THE HARVEIAN ORATION

ON

HARVEY AND GALEN.

*Delivered before the Royal College of Physicians of London on
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[AFTER referring to the death of the late President, Sir Russell Reynolds, and a new benefaction received by the College during the past year the Harveian orator drew attention to the special objects with which Harvey had founded this oration, and then proceeded as follows :—]

FORERUNNERS AND DISCIPLES.

It has always been the tradition, with which one would not willingly break, that Harvey himself and his great discovery should be specially commemorated on this occasion. A long series of eminent men have so fully and ably treated of the immediate circumstances of the discovery of the circulation, its consequences, and its development in modern times, that it would be difficult indeed to add anything new to what they have already given us. But still I find that the genesis of Harvey's idea—and more especially its historical connection with the labours of the great men of antiquity who laid the foundations on which our modern anatomy and physiology rest, have not received the same degree of attention. The antecedents, however, no less than the consequences, have to be taken into account in giving its true value to any scientific discovery.

It is generally admitted, though perhaps not always borne in mind, that no kind of knowledge has ever sprung into being without an antecedent, but is indissolubly connected with what was known before. In this respect science is only like all other kinds of natural phenomena. The present aspect of the world, geologists tell us, is a necessary consequence of previous conditions and changes. The present races of animals and plants are the descendants of a long series whose origin we cannot trace. Modern civilisation is the outcome of the efforts of man in all past ages to construct a social fabric. And so even our modern science—which we sometimes speak of as though it were altogether a new thing—is only the final resultant of all the endeavours of men in past times to penetrate the secrets of Nature. When we look back upon those strivings they often seem perverse and contradictory. Men at certain periods seem to have gone backward rather than forward. We are struck less by the few grains of truth than by the great mass of what we call errors. But let us speak gently of these errors, and call them rather imperfect truths—for in science, at least, the truth of to-day is error to-morrow. They are parts of a continuous evolution, in which the so-called truth and the so-called error are inseparably mingled.

Again, it seems to be sometimes thought that great original thinkers and discoverers make an exception to this law of continuous evolution. We imagine that such men as Aristotle, Galileo, Harvey, and Newton were independent of their predecessors, that, in fact, their great work was to demolish the errors—that is, to destroy the work of those predecessors and to start afresh. But in reality no man, even the greatest, was ever thus independent. The investigator is indebted to those who went before him, not only for the instruments of research which they perfected, but for the conclusions which they arrived at. These conclusions, whether he admits or rejects them, serve for his help and guidance. It is easy to see that a discoverer profits by the ascertained discoveries of his forerunners. It is not so easily seen that the so-called errors of those men are also of great value to him. How many false solutions of a problem are required before the true solution is arrived at! How many are indeed necessary elements in this final solution! I know that there are various kinds of errors, and that while some are stepping-stones others are stumbling-blocks, but still there is much truth in the general proposition that error is a stage in the development of truth.

A certain novelist has sketched the character of a philosopher who devoted his life to writing the *History of Human Error*. Were such a work ever honestly written it would be the *History of Human Progress*. I ask your indulgence for entering on these abstract topics, because they will be found to bear immediately upon the subject of my discourse, which is "The relation of Harvey to his predecessors, and especially to Galen."

It will be found, I think, that after tracing the services of Harvey's own generation and that immediately preceding it, in providing him with the indispensable methods and instruments of research, we are led back to Aristotle and Galen as the real predecessors of Harvey in his work concerning the heart. It was by the labours of the great school of Greek anatomists of whom Galen was the final representative (not forgetting their successors in the sixteenth century) that the problem though unsolved was put in such a shape that the genius of Harvey was enabled to solve it. Harvey's debt to Aristotle was warmly acknowledged by himself and has been frequently insisted upon, so that it is less necessary to enlarge upon that theme. But his relations to Galen and the Greek anatomists, Harvey himself, for reasons which I shall presently state, was unavoidably led to mention less clearly, and in modern times they have been greatly undervalued or even misunderstood. It is therefore to Galen and Greek anatomy in general that I propose chiefly to confine myself. We need not fear that the result will be to lessen our admiration for Harvey or for his momentous discovery. The very contrary will be the case.

LINACRE, CAIUS, AND HARVEY.

One sometimes wishes history could be written backwards, that we could show how the state of affairs to-day is the consequence of that which existed yesterday or the year before, and so on. The practical difficulties of such a method would probably be too great, but in the present case I should like to trace the circumstances which influenced Harvey through the two generations preceding his own, more especially as that will give me the opportunity of obeying the Harveian precept by commemorating two great benefactors of our College—Thomas Linacre, our honoured founder, and John Caius. Harvey, as we all know, was a student first at Cambridge in the great college which owed its second foundation to Caius. He never knew Caius, who died five years before Harvey was born, but he worked under the posthumous influence of that eminent physician, and the example of a man so distinguished and standing in such a relation to the young scholar must have had weight in determining the aspirations and the course of study of the greatest alumnus of his college. Beyond the one fact that Harvey followed Caius's example in studying in the schools of Italy I will only now draw attention to two of Caius's intellectual characteristics. He was an enthusiastic student of Greek medicine and more especially of Galen, spending much time in revising and publishing some of his writings. Beside, or rather in consequence of this bent, he was keenly interested in anatomy and founded a lectureship in his own college to promote its study. Caius stood as to time much in the same relation to Linacre as Harvey did to himself, being about four years old when Linacre died, but in spirit the earlier pair were much more intimately connected. Caius cannot have known the older physician, but he made him in most respects the model of his life and was in the truest sense his intellectual heir. Indeed, it was in a filial spirit that he repaired the neglect of others by erecting a monument to Linacre in St. Paul's Cathedral with its well-known affectionate inscription. We are brought back, then, to Linacre, our founder, as in a sense the intellectual grandfather of Harvey, and we ask what share had he in moulding the mind or influencing the life of the most famous of his progeny? How far did he contribute to lay the foundation on which Harvey's great work was built? The answer is that though neither Linacre nor Caius even through their writings may have had any direct influence on Harvey, they represent not only the two preceding generations of English physicians, but also represent two successive stages in a great intellectual movement which was the indispensable preliminary to Harvey's work and of which his great discovery may be called the culmination. This was the movement generally called the Renaissance or the revival of learning, but which for our

present purpose may be more closely defined as the "revival of Greek science." Everyone knows that the most important factor in the revival of learning (so far as it took place in the fifteenth century, though doubtless it began much earlier) was, beside the invention of printing, the revival of Greek learning and the study of Greek writers in the original. This was largely influenced by the migration of Greek scholars to Italy after the fall of Constantinople, bringing with them the "brown Greek manuscripts," which it was thought worth a journey to Italy to read and transcribe. From this arose a new science, along with a new literature and as some think a new theology. Mr. Goldwin Smith has finely said that at this time "Greece rose from the dead, the New Testament in her hand." He might have said that in the other hand was the book of science. We mention Linacre, therefore, because among the Hellenists or scholars concerned in the Greek revival he occupied a high and honourable place. Not less was he known as a humanist, being an elegant Latin scholar, and as such acquired a reputation which lasted far into the next century. On his public services as the founder of our College it is needless to dwell, except as a passing tribute of grateful remembrance; but a few facts from his life will help us to understand his position. Linacre was born about 1460, seven years after the conquest of Constantinople by the Turks, and a few years after the first book was issued from a European printing press, cardinal dates as I have said in the history of learning. After studying at Oxford he set the example followed by Caius and Harvey of travelling to Italy to bring home the treasures of the new learning. The records of his Italian journey show the romantic interest with which such a journey at that time might be invested. He carried introduction to the greatest scholars such as Chalcondylas and Poliziano, he heard at Florence the lectures given to the princes of the house of Medici, and after moving among the Italian humanists, "himself not least but honoured of them all" bore off the highest laurels of Padua. Returning to his native land, Linacre occupied a unique position in his profession, for he was probably the only physician in England who had read the Greek medical fathers in their original tongue. Many honours and dignities as we know fell to his lot. Late in life he exchanged medical practice for the priesthood, and thus enjoying comparative leisure, crowded all his important work into the last seven years of his life. The year before his death he published a translation from Galen, which he says was accomplished with difficulty in the intervals of a painful disease. Almost on his deathbed he must have been correcting the proofs of his last work, an elaborate treatise of Latin composition, which was published shortly after his death. Linacre has left us the example of a noble life, inspired by enthusiasm for learning, he was an idealist, devoted to aims which the world thought little of.

Robert Browning, in his fine poem, "The Grammarian's Funeral," has given a picture of the ideal scholar in a way which fits Linacre precisely, if it was not meant for him; though possibly through a passage in Erasmus, it was so meant.

Yes, this in him was the peculiar grace,
Still before living he'd learned how to live—
No end to learning.
Earn the means first—God surely will contrive
Use for our earning
Back to his book then; deeper drooped his head;
Calculus racked him
Lead on before, his eyes grew dross of lead:
Tussis attacked him.
"Now, Master, take a little rest"—not he!
Not a whit troubled
Back to his studies fresher than at first
Fierce as a dragon.
So with the throttling hands of Death at strife,
Ground he at grammar;
Still through the rattle parts of speech were rife.
While he could stammer
He settled *Hottis*'s business—let it be!
Properly based *Omn*
Gave us the doctrine of the enclitic *De*,
Dead from the waist down.

Looking back on the three great English physicians of successive generations, we see that they all visited Italy, and each doubtless owed much to that holy land of the northern student. But they brought back different treasures. Linacre

brought a knowledge of Greek and an enthusiasm for the new learning; Caius also much Greek and Latin, with a zeal for anatomy and training in clinical medicine; Harvey again a profound knowledge of anatomy, some experimental methods, and also a great enthusiasm for Aristotle, extending not only to his natural history, but to his physics and metaphysics, as we see in the *Treatise on Generation*.¹

To return to Linacre. His great objects in life, which he pursued through all difficulties, were these. One, and the lesser, was to improve Latin scholarship, on which he wrote several books which we need not speak of. The other and the greater was to make the works of Aristotle and Galen accessible by means of translations to scholars in general. He formed a sort of Aristotle society or club with his friends Grocyn and Latimer for the study and translation of the philosopher, and Erasmus tells us some versions of Aristotle were lying in Linacre's desk, which he hoped would be profitable to future scholars; but they never appeared. Of Galen's works he translated several, some of them long and important. In medicine he wrote nothing original, and the above constitutes the life's work of this ardent and indefatigable scholar. We need not ask what the value of the positive achievement was, for it was curtailed by external circumstances and also by Linacre's fastidious accuracy, which made it difficult for him ever to think any work perfect enough to be published. But it may be asked, Was the aim which Linacre and his fellow humanists set before them sufficiently important? Was it anything more than a matter of philological interest to revive and translate the Greek medical and philosophical classics? I think it was a worthy aim, and was justified by the event, for out of this work of the scholars grew the scientific movement, and out of this movement, in anatomy and botany more especially, was developed the first possibility of a scientific medicine. To show how these things happened would take a long time. I can only give a brief sketch of the position of the Greek fathers of medicine in Europe during the Middle Ages.

THE ARABIAN AND THE GREEK SCHOOLS.

During what are called the Dark Ages the tradition of ancient medicine and science had been in the Western Empire completely broken. Galen and Hippocrates may have been known by name, but were quite inaccessible to physicians, as Greek had been forgotten even as a learned language, and Latin versions, if such had existed, were quite lost. When the medical classics came back to Europe, it was by a circuitous route and through the medium of another language, the Arabic. The Arabian Mussulmans possessed versions made from the original Greek of the chief works of great Greek writers in philosophy, astronomy, and other sciences, as well as in medicine. From these Arabic versions, a great number of Latin translations were made in the eleventh and twelfth centuries, chiefly in Mohammedan Spain, till gradually a large part of Greek science and medicine, with the Arabic comments and compilations, was put into Latin, and a knowledge of it became diffused through Europe. It is well known that a great stimulus was thus given to European thought. To this was due the first scientific revival, associated to us with the names of such men as Roger Bacon and Albertus Magnus. And in our own subject, the Arabic version of Greek medicine thus presented was the foundation of all medical knowledge through the Middle Ages. But among all these writers two names were always conspicuous, Aristotle and Galen, both of whom the Arabs honoured almost to adoration, and who largely for this reason took a corresponding position in the mediæval world. It has often been said that while Aristotle reigned supreme over the schools Galen was the autocrat of medicine, rulers whose authority it was almost impiety to question. Hippocrates was often named as the master of Galen, but was certainly little read. A great crowd of Arabian and modern writers formed the court and retinue of the monarch Galen, and, as may happen in actual life, had in many cases more influence than the titular sovereign. Chaucer has given us in his portrait of the doctor of physic a good notion of the literary baggage of a mediæval physician.

¹ This may, I think, be clearly traced to the contemporary Peripatetic or Aristotelian School in Italy.

Well knew he the old Esculapius
And Dioscorides, and eke Rufus;
Old Hippocrates, Hali, and Galien,
Serapion, Rasis, and Avicen;
Averroes, Damascene, and Constantin.
Bernard, and Gatisden, and Gilbertin.²

The mediæval world was thus in a sense possessed of the chief Greek medical writers, and if this was so one asks why Linacre and the humanists thought they were rendering such an important service to medicine in retranslating Aristotle, Galen, and Hippocrates from the original Greek. The fact was that the doubly translated versions of the Greek classics had, as might be expected from their history, many defects. Their style was considered barbarous, and, from the ignorance of the translators, often quite unintelligible. To the mediæval doctor who wanted an authority to quote from rather than to understand this defect was less conspicuous. Then many of the best Greek works were either untranslated or practically unknown. It has been said that many a mediæval scholar called himself a staunch Aristotelian though he knew no more of the master than two short logical treatises,³ and the mediæval physician who swore by Galen often went no further than his smaller therapeutical work known as the *Liber Tegni* or *Ars Parva*. Moreover, as time went on, the popularity of the translated Greek works evidently diminished, while Avicenna and other Arabians became predominant. Along with them the mediæval compilers and copyists known as the Arabists or Neoterics (whom Harvey is recorded to have spoken of with great contempt) gradually became the most popular of all, being naturally more easily understood by their contemporaries. The scholars began to complain that the Arabians and their followers, the Neoterics and writers of so-called *Practica*, reigned in all the schools while the pure fountains of Greek medicine were neglected. Linacre and his fellow humanists doubtless thought that if they could return to those uncorrupted springs, and present the best works of antiquity in a classical form without barbarous corruptions, medicine might go back to the glory of ancient Greece, and Hippocrates and Galen have worthy modern successors. In a certain sense they were right, though the ultimate success of their efforts came in a different form from what they anticipated. At all events the revival of the Greek medical classics led to a sort of declaration of war against the Arabians. With some enthusiasts it became a crusade in which, strangely enough, Hippocrates and Galen were counted on the Christian side. One fantastic writer imagines that St. Luke, the Evangelist physician whose day we commemorate in this meeting, by his intercession with the Almighty, secured Divine aid for the holy war which was intended to liberate the heroes of Greek medicine from their captivity among the infidels.⁴ These were extravagancies. The scholar, however, had more serious aims, so that in about one generation, or say roughly by the middle of the sixteenth century, a large number of physicians had adopted the revived Greek medicine in preference to the Arabian, though the older school was not at all superseded.

THE INFLUENCE OF GALEN AT THE RENAISSANCE.

It is noticeable that the name which the new school adopted and was called by was Galenical, or the Galenists. A small society of young physicians in Florence called themselves, in imitation of the well-known Platonic Academy, the Galenical Academy of Florence. Our own college, one of the first fruits of the Renaissance, was, as might be expected from its history, strongly Galenical. This was the work accomplished by the school and generation to which Linacre belonged, the first stage of the Hellenic revival. We may conveniently connect it with the name of Linacre, but of course there were many others associated in the work—as Copus of Paris, Winter of Andernach, Leonicensio in Italy, and Cornarius (Hagenbut) in Germany. It was assisted also by such men as Michael Servetus, the theologian, and François Rabelais, the great humourist. I have called this school elsewhere the Medical Humanists. Now it might be thought that the only result of this change would be to confirm the rule of Galen more firmly than ever. New Galenism would

only be mediæval Galenism "writ large." To a certain extent and for a time this was the case. Galen was still thought infallible. If any error was detected in his anatomy it was said either that the text was corrupt or that the structure of the body had changed since his time. The history of our own college shows that Galenical orthodoxy could rival the theological in its rigour. But this was not for long. When the heaven had had time to work, and a second generation of Galenists had assimilated the new doctrines more completely, a totally different spirit began to prevail. All over Europe this phenomenon presented itself—that the medical humanists and Galenists, especially those well skilled in Greek, were turning to the investigation of Nature. The sciences of anatomy and botany were especially cultivated by them, and it would seem by them alone. Clinica medicine owed its revival to the Galenists. It was evident that the revived Hellenism so far from perpetuating the reign of dogma had an inspiring and vivifying influence. Thus it was with the second generation of the medical humanists, the second stage of the Greek revival, sufficiently denoted for us by the name of John Caius, but including other and greater names, which must be briefly referred to.

One of the earliest anatomists at this time was Jacobus Sylvius, professor at Paris, an ardent student in the original Greek of Galen's works, in which he could see no error, but also an independent dissector. Among his pupils were Servetus, a typical scholar of the Renaissance; Charles Étienne or Stephanus, belonging to the family of printers of that name, renowned for their learning, and the celebrated Vesalius. The latter was an ardent Greek scholar. Caius has told us how, when the two physicians lived in the same house at Padua, Vesalius would bring out his Greek manuscripts to clear up some passage in Galen, or some difficult point in anatomy. Vesalius has been chiefly praised for correcting the errors of Galen, and rightly so praised. But his researches were based upon the system which he destroyed, and though it is rash to say what might have happened had things been different, it is hard to see how anatomy would have arisen when it did had Galen's works perished. What anatomy there had been in the Middle Ages from Mondino to Berengario Carpi was based on rude compilations of anatomy derived from Galen; but when his works were studied in the original we see the difference modern anatomy began. Even to this day every student who goes down to the dissecting room, textbook in his hand, has reason to be thankful that in the fifteenth century men began to read Greek manuscripts.

THE HERBALISTS.

Botany and the allied science of drugs owed its renovation to the revival of Dioscorides, and in a minor degree to Galen. The great German herbarists whose beautifully illustrated works superseded the rude herbals of the Middle Ages were all Greek scholars: some, such as Fuchs, original and learned editors of the Greek classics. The works of the Italian Matthioli, the most popular of all books of plants, were based on Dioscorides. Cesalpino, considered the first botanist of his age, was a profound Aristotelian scholar. Gesner, the first naturalist, in a wide sense, since Aristotle, was at the same time professor of Greek and an editor of Galen. Nor was this activity confined to men of eminence. The young physicians of the Galenical Academy at Florence before referred to thus describe their pursuits. In winter they studied from Dioscorides the history and forms, and from Galen the uses of plants. So soon as the season permitted, and the snows began to disappear from the Apennines, they made excursions into the country and on the mountains to gather herbs useful in medicine. In this way they hoped to restore the ancient medicine of Hippocrates and Galen, and thus only they thought could they become worthy to be called true Galenists. The story is everywhere the same. The Galenists were the students of Nature, and thus modern natural science grew out of the ancient science of the Greeks. In what way it could have arisen otherwise is only a matter of speculation.

GALEN AND CLINICAL TEACHING.

Clinical medicine may be thought to be that department in which the study of the ancients could be of the least use, and that observation alone, without any reference to books,

² *Canterbury Tales*: The Prologue.

³ Sir Alexander Grant's *Aristotle*, 1877, p. 50.

⁴ Symphorien Champier, *Symphonia Galeni ad Hippocratem*, Lyons, 1528, p. 15.

would have been the surest guide. But here again we find that the Greek scholars led the way. Da Monti (Montanus) first distinguished by his editions of Galen, was the earliest clinical teacher of medicine in the modern sense. His lectures at Padua attracted crowds of students from all parts of Europe. Yet Da Monti's method of learning and teaching medicine, on which he wrote special books, was avowedly based on Galen. His pupil, our own John Caius, followed in his steps. Caius was a zealous editor and commentator of Galen, and supplied emendations of his text, which, I am told, are still valued. He also wrote a *Methodus Medendi* according to the system of Galen. But it was Caius again who made, in his admirable works on the Sweating Sickness, the first original contribution to clinical medicine of which our country can boast. Indeed, the best of the numerous writings on this disease were due to men who were distinguished for their scholarship. The same was true of syphilis, a disease in which the direct teaching of the ancients could be of no service, but of which men trained in Greek scholarship, such as Leonicensus of Vicenza, and others, whom it would be tedious to mention, have left the best descriptions.

The study of Galen again led inevitably to that of Hippocrates, the great master of clinical description. Cornarius and many of the great humanists edited and translated his works; Rabelais, at Lyons, gave lectures on Hippocrates, which we may hope were lively. These labours, together with the long forgotten work of Celsus, prepared the way for the revival of Hippocratic medicine in the seventeenth century, with which will always be connected the illustrious name of Sydenham. It will then appear that the revival of medicine in all its departments was essentially a revival of Greek science. For the third time in history the Greek spirit gave new life to the intellectual progress of another race; as it had before to the Romans and then to the Arabs, so now to the modern Europeans. Out of the great revival grew the new birth of medicine; which through the scholars and the anatomists led up to what was in anatomy its culminating point, the great discovery of Harvey.

HARVEY THE HEIR OF ARISTOTLE AND GALEN.

With his momentous innovation the wave of the Greek revival had spent its force; and the era of modern medicine began. But still Harvey was in an intellectual sense the heir of Aristotle and Galen. If the sketch which has now been given of the two generations antecedent to Harvey be correct, his discovery of the circulation was the outcome of that movement which began a century and a half before, with the revival of the Greek medical classics and especially of Galen, for without Galen's insistence on the all-importance of anatomy in every branch of medicine and surgery, the anatomical revival would probably never have taken place. What honour or gratitude has Galen received for this signal service? In modern times scanty praise or none. The great physician whom Harvey speaks of *divinus ille vir* seems to be thought good for little better than to point the moral of erroneous science. In some modern works, nay, sometimes even in a Harveian oration, we hear only of the astounding errors of Galen. There is perhaps no other instance of a man of equal intellectual rank who has been so persistently misunderstood and even misrepresented; a reaction doubtless from the extravagant homage formerly paid him. Some have thought it would have been better if Galen had been forgotten, and the medical revival had started direct from Hippocrates. I cannot think so. In that case there would probably have been no anatomy, which is little regarded in the Hippocratic treatises, and the great discovery of Harvey might not have been made. Medicine would probably have lapsed into pure empiricism and might not for centuries have been placed upon a scientific basis.

Still less can we wish that medicine had followed Paracelsus in his violent revolt against Galen and the ancients. Paracelsus equally repudiated anatomy; and, moreover, experience shows that blank denial and contradiction are not the best means of dealing with traditional doctrines. The school of Paracelsus, though it did some service to medicine, by way of chemistry, remained a sort of side stream or back water, no part of the great river of scientific progress which took its rise from the revival of learning. European medicine

passed in fact through the same three stages which we now think necessary in medical education; of general, of scientific, and of practical training. First it was disciplined by Linacre and the humanists in accurate knowledge of the medical classics; next by the anatomists and botanists in the revived Greek science; and thus it was prepared for the right appreciation and study of practical medicine. We cannot wish that the order of progress should have been otherwise.

If Harvey's discovery is the final culmination in medicine of the renaissance or Greek revival, it will be interesting to compare his work with that of the Greeks and more especially with that of Galen. The intervening generations of anatomists, Vesalius, Columbus, Fabricius and the rest, added much to the older knowledge of the structure of the body; but except in the explanation of the pulmonary circulation, little to the knowledge of physiology. On this field Harvey stands face to face with Galen: nor is there any third figure that can be compared with them except that of the founder of biological science, Aristotle himself. Galen and Harvey seem at first sight such different personalities that it might be easier to find in them features of diversity than of likeness. But there was between them at least one point of contact, their love for anatomy, including what neither of them ever conceived of as a distinct science, the study of function which we now call physiology. If Galen had written nothing else than his works treating of these subjects he might not have received almost divine honours, as he did for a thousand years: but he would still be one of the greatest anatomists and physiologists of the world.

THE WORKS OF GALEN.

In speaking of Galen, we are impressed with a sense of the immensity of the subject. His works form one vast encyclopædia of ancient medicine, comprising anatomy, physiology, practical medicine, and surgery, therapeutics with the knowledge of drugs and practical hygiene, and professional ethics. Then we have materials towards the history of medicine which can be found nowhere else, while nearly all that is valuable in the Hippocratic writings could be recovered from Galen. Philosophy and logic are largely discussed, though most of Galen's works on those subjects are known to be lost. No one could better deserve to be called an encyclopædist. But what Galen most prided himself upon was his method. He claimed to have organised medical science and practice so that his disciples could find their way through the tangled maze of medicine, and compared himself to Trajan, who by his great military roads through Italy had made government as well as communication easier. Here we have the clue to the one element in Galen which is not Greek, something of the organising and governing faculty of imperial Rome, which he might have derived from personal acquaintance with the rulers of the Latin world. His ideal was rather an empire of medicine than a group of republics. This very spirit of system while it aided his supremacy through so many centuries, is in modern eyes his weakness.* For systems are essentially temporary and doomed to decay, while the objective statement of original observation will always possess a certain value. It must not be supposed, however, that Galen's works contain no original observations. There are many and of great value; but often they have to be dug out of his theoretical expositions like fossils from a rock. The other great fault which both ancients and moderns find in his work is his immense prolixity; Galen in a way confesses this. But he says naively, "If I do write long books, it is not my fault; it is the fault of the other people, who will write books full of so many wretched arguments." His obscurity often results from extreme subtlety of thought. Few physicians or even scholars in the present day can claim to have even read through this vast collection, I certainly least of all. I can only pretend to have touched the fringe, especially of the anatomical and physiological works. Even a cursory survey, however, is enough to give a clear notion of the point to which I desire to draw special attention: his methods of inquiry, his standard of evidence and of scientific proof. In these respects I think he will not be found wanting even judged from a modern standpoint.

Galen's great anatomical work, *De Administrationibus Anatomicis*, or manual of dissections, consists of fourteen books, of which the last five are not accessible in either Greek or Latin,

but exist only in a manuscript Arabic version which has not been published. Unfortunately, the lost books contain part of his account of the nervous system. His chief physiological work, *De Usu Partium*, might almost be called a treatise on natural theology, being intended to show the wisdom of the Creator in the adaptation of the parts of the body to their functions. These relations, he says, truly constitute the basis of a perfect theology, which is far greater and more to be honoured than the whole of medicine. For Galen, it may be observed, was a devout monotheist; he was evidently acquainted with part of the Old Testament and had probably heard some echoes of Christian teaching. What he may have said in confidential moments about Jupiter and the Olympian deities we do not know. This theological bias gives a certain warp to the book, for feeling bound to show the perfection of arrangements which he imperfectly understood he was naturally led into many errors. Still, it contains a full account of the functions of all organs of the body, as he understood them, and in the words of Dr. Greenhill is a truly noble work. Beside these there are smaller works on special parts of anatomy and physiology; and one controversial book, *De Placitis Hippocratis et Platonis*, directed against the Stoics and Peripatetics (or Aristotelians) is of importance as showing his methods of proof and argument. This work is quoted by Harvey.

It must be remembered that Galen's own dissections were made entirely on animals, the dissection of the human body being then quite impossible. Probably he had occasionally a glimpse of the internal organs in man, but his own remarks show that it could only have been a hurried inspection. This fact is the cause of a large number of the anatomical errors detected by Vesalius in Galen's works, such as the description of a rete mirabile in the human skull, of the origin of the two carotids from a single stem, and many others. In one really important instance, that of the supposed perviousness of the ventricular septum, he does apparently allow deduction to take the place of observation. It was evident that the blood must somehow pass from the right to the left side of the heart, and being ignorant of the long circuit by the lungs, the old anatomists inferred a short circuit through the heart itself. Probably they were confirmed by the occasional imperfection of the ventricular septum in the lower animals and by some anatomical facts which I cannot enter upon now. The same is true of the supposed anastomoses between veins and arteries which he saw must somehow exist, though of course he was quite ignorant of capillaries. Even Harvey concluded from deduction, not from actual observation, that the terminal arteries and terminal veins were connected. Galen's views of the heart and the motion of the blood have often been expounded and discussed. It is therefore unnecessary to go fully into them. I only desire to show that his methods of investigation were perfectly sound, though they led to an erroneous conclusion. His sources of knowledge on the subject were:—First, dissection of a great variety of animals, mammalia (including at least once an elephant), birds, fishes, and reptiles. He says cautiously that he did not dissect such creatures as gnats, flies, bees, ants, and worms, because seeing what mistakes anatomists had made in dissecting larger animals, he thought they would be likely to go still more wrong in the case of these small creatures. Secondly, elaborate dissections, in the modern way, continually repeated of those animals most resembling men, especially apes. Thirdly, observation of the heart and vessels in living animals which he opened for the purpose. He speaks also more than once of the case of a boy in whom the chest walls were deficient from the results of an accident, so that the movements of the heart could be seen. Fourthly, numerous experiments on living animals, made in his time with less reserve than at the present day. These experiments, though not always leading to correct conclusions, were extremely well contrived and quite scientific in their plan.

GALEN'S STUDY OF ANATOMY.

Of course Galen had a large body of anatomical knowledge behind him derived from the Alexandrian anatomists and their successors, but he never quotes any of their statements as authorities, relying entirely on his own observations and demonstrations. Had he quoted those anatomists who had actually dissected the human body he would probably have

often been more correct according to modern knowledge, but his resolute independence forbade him to describe what he had not seen. I quote a few instances to show his method of argument. The most important error of Galen and the old anatomists was no doubt that of attributing the origin of all veins to the liver. Nothing was a greater hindrance to a correct idea of the circulation. But this, as a *primæ facie* view, was very natural. When we open the body after death has taken place by the ordinary asphyxial method we find all the veins full of blood and all apparently communicating with the liver: the systemic veins by the hepatic; the portal system separately. Moreover, the connection of the umbilical vein with the liver in the fetus was also noticed. This view was not universally accepted. Galen's first instructor in anatomy, Pelops, taught that all blood vessels originated in the brain, a view which the scepticism of the pupil—even at that early age—refused to accept.⁵ The doctrine of Aristotle was that all blood vessels originated in the heart, the vena cava and its branches supplying the right side of the body, and the aorta and its branches supplying the left side. Aristotle's views were maintained by contemporaries of Galen, whose answer to them was that there was one system of veins unconnected with the heart—namely, the portal system, which communicated only with the liver. This, he says, "I have demonstrated to those desirous of knowing the truth, and they have been astonished at the error of those who maintained that all veins came from the heart."⁶ Galen's argument is perfectly sound from his facts, though it confirmed him in an erroneous conclusion. What Aristotle's answer would have been we do not know. The Peripatetics—the followers of Aristotle in Galen's time—seem to have had no answer except *a priori* arguments. In fact, Galen's argument was never answered except by Harvey.

It is well known that Erasistratus and all anatomists before Galen, except Aristotle, maintained that the arteries contained only "spirit" or air—not blood. Galen proved that they contained blood, not only by the familiar experience of blood flowing from a cut artery (which the older anatomists explained by a supposed anastomosis between veins and arteries) but by placing two ligatures on an artery and dividing the vessel between them, when of course only blood would be found. He also inserted a fine cannula into the left ventricle of the heart during life, and showed that blood immediately flowed out, without a moment's interval in which the supposed spirit might have escaped.⁷ This, he says, he demonstrated to many persons who were incredulous on the subject. Galen clearly states that the bright-coloured, thin, subtle, spirituous—in modern phrase, arterial—blood, formed in the left ventricle by mixture with "vital spirit" concocted in the lungs with the help of the air, was violently carried by the arteries all over the body.⁸ If we put "vital air"—or oxygen—for "vital spirit" it approximates strangely to the modern doctrine, though the anatomical errors are obvious and need not be dwelt upon. At the same time the air returning to the lungs was supposed to carry off and send out in expiration what was, as it were, burnt-up and smoky or sooty matter. If we put for smoky, carbonaceous, we have a near approach to a theory of respiration which was in vogue about fifty years ago.⁹

It seems strange to us that the ancients should have supposed spirit—and not blood—to be conveyed from the lungs to the heart by the pulmonary veins. But it should be remembered that after the ordinary asphyxial mode of death when the heart is healthy the left auricle and pulmonary veins are usually collapsed and empty, and would therefore have been supposed to contain during life air which had escaped. It is otherwise in the living animal, and it was Colombo¹⁰ who first proved by actual experiment on the living heart that they conveyed blood from the lungs. It seems strange that Galen, who was so fond of experiment, never tried a like experiment on the pulmonary veins. Galen's knowledge of comparative anatomy enabled him to confute Aristotle's statement that large animals have three

⁵ *De Placitis*, vi, Cap. 3. Kühn, v, p. 527.

⁶ *Ibid.*, vi, Cap. 5. Kühn, v, p. 542.

⁷ *Ibid.*, i, Cap. 5. Kühn v, pp. 182-184.

⁸ *Ibid.*, vi, Cap. 8. Kühn v, p. 572.

⁹ *De Usu Partium*, vi, Cap. 2. Kühn, iii, p. 412.

¹⁰ Realduo Columbus, *De Re Anatomica*, Lib. xiv, Venetiis, 1559, p. 261.

cavities in the heart while small animals have only two, of which several explanations have been suggested. The horse, he says, has no more than the sparrow, nor the ox than the mouse.¹¹ He found the right ventricle of the heart always wanting in animals which had no lungs and did not breathe the air—like fishes (but not in all aquatic animals), and concluded that the right ventricle was made for the sake of the lungs. It appears, then, that Galen's sources of evidence respecting the motion of the heart were the same as Harvey's—namely, comparison of structure in a variety of animals, argument from the use of these structures, observation of the living heart, and numerous experiments on animals.

It may be asked why if Galen had a correct method and knew most of the facts so accurately, did he not discover the circulation? The difference of structure between human and inferior anatomy, which was Galen's weak point, did not come in here. But why did not Vesalius, or Fabricius, or Colombo, whose anatomical knowledge was quite as complete as was required, get near it? The fact seems to be that the problem was one of those in which you must be wholly right or wholly wrong. It is like those word puzzles in which a number of letters are thrown on the table to make a word. No combination except the right one is much nearer the truth than another. The word is not spelt till the right combination is effected. So in this problem the mere accumulation of correct data was of little avail. Galen made a marvellously ingenious combination of letters, but it did not spell the right word. Harvey had no difficulty in showing that Galen was inconsistent with himself, more inconsistent indeed than those who knew less. Servetus and Colombo, who knew the lesser circulation, Fabricius, who described the valves of the veins, were still more inconsistent. At last came the master mind, which arranged the letters in the right order, and so the word was spelt for all the world to read. To do this required that peculiar high faculty of synthesis which is rightly regarded as an attribute of genius; and is closely allied to the poetical imagination. This faculty seems not always to follow the strict chain of reasoning, link after link, nor to result from a mere collecting and marshalling of the data, however skillfully, as Bacon supposed. The creation of the poet is generated in his mind from pre-existing sensations and ideas by a process which he cannot understand himself, and which the great poets have spoken of reverently as a kind of inspiration. So the idea of a great discoverer or inventor is generated by some process of which he himself may be only partly conscious; and a new form, like that idea of Harvey's of a circular motion, results. The difference is that the scientific idea, unlike the poetical, requires to be carefully verified and proved, a process which Harvey himself was the last to neglect.

GALEN'S STUDY OF THE PHYSIOLOGY OF THE NERVOUS SYSTEM.

Further, to illustrate Galen's scientific method, I should like to say something about his physiology of the nervous system, to which justice has hardly been done, but which was certainly his greatest achievement. My object now is merely to show that Galen's method in investigating this subject was the only true one of observation and experiment, not to dwell upon his results, though they were very considerable. Before entering on this subject I should like to say a word on one point in which a difference of language makes Galen's views seem much more different from modern physiology than they really were, the old and famous doctrine of the animal spirits. He explained nervous action, both motion and sensation, by something descending from the brain through nerves to the muscles and other parts. This something he called *ψυχικὴ πνεῦμα*, a phrase of which the modern translation through two languages into "animal spirits" is somewhat misleading, being the origin of all our colloquial phrases, high and low spirits, and so on. The original meaning is rather "breath of the soul," or breath belonging to the psyche. The word "psyche" itself is difficult to render; soul, mind, consciousness, the sensorium, etc., all have other connotations, and so I find that some modern psychologists prefer to use the old term "psyche" for that which we suppose to be manifested through the brain. I cannot suggest any better definition of the psyche

than the tautological one that it is the subject of the science of psychology. The "pneuma" was supposed to be some kind of air or very subtle fluid capable of traversing the solid nerves. Our modern expression for what traverses the nerves is "nerve force." I am not sure that nerve force is itself a strictly scientific expression, since the correlation of this force with other physical forces is by no means rigidly established. It seems to be a convenient expression for something the nature of which we do not know. I may be heretical in this, but let that pass for the moment.

However, in justice to Galen's ignorance, we should remember that it was only the other day we were taught in every textbook of physics that electricity and magnetism were subtle fluids, and we were sometimes given the choice between the single fluid and the double fluid hypothesis. Electric fluid is a vernacular phrase. The term nervous fluid was retained in textbooks of physiology which some of us learnt from; and between nervous fluid and nervous pneuma there seems little to choose. The hypothesis of electric, magnetic, and nervous fluids no doubt explained many phenomena fairly well, till it was found there were other phenomena which they did not explain, and so they were given up. Galen unfortunately materialised his pneuma too much supposing it to be included like air in the ventricles of the brain. He also had strange theories of the production of swelling and tension by the pneuma, which of course were totally erroneous;¹² and hence his theory seems more remote from modern science than it really was. But it might be shown if I had time how curiously he thought the presence of pneuma in the cerebral ventricles was proved by his numerous and careful experiments on the living brain. His method of investigation was in intention perfectly sound. Galen maintained the doctrine of the Hippocratic school, if not of Hippocrates himself, and of Plato, that the brain was the centre of voluntary movement, sensation, and thought (the same conception is perhaps indicated by the old Greek myth of Pallas Athene springing from the head of Zeus); though inconsistently he retained the old attribution of certain passions to other organs, such as anger to the heart. He showed that all the nerves originated in the brain, either directly, or by means of the spinal cord, which he thought to be a conducting organ merely, not a centre. In opposition to this was, it should be remembered, the theory of Aristotle, who held that the heart was the seat of the sensitive soul with its correlative, voluntary movement, and that what we should call nervous action originated there; while the brain was of secondary importance, being the coldest part of the body, devoid of blood, and having for its chief or only function to cool the heart. Aristotle's reasons for adopting this unfortunate misconception of the brain have been much discussed and are fully stated in Dr. William Ogle's admirable translation of Aristotle, *De Partibus Animalium*. They were partly positive observations, such as that the brain substance was itself insensitive, and that many animals which could feel and move (our invertebrata) had no brain, and that he could not trace any connection between the organs of special sense and the brain. But also he was strongly influenced by his metaphysical idea that the "sensitive soul" was indissolubly connected with heat, and therefore could not have its seat in the coldest organ of the body devoid of blood. One wonders whether if Aristotle had been a practising doctor or army surgeon, accustomed to study the effects of blows on the head, he would ever have propounded this theory.

THE SPECULATIONS OF ARISTOTLE.

Aristotle's positive arguments for the heart being the centre of sensation and voluntary motion were partly the preconceived idea which I have just mentioned, partly his observations as a psychologist on the connection of emotions with the heart, and also one fallacious anatomical observation. Seeing the chordæ tendinæ of the heart, he thought they were nerves and the source of all the nerves in the body. True he did not distinguish between sinews and nerves, calling them all *νεῦρα* (neura), but he must have regarded these structures as having what we now call motor nervous functions, since he thought them the origin of all voluntary movement throughout the body. He does not appear to connect

¹² To find still stranger performances ascribed to the "spirits" we have only to look at the works of Willis,

¹¹ *De Usu Partium*, vi, c. 19. Kühn III, p. 42.

them with sensation. At all events, this was the foundation of the celebrated doctrine of the origin of the nerves in the heart, which was maintained by the followers of Aristotle for hundreds of years. Now, one does not recall these misconceptions with the paltry aim, which I have already condemned, of branding as astonishing errors the imperfect generalisations of the great founder of natural science. It is on account of their historical importance. This point of the relation of the brain and the heart was fundamental, and had, I think, the most injurious influence on the progress of physiology. Aristotle's great services to biology were first that he started the investigation, then his great generalisation of the unity of the animal kingdom, better appreciated now than ever; and also his marvellous contributions to morphology, which seem to me incomparably more important than his explanations of function, which are largely tinged with metaphysics. In physiology his great achievement was his conception, derived from his studies of the embryo, of the indissoluble connection of the heart, the blood vessels, and the blood; by which he kept clear of the liver, that great stumbling block of the medical anatomists. It was this which Harvey so much appreciated, and one reason which led him to speak of Aristotle with such generous enthusiasm.

Aristotle's great authority maintained his views as to the rival claims of the heart and brain to be the seat of nervous function and vitality for many centuries. They were supported chiefly by the philosophers and opposed by nearly all the medical anatomists. They were the subject of active controversy in the time of Galen. In the Middle Ages they were maintained in opposition to Galen by Averroes, the reviver of the study of Aristotle, and Cesalpino, often spoken of as a forerunner of Harvey, presented them again in the sixteenth century. Nay, about 2,000 years after Aristotle's time a professor at Padua contemporary with Harvey, one Cæsar Cremoninus, wrote a long book to defend Aristotle's theories on these points in all their details against Galen and the modern anatomists. For all I know, they found still later defenders.¹³ Galen, as Harvey says,¹⁴ in demonstrating the connection of the nerves with the brain might justly boast that he had discovered what was unknown to Aristotle. Galen, when he was endeavouring to found the physiology of the nervous system on the basis of experiment and observation, had to deal with Aristotle's views. Vesalius¹⁵ and others have blamed Galen for criticising so severely the *obiter dicta* of the illustrious ancient philosopher. But it was impossible for Galen to look upon these matters with the dispassionate calm of a historian. It was a living question. He was meeting every day with people who said that the nerves originated in the heart, and that Galen's ideas about the brain were mere fancies. He was thus inevitably drawn into an attitude of opposition. So in later times Vesalius and Harvey were forced to appear as the opponents of Galen whom they greatly respected, for Galen in their time had warm supporters. But it should be remembered that had Galen been out of the way, and had the tradition of physiology descended, as some seem to think it did, straight from Aristotle, Harvey must have appeared as the opponent of Aristotle himself. Harvey's singleness of purpose and fine urbanity however make him appear as little as possible the opponent of anyone.

GALEN'S APPEAL TO OBSERVATION.

Our present question is, however, What were Galen's grounds of belief? How did he meet his opponents? His great complaint against the Peripatetics or Aristotelians was that while they discoursed about anatomy they would not dissect. He met an argument with a dissection or an experiment, "Come and see for yourselves" was his constant cry. "A thousand times," he says, "I have demonstrated by dissection that the cords in the heart called nerves by Aristotle are not nerves and have no connection with nerves." Doubtless in meeting the speculations of the philosophers he often fell into the weakness of answering a fool according to his folly. At the special request of his friends he says he

followed the philosophers into their own field and showed that he could spin out logic and quote poetry with the best of them. But I must try and give some idea of the strange intellectual atmosphere in which Galen upheld so manfully the standard of scientific truth. The followers of Chrysippus, a Stoic philosopher, are, says Galen, not ashamed to assert that when we wish to indicate emphatically "I myself" we lay the hand upon the heart or nod the head downwards pointing to the chest; whence it follows that the heart is the principal seat of the soul.¹⁶ Chrysippus drew the same conclusion from a fantastic idea about the movement of the lips in pronouncing the word *ἐγώ*. Galen gives here an interesting statement of his own views of the right method of reasoning in science, too long to quote.¹⁷ His conclusion is that arguments from the opinion of men, whether of the vulgar, or of poets, or of philosophers, arguments from nodding or not nodding your head, arguments from words are all bad arguments, most nearly allied to the sophistical kind. It is a bad argument to say that the heart must be the supreme organ of the body because it is in the centre of the body; and equally bad to say the head is the supreme organ because it is on the top. Enough is said to show that his standard of scientific reasoning was perfectly sound, judged by the criteria of Bacon or Mill.

Another wild theory of the philosophers, founded perhaps upon an obscure passage of Aristotle, was that the voice proceeded from the heart. Galen explains—as we should now—that voice is produced by an expulsion of air caused by the movements of the thoracic walls (which he clearly understood to be the cause of the movements of the lungs—not *vice versa*), modified by the movements of the larynx, both organs being controlled by nerves coming from the brain.¹⁸ When I tell them this, he says, and add that all voluntary movement is produced by muscles controlled by nerves coming from the brain they call me *παράδοξολόγος*, "a teller of marvellous tales," and have no argument beyond the simple assertion that the trachea is near the heart. But what I say I can demonstrate by dissection. Their method of simple assertion is much easier. "They have chosen," he exclaims, "the short and easy way, instead of the long and arduous way which alone leads to the desired end, but the short and easy way fails to attain the truth"—a phrase in which we seem to hear an echo of words better known to us about the broad and the narrow way. "No one," he goes on, "has ever been able to withstand me when I have demonstrated the muscles of respiration and voice. The muscles move certain organs, but they themselves require, in order to be moved, certain nerves from the brain, and if you intercept one of these with a ligature immediately the muscle in which the nerve is inserted, and the organ moved are rendered motionless. Whoever is really a lover of truth, let him come to me, and if only his senses are unimpaired he shall see clearly on the animals themselves that free or normal inspiration is caused by certain organs, muscles, and nerves, and forced inspiration—such as occurs in disease and in violent exercise—when we see the shoulder blades raised—by other muscles; and so with expiration. Also I will show you the organ of voice, the larynx, its motor muscles, and the nerves of those muscles coming from the brain; and similarly with the tongue the organ of speech. I will prepare several animals, and show that sometimes one, sometimes another, of these activities is abolished when the several nerves are divided." Indeed, Galen wrote a special book on the dissection of the nerves in order to show students how to verify these facts for themselves.

If there were time it might be shown that his method in the investigation of the brain was the same. He was indeed a little impatient with the doctrine of Aristotle on this subject, and no wonder. When met by the Peripatetics with the assertion that the magnificent human brain served no better purpose than to cool the heart, Why then, says Galen, have we this complex structure, these membranes, blood vessels, cavities, glands, nerves, when for the purpose of cooling only it ought to have been made like a sponge, inert and shape-

¹³ *Apologia Dictorum Aristotelis de Origine et Principatu Membrorum adversus Galenum Cæsaris Cremonensis in Scholâ Patavinâ Philosophi Præne Sedit. Venetiis. 1627.*

¹⁴ Harvey: *Praelectiones*. M.S., fol. 95—"Hoc jure gloriari Galenum invento Aristoteli ignoto." This was, however, more than Galen claimed for himself.

¹⁵ *De Humani Corporis Fabrica*. 1543. P. 55c.

¹⁶ *De Placitis*, Lib. ii. cap. 3. Kühn v. p. 216.

¹⁷ *De Placitis*, Lib. ii. cap. 3. Kühn v. p. 221.

¹⁸ *De Usu Partium*, vii. 5. Kühn iii. 525; *De Placitis*, ii. 4. Kühn iii. 233.

less?¹⁹ Other obvious arguments occur, but Galen's demonstration of the functions of the brain rested on the experiments he made on living animals. He found that various injuries to the brain immediately abolished sensation and movement, and was aware of the law that injury to one side of the brain affects the opposite side of the body. He traced the effect of cerebral lesions on the voice and on respiration as well. But if the heart was injured in the same way none of these things happened, indeed sensation, voluntary movement, and the voice were set in violent activity, as we may well imagine, in the animals experimented upon. His actual conclusions I need not dwell upon, though it is clear that his conception of the brain and the nerves in relation to sensation and voluntary movement were essentially the modern ideas. It is evident from the nickname given him that his ideas were regarded as new and strange. Galen's experimental investigation of the spinal cord by sections at different levels and by half sections was still more remarkable. It is quite modern in precision and completeness, but I cannot dwell upon it now.²⁰

As regards his method, although it is now the fashion to praise Aristotle and not to praise Galen, it is clear that Galen's methods were far more scientific than those of his predecessor. Instead of dim adumbrations and analogies, we have actual experimental proof. Galen was, in fact, a modern experimental physiologist, and may rightly be regarded as the founder of the physiology of the nervous system. Haeser indeed goes so far as to call him the founder of experimental physiology in general.²¹ It was long before he had any rival in this field. His own immediate successors seem to have dropped the experimental method, as indeed the whole idea of scientific investigation. On the revival of anatomy Vesalius and his contemporaries practised vivisection, closely imitated from Galen, but established nothing in nerve physiology. Harvey published nothing about the nervous system. Willis reconstituted the anatomy of the brain, but added nothing experimental with regard to its functions. It is not till we come to the days of Sir Charles Bell and Magendie that we find any one comparable to Galen as a nerve physiologist.

GALEN AND HARVEY.

It is surely evident then that the conception of Galen as an ancient philosopher whose errors were exploded by Harvey is totally unjust. He was Harvey's most brilliant model, and forerunner in one side of his work, the experimental, just as Aristotle was in another side, that of observation and generalisation. We cannot, I think, look without sympathy upon the spectacle of Galen wrestling with the philosophers, striving to bring them to the evidence of fact and the teaching of Nature. There are many other references in his writings to the same combat of experiment and observation against theory and tradition. But it does not seem that his efforts were of much avail. Philosophy went its way independent of him. The Peripatetics never learned to dissect, nor the Stoics to use scientific arguments. What was worse, the theoretical and traditional method infected medicine itself. For a thousand years after Galen's death there were well educated and learned Greek physicians, some of them acquainted with anatomy, in the western, and more especially in the eastern empire. Practical medicine possibly advanced, as practical surgery certainly did, but scientific progress there was none. All was copying and compiling from the ancients, from Galen most of all; though he never enjoyed among the Greeks that position of absolute predominance which was his lot among the Arabians and in mediæval Europe. To inquire into the causes of this decay of originality and progress in medicine would be a long question which I feel incompetent to discuss. All assigned causes seem to me somewhat inadequate, beyond the trite remark that the Greek genius seemed in some way exhausted. We know only that there are in the history of

thought germinal epochs when new thoughts and new discoveries arise, often followed by long tracts of time in which men are capable only of repeating and copying, not of originating. Just as in a plant there are nodes where alone buds, leaves, and flowers are put forth; and then internodal spaces with none of these. The botanist cannot explain the one, nor can the historian the other. But in regard to medicine, I cannot see that this barrenness and the long reign of dogma was, as sometimes supposed, the fault of Galen's system. Other writers have shared the same faults, but by no means the same fate. It has not been their lot to be the autocrat of the medical world for so long. The fault was, as I said before, in the time; it was the subservient spirit of the Arabians and the mediæval Europeans, not his own demerit, which raised Galen to that bad eminence. It was the same with Aristotle, who, through no fault of his own, became the intellectual monarch of the Middle Ages in another field. In the case of both these great, though of course unequally great, men, the excessive adoration paid to them was succeeded by unjust neglect. They deserved neither the one nor the other. For Aristotle the reaction is come, and though no longer adored he receives due honour. For Galen I think the day of restitution cannot be long delayed. He was not one of the great geniuses of the world, but very high in the second rank. He was one of the most illustrious of all physiologists, and among the ancient physicians we may still allow him the old honourable epithet so often used, "Omnium medicorum secundum Hippocratem facile princeps."

For our great Harvey we need not fear that his noble shade would be troubled at this tribute paid to his great predecessor. His mind was too generous; and, indeed, it increases his praise, for to have succeeded where other acute intellects failed is the greater honour. Harvey himself warmly acknowledged what he owed to Aristotle; and if he mentions Galen less it was because the force of circumstances made him his opponent. But at this distance of time we can see plainly that it was hardly necessary to mention him, for in so many places his work is taken for granted.

As I remarked in the beginning, all great work is based on work done before, even where the results appear to be different. And so we arrive, I venture to suggest, at the generalisation that all high thought is really continuous. The magic of literature brings together thinkers widely separated in place and time, and as one magnet makes other magnets, the activity of one great mind sets other minds in vibration. The polarity of the second magnet may be opposite to that of the first, and so the result of the induced intellectual activity may be contradictory to that which set it in motion; but the one was nevertheless derived from the other. The moral is, I think, that the influence of the past on the present is even more potent than we commonly suppose. In common and trivial things we may ignore this connection; in what is of enduring worth we cannot. As Goëthe says:—

Nur im Vergangenen lebt das Tüchtige
Verewigt sich in schöner That
(All that has worth lives only in the past
Becoming immortal in splendid activity.)

Hence the past is worth our study, and even more so the further we advance. This is, indeed, a growing sentiment. Even, or rather more especially, in this age of restless innovation and bewildering scientific progress, the study of the past, whether of Nature or of society, in geology, archaeology, history (all embraced under the one head of evolution), is gaining a firmer hold of men's interests, and, inspired by better methods, has acquired wider scope and vision. With the revival of history in a wide sense there is evident a renewed interest in the history of medicine, a study in which our own country, it must be confessed, has done less than any other of the great civilised States. As a small contribution to this history I have endeavoured to bring before you, however imperfectly, this sketch of the relations of Harvey to his predecessors.

PROFESSOR RUDOLPH VIRCHOW attained his 75th year on October 13th. Numerous telegrams of congratulation and presents were left at his Berlin house, as Professor Virchow is at present absent from the capital.

¹⁹ *De Usu Partium*, viii, Cap. iii. Kühn iii, 624.

²⁰ *De Anat. administ.* viii, Cap. vi to ix. Kühn II, pp. 683, 696, etc. He refers also to the lost book xiv.

²¹ Galen's application of his physiological knowledge in the diagnosis of disease is very striking. He always makes it his first object to determine the organ or part affected by means of the functional disturbance. Thus he infers the height of a lesion in the spinal cord by noting whether the upper or lower limbs, the diaphragm, intercostal muscles, etc., are paralysed, a method familiar to us, but unknown in the last century. In physiological diagnosis he stands alone among the ancients.