibility make its way by attraction or injection to the seat of conception; and repeated examination led me to the conclusion that none of the semen reached this seat" (Exercise lxvii); and in another place (Exercise l) he asks "whether the conception of the uterus be of the same nature or not with the conceptions of the brain, and fecundity be acquired in the same way as knowledge—a conclusion in favour of which there is no lack of argument;" and in his essay on Conception he gives us what I imagine was his final conclusion: "The woman, after contact with the spermatic fluid in coitu, seems to receive an influence and become fecundated without the co-operation of any sensible corporeal agent, in the same way as iron touched by the magnet is endowed with its powers."

The aphorism *Omne vivum ex ovo* is ascribed to Harvey, and often quoted as if he made use of the expression. It is true that at the end of his consideration of the development of the egg he concludes by quoting Aristotle with approval: "All living creatures, whether they swim, walk, or fly, and whether they come into the world in the form of an animal or of an egg, are engendered in the same manner." But it is quite evident from many passages in his treatise that Harvey did not unconditionally reject the doctrine of spontaneous generation. In Exercise lxiii, after stating "now we at the very outset of our observations asserted that all animals were

in some sort produced from eggs," he goes on to explain his meaning more fully: "an egg is a conception exposed beyond the body of the parent whence the embryo is produced. Let us therefore say that that which is called *primordium* among things arising spontaneously, and seed among plants, is an egg among oviparous animals; the prime conception in viviparous animals is of the same precise nature;" and earlier in Exercise xlv, when discussing the difference between epigenesis and metamorphosis, he says: "Some animals are born of their own accord, concocted out of matter spontaneously." Harvey showed that the mode of development and growth was the same in the embryos of viviparous and oviparous animals, and maintained that in creatures said to arise spontaneously or to take their origin from putrefaction, filth, etc., the same developmental changes occurred, but nowhere expresses an opinion as to the origin of the ova themselves, although it is probable that he inclined to the belief that they were "propagated from elements and seeds so small as to be inconspicuous (like atoms flying in the air) scattered or dispersed here and there by the winds" (Exercise xliii). In the same way he expresses no opinion as to the origin of the animalcules generated in our bodies, and of the worms produced from plants and their fruit or from gall nuts, the dog rose and various other galls, contenting himself with remarking that the living principle of the animals thus arising cannot have existed in the plants on whose juices they live (Exercise xxvii).

Though misled from the want of proper means for observation in the fundamental facts of generation, there is much touching general physiology scattered through the treatise, which is extremely interesting. Harvey remarks that he was the first to note that the bronchia or ends of the trachea in birds open into air-sacs in the abdominal cavity (Exercise iii), an observation which, so far as I know, attracted no attention, and did not receive confirmation until John Hunter demonstrated these air-sacs afresh, and showed that the bronchia in birds were continuous also with the hollow spaces in their bones. In Exercise lvi he has anticipated Darwin's explanation of sexual adornments, remarking, "Ornament, of all kinds, such as tufts, crests, combs, wattles, brilliant plumage and the like, of which some vain creatures seem not a little proud, are most conspicuous in the male at that epoch when the females come into season, and whilst in the young they are still absent, in the aged they also fail as being no longer wanted." Hereditary likeness did not escape him, nor that form which is spoken of as atavism, for he asks, "Why the offspring should at one time bear a stronger resemblance to the father, at another to the mother, and at a third to progenitors, both maternal and paternal, further removed." (Exercise lxii.)

After the circulation of the blood and the mysteries of generation, the subject which appears to have had most attraction for Harvey was that of "innate heat"—*calidum innatum*—the *θερμὴ εὐφυρὸς* of Aretæus, a term by which more was meant than the temperature, although that was the sensible evidence of it. Harvey distinguished the *anima*—soul or vital principle—from the innate heat; to the consideration of the latter he devotes Exercise lxxi, and treats at length of the former in Exercises xxvi and xxvii. It would take me too long to attempt to give a sketch of his views of the *anima*; it is clear that he himself was dissatisfied with his own conception of the vital principle or *anima*, for he says in Exercise xxviii, speaking of the way in which the egg is produced, "leaving points which are doubtful and disquisitions bearing upon the general question (that is, on the *anima*), we now approach more definite and obvious matters."

Animal heat before the knowledge of the production of heat by chemical union was an inscrutable mystery which not even the genius of Harvey could penetrate. The maintenance of animal heat was supposed to be the gift of the heart to the blood. The belief that the heart was the source of heat was universally held by the ancients, Aristotle saying "that its wall is thick that it may serve to protect the source of heat."

This Aristotelian doctrine Harvey dissented from and destroyed by reasoning little less cogent than that by which he demonstrated the circulation, although he was unable to account for the presence of animal heat and imagined that

it was inherent in the nature of blood, and of divine origin. His words are so grand and poetic that I may be permitted to quote them at length:

"I say that innate heat and the blood are not fire, neither do they derive their origin from fire. They rather share the nature of some other, and that a more divine body and substance. They act by no faculty or property of the elements; but as there is something inherent in the semen which makes it prolific, and as in producing an animal it surpasses the powers of the elements—as it is a spirit, namely, and the inherent nature of that spirit corresponds to the essence of the stars—so there is a spirit of certain force inherent in the blood acting superiorly to the powers of the elements, very conspicuously displayed in the nutrition and preservation of the several parts of the animal body; and the nature, yea, the soul in the spirit and blood, is identical with the essence of the stars" (Exercise lxxi). This outburst of Harvey's is most striking, so unlike his usual manner, and one cannot but be astonished at his inconsistency, for it occurs in the same exercise as the following shrewd and calm remark: "We are too much in the habit, neglecting things, of worshipping names. The word blood signifying a substance which we have before our eyes and can touch, has nothing of grandiloquence about it, but before such titles as spirit and *calidum innatum*, or innate heat, we stand agape," for assuredly the substitution of the phrase that the nature inherent in the blood was responsive to the essence of the stars is not less calculated to set us wondering than is the term "*calidum innatum*." Harvey nevertheless disproved for once and all the doctrine that the heart was the source of heat; he showed how animal heat was dependent on the due circulation of the blood and that the belief that the function of the lungs was to cool the heated blood was absurd. He says: "The blood, instead of receiving, rather gives heat to the heart, as it does to all parts of the body; and it is on this account that the heart is furnished with coronary arteries and veins; it is for the same reason that other parts have vessels, namely, to secure the access of warmth for their due conservation and stimulation, so that the warmer any part is the greater its supply of blood, or otherwise, where the blood is in the largest quantity there also is the heat the highest."

The *Praelectiones* are but notes to assist Harvey whilst lecturing, and it is therefore impossible to know what interpretation to place on them, but I think it highly probable that in the course of years Harvey, as his physiological knowledge increased, modified his views of the connection between animal heat and the heart, for in the *Praelectiones* he speaks of the heart as the *fons totius caloris*, and calls it *arx et domicilium caloris*, from which it appears that in 1616 he still held the Aristotelian opinion of the heart being the source of heat.

No portion of the *Praelectiones* show more strikingly the closeness of Harvey's observation, the amount of his knowledge, and the acumen of his reasoning than that relating to the exposition of the anatomy and the functions of the lungs. In his description of them and the pleuræ he makes constant references to their morbid anatomy and their embryonic condition. He is evidently in doubt whether the lungs expand and contract from their own movements or merely follow the movements of the thorax—a question which was afterwards fully investigated and explained by Mayow.

The immediate followers of Harvey naturally turned their attention to the subjects on which he had thrown so much light—the circulation and respiration. Most notable among them were two distinguished Cornishmen, Richard Lower and John Mayow. The former is the best known from his experiments on the transfusion of blood, which attracted the attention of the general public, but those experiments, though the best known, are by no means the most important of his physiological researches. In addition to demonstrating in many ways that the red colour of arterial blood was due to the action of the air, he calculated also the force of the heart and the quantity of the blood passing through it. He showed also by demonstrations on dogs that cedema of the parts distal to the heart followed ligature of the veins, and produced ascites by tying the vena cava in the thorax. Lower also was the first to show the dependence of the heart's action on nervous influence and to demonstrate the moderating effect of the pneumogastric nerve on the heart.

Mayow, though recognising that there was an interchange between the blood and air in the lungs, still thought that the source of vital heat was in the heart, "not that it contained a biolynchium (that is, a vital torch) flaring within it, but that from its perpetual motion for carrying on the circulation, the nitro-aërial and sulphureous particles in it must be in a state of perpetual effervescence and that necessarily remarkable heat must be excited."¹⁰ Mayow thought that air was impregnated with a certain universal salt, which was of the nature of nitre, and with vital spirit, and with fire; notwithstanding this erroneous view of the nature of air, it is remarkable how closely his explanation of the action of this imaginary salt on the blood agrees with the actual action of oxygen, and he sums up his conclusions as to the uses of respiration as follows: "Life consists in the distribution of animal spirits which must be supplied for the pulsation of the heart. In very truth it is highly probable that the aërial salt is necessary for any muscular movement, so that without it no pulsation of the heart is possible."¹¹ In his essay *De Respiratione Fœtus in Utero et Ovo* he correctly infers that the blood of the fœtus obtained through the umbilical arteries not only nourishment but also aërial salts which obviated the necessity of functional activity in the lungs during intrauterine life, and states definitely that the placenta should not be regarded as an amplified liver, but as a uterine lung. It is not for his chemico-vital theories alone that Mayow deserves to be remembered; he first accurately described the action of the intercostal muscles and diaphragm, and showed that inflation of the lungs depended on atmospheric pressure.

It was not until upwards of a hundred years later, when Black had shown the presence of carbonic acid in expired air, and investigated the phenomena of latent and sensible heat, when Priestley had isolated oxygen, and Cavendish and Lavoisier had completed the analysis of atmospheric air, that any real progress could be made in the study of respiration and animal or vital heat. Even now we are by no means fully acquainted with this most complex and difficult subject. Your Croonian Lecturer pointed out a few months ago some of the many difficulties which still have to be surmounted before we can arrive at an adequate knowledge of how and where the interchange between the oxygen of the air and the tissues takes place, and how our systems accommodate themselves to the changes of pressure and temperature in the air, so as to maintain the animal heat at a uniform level.

I have endeavoured, very imperfectly I fear, to set before you the rise of physiology in England. Before the discovery of the circulation of the blood, a right understanding of the means by which life is carried on was impossible, and Harvey's discovery should rank on the same level as Newton's discovery of gravitation. In both cases others had to a certain extent prepared the way, and may have had glimpses of the truth, but to them the truth was revealed, and they might say with Tennyson's Holy Sage—

Idle gleams to thee are light to me,
and the light which their genius led them to perceive enabled their successors to reveal what we now know of the mysteries of animate and inanimate Nature.

We know very little of Harvey's practice as a physician; what little we can gather from his writings show him to have been fertile in resource and skilful in the management of gynecological cases. We cannot doubt that one who showed such acumen in deciphering the problems of life, and who speaks so wisely of the necessity for the study of morbid anatomy, must have been far ahead of the rest of his contemporaries in the application of his knowledge to clinical work; and the disparaging gossip of Aubrey merely reflects the opinions of those too ignorant and too bigoted to appreciate him.

I have already spoken of the overpowering authority of Aristotle over the minds of the students of Nature, but the completeness of his dominion was not to be compared to the overwhelming influence of Galen in the medical world during the sixteenth and early part of the seventeenth centuries, and it needed yet another than Harvey to enable men to throw off the benumbing mantle of Galen. Our College annals

¹⁰ *De Spiritibus Animalibus*, chap. iv, p. 31.

¹¹ *De Respiratione*.

recount, as pointed out by our learned Librarian in his Roll of the College, that in the year 1559 Dr. Geynes was refused the Fellowship because he had ventured to doubt the infallibility of Galen; and in our annals it is stated that Dr. Hook was not granted admittance to the examination for the licence because he had the honesty to say that he had not read Galen. The revival of anatomy had by Harvey's time somewhat undermined the authority of Galen, which was still further impaired by Harvey's own discoveries. Nine years after Harvey's death appeared Sydenham's *Methodus Curandi Febres Propriis Observationibus Superstructa, etc.*, and the world became aware that one had arisen who brought independent thought, unbiassed by the traditions and views of the various schools of medicine, to bear on the study of disease.

Our ignorance of the details of Sydenham's life renders it difficult to express an opinion as to the position he occupied in society or among his professional brethren in the year 1666, when the *Methodus* first appeared. He had then been settled in Westminster for ten years, and his intimacy during his Oxford life with Locke, and Boyle (to whom he dedicates the work) makes it probable that from his first arrival in town he must have mixed with those bright and inquiring minds who instituted the Royal Society. Be that as it may, his treatise at once attracted their attention, and in the same year in which it was published we find it reviewed in the *Philosophical Transactions of the Royal Society*, then in the second year of its existence.

I will not stay to consider how great or how small were Sydenham's literary acquirements, or whether he wrote his works in Latin, or whether they were translated from the vernacular by Dr. Mapletoft and Mr. Havers; the subject is fully treated of by Dr. Latham in his *Life of Sydenham*, and I know of no fresh evidence that has been obtained. Whatever may have been the amount of Sydenham's scholarship, no one who reads his works can fail to see from his frequent allusions to Horace, Lucretius, Seneca, etc., that he was intimately acquainted with the Latin classics, and, like Dr. Latham, I should be sorry to consider that his admiration for Hippocrates—the divine old man—was taken at second-hand. As to the other disputed point, whether Sydenham served as an officer in the Parliamentary army, the question has been set at rest by the discovery in the Record Office of a petition to the Lord Protector signed by Thomas Sydenham and endorsed Captain Sydenham's Petition.¹²

Nurtured during the civil war, the rough and turbulent early life of Sydenham left perhaps its stamp upon his character—a thoroughly upright, honest, God-fearing man, but somewhat intolerant of opposition, and of singular independence of mind. He had not the sweet nature of Harvey, which appears to have enabled that gifted man to have lived in peace with all men; but we must, I think, receive with caution the few contemporary anecdotes which have come down to us concerning him. It is pretty certain that Sydenham thought Sir R. Blackmore a pedant and prig—an opinion shared by many, for, besides Dryden's well-known castigation of Sir Richard Blackmore, we have the following description of him by a contemporary:

By Nature formed, by want a pedant made,
Blackmore at first set up the whipping trade;
Next quack commenced, when fierce with pride he swore
That toothache, gout, and corns should be no more.
In vain his drugs, as well as birch he plied,
His boys grew blockheads and his patients died.

Col. Coddington.

The oft-quoted story of the advice Sydenham gave him to read *Don Quixote* was probably only passing on that which Locke had given Sydenham, for the former says: "Of all the books of fiction, I know none that equals Cervantes's *History of Don Quixote* in usefulness, pleasantness, and constant decorum."¹³ And it may also have contained a covert allusion to the fictitious character of most medical writings.

Sydenham's independence of mind is the key to his position in medicine. The opening paragraph in the preface to the first edition of the *Methodus Medendi* exhibits to us the serious and lofty view that Sydenham took of the physician's duty, whilst in the greatly-expanded preface to the third

edition he instructs us as to the means by which the science of medicine was to be advanced. It was his determination to study diseases as they presented themselves to him, keeping the peculiar and constant phenomena apart from the accidental and adventitious, and laying aside all hypotheses as to their nature, which enabled Sydenham to draw up those pictures of gout, dropsy, and fever which will remain classical for all time and justly entitle him to be called the modern Hippocrates. From Harvey's physiological teaching, and from clinical observations carried on in the spirit of Sydenham, our present knowledge of disease became possible. Harvey's work and writings had no direct influence on Sydenham; the latter makes no reference anywhere to Harvey, nor does he seem, in his treatise on *Dropsy*, written in 1683, to have seen the bearing which Lower's experiments, made fourteen years previously, of ligature of the veins, had on dropsy. Sydenham considered "weakness of the blood" to be the sole cause of dropsy, and throughout his writings he nowhere alludes to the physiology of the tissues. He quotes Hippocrates with approval, as blaming those who in their exceeding curiosity and officiousness busied themselves in speculations on the human frame, and whilst admitting that more than one valuable medicine had been obtained from the chemists, blames those who thought that medicine could be promoted by the new chemical inventions of his day;¹⁴ and he further on says "the whole philosophy of medicine consists in working out the histories of diseases and applying the remedies which may dispel them; and experience is the sole guide."¹⁵ Yet Sydenham himself had his theories, and, viewed by the light of our present knowledge, very incorrect ones, for without theory, or, in other words, general principles, experience is a blind and useless guide. Rational theories of disease and its treatment can only be founded on physiological knowledge, and until, comparatively speaking, a very few years ago the knowledge of physiology and medicine were inseparably connected, for, with very few exceptions, the former was cultivated by medical practitioners alone, and may, without disrespect, be said to have been parasitic on medicine.

This is no longer the case, for using the term in its widest sense, as embracing the study of life, whether under normal or abnormal conditions, it has become the largest division of the natural sciences, throwing out like a gigantic tree huge branches from its main trunk, which depend more or less for support on chemistry and physics, and embracing within its ample boughs a vast series of subjects with whose rapid growth it is beyond the powers of any man to keep abreast. What is to be the future relation of it to medicine, or rather, I should say, of medicine to physiology? The old position is reversed, and medicine—that is, the study of the manifestations of disease, its origin, course, and the means of alleviating its effects or preventing its occurrence—may be regarded as a branch of physiology, and one not less scientific than the observation of physiological phenomena in the laboratory. The practitioner of medicine turns to the physiologist, the bacteriologist, the chemist, and the physicist for aid in unravelling and explaining the symptoms he observes and has to deal with, and so long as they work together in the spirit which influenced Harvey and Sydenham—the pursuit of truth—the world must be the gainer.

The very brilliancy of recent discoveries and the vast increase in our knowledge may for a time react prejudicially on the art of medicine. Are we not in danger of being carried away by our enthusiasm? And may we not fall into the predicament described many years ago by Buckle, of our facts outrunning our knowledge and encumbering our march? More especially does this difficulty arise in the training of our students. So vast is the range of subjects bearing on medicine, and so important does each appear to those best acquainted with them, that there seems to me danger lest, in endeavouring to secure an acquaintance with them all, we may forget that the future life of the majority of those entering our profession is to be spent in ministering to the victims of accident or disease, and that for the due recognition and treatment of sickness and injury, experience and trained clinical observation is absolutely necessary. No amount of laboratory training will enable a man to recognise the nature and proper mode of

¹² A copy of the petition, together with other remarks, was published by Dr. Gee in *St. Bartholomew's Hospital Reports*, vol. xix, p. 1.
¹³ *Some Thoughts concerning Reading and Study*

¹⁴ On *Dropsy*, par. 23, *Sydenh. Soc. Trans.*

¹⁵ *Op. cit.*, par. 45.

reduction of a dislocation, or know scabies when he sees it, and the words of Sydenham to his dear friend Dr. Mapletoft, "The art of medicine can be properly learned only from experience and exercise," will always hold good.

There is no need to urge on the Fellows of the College another of Harvey's directions to the Orator of the day "to search out the secrets of Nature by way of experiment," for at no period during the existence of our College have they manifested greater activity than at the present.

The great scientist who has recently passed away in the fulness of years and fame opened to us new and most fascinating fields for future research, pregnant, I believe, with an abundant harvest, of which he himself was permitted to see the first fruits. Working out with scientific patience and accuracy the clue afforded by Jenner's discovery of the efficacy of vaccination in small-pox, Pasteur not only threw light on the darkness which surrounded the communicability of specific diseases, but placed in our hands a means to fight them. Pasteur has gone to his rest surrounded with all the honours a grateful nation could pay to his memory, and I know not that I can pay a greater tribute to his genius than by saying that he will worthily be placed in the Temple of Fame by the side of our Harvey, both men honoured alike for the blameless character of their lives and the brilliancy of their discoveries. If we, as a nation, have not been able, through the action of our Legislature, to bear our full share in the furtherance of Pasteur's discoveries, we have at least the satisfaction that Lister was the first to recognise their bearing on morbid processes, and to introduce new principles into surgery, which have added a hundredfold to its powers. The later developments of Pasteur's discoveries in the hands of Koch, Behring, Roux, Klein, and a host of equally earnest inquirers have had in medicine a correspondingly important and beneficial effect on our conceptions of disease and its treatment.

Remarkable as has been the nineteenth century in the development of science and its application to the needs of mankind, in no direction has it been more remarkable than in the progress of medicine. The introduction of anæsthetics marks the middle of the century, and its close will in the future be ever memorable as the era in which we commenced to have a truer and fuller insight into the causation and nature of disease than the world has yet seen. Let us all, then, strive to work after the examples of Sydenham and Harvey in the confident hope that as our knowledge advances we shall obtain greater powers of control over disease in all its forms, and that pain and suffering may be yet further mitigated.

MIDWIVES IN BELGIUM.—The Belgian Gynæcological and Obstetrical Society has recently passed resolutions to the effect that midwives should be placed under the active supervision of a competent authority. It recommends that they should be taught to employ certain specified methods of disinfection and asepsis; to use the thermometer regularly, and summon the doctor when the temperature of the patient remains above 101° F. for more than twenty-four hours; to call in the doctor also as soon as any signs of purulent ophthalmia are noticed in the infant. The strictest precautions are enjoined after attendance on cases of puerperal septicæmia, and it is recommended that any neglect in this respect should be made punishable by law. Any case of puerperal fever must be notified to the proper authority within twenty-four hours.

PRINTING AND MORTALITY.—The Labour Department of the Board of Trade has just completed an inquiry into the relative mortality of a number of group occupations. Their inquiry covers (1) printing and bookbinding, (2) shipbuilding, (3) metal, (4) building, and (5) miscellaneous trades. They find that the following are the rates of mortality per mille of the members of the respective unions in these occupations: Printing, 12.27; metal, 11.87; miscellaneous, 10.15; shipbuilding, 9.37; and building, 7.93. Taking the average age at death, printing again occupies the unenviable position of being worst. These are the actual figures: Printing, 44.5; shipbuilding, 46.6; building, 47.5; miscellaneous, 50; and metal, 50.5.

DR. A. L. F. ROBERTSON-FULLARTON has been appointed Deputy Lieutenant of the county of Bute.

SIXTY-THIRD ANNUAL MEETING

OF THE

BRITISH MEDICAL ASSOCIATION.

Held in LONDON July 30th, 31st, and August 1st, 2nd, 1895.

PROCEEDINGS OF SECTIONS.

THE SECTION OF LARYNGOLOGY.

FELIX SEMON, M.D., President.

THE INFECTIOUS NATURE OF LACUNAR TONSILLITIS.

I.—Professor Dr. B. FRAENKEL,
University of Berlin.

UNDER the title of tonsillitis, or angina lacunaris, or as it was formerly called follicularis, we understand an inflammatory affection of the tonsil which is distinguished by its phenomena and course as a disease *sui generis*. It begins in the majority of cases with a rigor and rapid rise of temperature. Simultaneously or after a short delay the patient experiences a sense of uneasiness in the throat. Swallowing, and particularly swallowing saliva, causes him some pain, though this is usually insignificant, and even when he is not swallowing he feels that the throat is not normal, or rather that some slightly painful change has occurred in it. In some cases these subjective phenomena precede the rigor by a few hours. If the throat is examined at the beginning of the illness the palatine tonsils are seen to be red and swollen. A few hours later whitish elevated spots make their appearance, and these prove on closer inspection to be drops of secretion issuing from the orifices of the lacuna. These may be seized and pulled away, and if this is done they usually become drawn out into threads, which retain an attachment to what is left behind in the lacuna. Fresh secretion is formed and expels what is already present, and in this manner drops of secretion reform at the lacunar orifices. They finally gravitate downwards, and may coalesce with similar drops from neighbouring lacunæ. In this way a larger or smaller extent of the surface of the tonsil may be covered with the whitish secretion. The latter is of a dense fluid consistency, and adheres fairly firmly to the underlying parts. It is, however, not a pseudo-membrane, for it may be removed without any injury to the surface on which it lies, and proves on microscopic examination to contain no fibrin. It consists in the main of large numbers of cells (chiefly leucocytes, together with epithelial cells), which exhibit granulation and the other usual indications of impaired nutrition. Besides the cells, micro-organisms (chiefly cocci) are present in crowds; but, as I said before, there is no fibrin.

With the further progress of the disease the redness and swelling of the tonsils increase, but these phenomena as well as the pain in the throat usually keep within moderate bounds; while, on the other hand, the fever advances with rapidity, a temperature of 40° C. and more being reached as early as the first evening of illness. Next morning the fever remits, but again rises in the evening, until during the night of crisis the temperature sinks to normal, with the occurrence of perspiration and urinary sediment. In some cases the fever ceases even within twenty-four hours of onset, in others it lasts three or four days. In all cases, however, it gives us, by the suddenness of its onset and by its termination in crisis, the impression of an infective fever, an impression which is strengthened by the disproportion which exists between the local phenomena and the height of the fever, while it is further supported by the fact that in a fraction of all cases a swelling of the spleen is to be detected.

Owing to the favourable course which the disease usually takes one seldom has an opportunity of meeting with it in the cadaver. The pathological anatomy can nevertheless be studied without difficulty. When the affection occurs in individuals who suffer from hyperplasia of the tonsils—and